STATE OF NEW MEXICO
ENVIRONMENTAL IMPROVEMENT BOARD

IN THE MATTER OF THE APPEALS OF THE AIR QUALITY PERMIT NO. 7482-M1 ISSUED TO 3 BEAR DELAWARE OPERATING – NM, LLC.	EIB No. 20-21 (A)
AND	
REGISTRATION NOS. 8720, 8730, AND 8733 UNDER GENERAL CONSTRUCTION PERMIT FOR OIL AND GAS FACILITIES	EIB No. 20-33(A)

WildEarth Guardians,
Petitioner.

REBUTTAL TESTIMONY OF JEFFRY D. BENNETT, PE, AND LORI K. MARQUEZ

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1. Introduction

WildEarth Guardians (WEG) appealed the decision of the New Mexico Environment Department (NMED), Air Quality Bureau (Bureau), to issue New Source Review Permit number 7482-M1 to 3 Bear Delaware Operating – NM, LLC (3 Bear). The action modified the minor source air permit for the 3 Bear Libby Natural Gas Plant (Libby) in Lea County, New Mexico. As described in our direct testimony, NMED followed the applicable regulations at 20.2.72.203 and 20.2.72.207, NMAC, when issuing the permit modification.

We have reviewed the direct testimony submitted by WEG on August 3, 2020 in this matter including the "Expert Report by Dr. Ranajit (Ron) Sahu, Consultant, in support of Petitioner in EIB No. 20-33(A) and EIB No. 20-21(A)" (Sahu Direct). WEG claims that NMED should have denied the permit modification because emissions from minor source oil and gas facilities, including Libby, cause or contribute to violations of the 70 part per billion (ppb) National Ambient Air Quality Standard (NAAQS) for ozone in southeastern New Mexico.

WEG's direct testimony does not identify any concerns or deficiencies specific to the Libby permit (Sahu Direct at 2), the process for issuing it, or Libby's compliance status with applicable permitting requirements. Instead, the testimony attempts to make the case that "permits and registrations should not be issued at this time since they allow the emissions of more precursor NOx and VOC emissions while the area is clearly in ozone nonattainment" (Sahu Direct at 3). WEG argues that NMED should not permit "any new source" and that "any additional emissions" are presumed to contribute to NAAQS violations. Sahu Direct at 2, 22.

WEG's position misstates what it means to "cause or contribute" to a NAAQS violation, conflicts with EPA and NMED regulations and guidance, and is technically flawed.

Our rebuttal testimony explains the proper criteria for determining whether a source of emissions causes or contributes to a violation of the ozone NAAQS. We demonstrate that modeling the ambient ozone impacts of individual minor sources is unnecessary and infeasible given the timeline necessary for minor permit issuance in New Mexico. We highlight Dr. Sahu's reliance on studies of industry-wide ozone impacts and his failure to show that the Libby plant or any individual minor source causes or contributes to ozone NAAQS violations. We show that Dr. Sahu's position is inconsistent with NMED's permitting regulations. We conclude that NMED's practice of issuing minor source permits without requiring single source ozone modeling or other demonstrations of a single source's ambient ozone impacts is reasonable and consistent with NMED and EPA air quality regulations.

2. Sources Whose Ambient Impacts are Below Applicable Significant Impact Levels (NMED Significance Levels) do not Cause or Contribute to NAAQS Violations

WEG argues that "[u]nder 20.2.72.208.D NMAC, NMED is required to deny any air permit application if 'the construction, modification, or permit revision will cause or contribute to air contaminant levels in excess of any National Ambient Air Quality Standard or New Mexico ambient air quality standard…'" Petition for Hearing, EIB No. 20-21(A) (May 11, 2020). Dr. Sahu similarly testifies that "[t]he New Mexico SIP prohibits the approval of permits that would authorize air pollution that causes or contributes to violations of the national ambient air quality standards." Sahu Direct at 2. Although WEG and Dr. Sahu make no attempt to define or explain the term "cause or contribute," EPA and NMED guidance clarify that a facility causes or contributes to a NAAQS violation only if its ambient air quality impacts exceed a defined pollutant-specific significance level.

(a) A Source "Causes or Contributes" to a NAAQS Violation Only if it Results in "Significant" Ambient Impacts for the Pollutant of Interest

The term "cause or contribute" is used in the federal Clean Air Act's prohibition on construction of a Prevention of Significant Deterioration (PSD) major source unless the owner or operator demonstrates that "emissions from construction or operation of such facility will not cause, or contribute to, air pollution in excess of any . . . (B) national ambient air quality standard." 42 U.S.C. § 7475(a)(3) (Clean Air Act § 165(a)(3)).

The EPA has historically used pollutant-specific concentration levels known as "significant impact levels" (SILs) to identify the degree of air quality impact that "causes or contributes" to a violation of a NAAQS. According to EPA guidance, proposed sources meet the requirement to demonstrate that they do not cause or contribute to a violation by showing that the ambient air quality impacts resulting from the proposed source's emissions are projected to be below these pollutant-specific concentration levels. EPA has established an ozone SIL of 1.0 ppb. Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program, EPA, April 17, 2018. (Exhibit 1)

The SIL concentrations have served in the PSD program as a tool to demonstrate that a new or modified major source does not cause or contribute to a NAAQS violation. The implementation of the SILs has reduced the burden on permitting authorities and applicants to conduct time-consuming and resource-intensive air dispersion modeling where such modeling was unnecessary to demonstrate that a permit applicant meets the requirements of Section 165(a)(3), consistent with the procedures set forth originally in 1977 in the "Guidelines for Air Quality Maintenance Planning and Analysis, Volume 10 (Revised) and Procedures for Evaluating Air Quality Impact of New Stationary Sources." This document provides a historical perspective demonstrating the longevity of this approach. EPA has consistently applied this approach in multiple guidance documents including Exhibit 1.

Many states, including New Mexico, apply a significant impact threshold to minor source permitting. Air quality impacts projected to be less than the "significant ambient concentrations" in New Mexico are not found to cause or contribute to ambient air quality violations.

Section 20.2.72.216, NMAC, Nonattainment Area Requirements, imposes emissions offset requirements on "a new source or modification of an existing source that will emit a regulated air contaminant such that the ambient impact of the contaminant would exceed the significant ambient concentration is 20.2.72.500 NMAC, Table 1 at any location that does not meet the New Mexico ambient air quality standard for the contaminant." The nonattainment area permitting requirements of Section 20.2.72.216 do not apply to sources with emission increases that will not cause an exceedance of the significant ambient concentration.

This is consistent with Section 2.4.1 of the NMED Air Dispersion Modeling Guidelines (Exhibit 2) which defines a "Significance Level" as follows:

> Modeling significance levels are thresholds below which the source <u>is not considered to contribute to any predicted exceedance of air quality standards</u> or PSD increments. (Emphasis added).

The Modeling Guidelines provide significance levels and explain modeling procedures for the pollutants listed in 20.2.72.500 NMAC, Table 1. The Guidelines also adopt EPA's ozone significance level of 1.0 ppb. Modeling Guidelines § 2.6.5 Table 5E, *citing* "Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program," EPA, April 17, 2018. NMED's use of significance levels is consistent with federal guidance for screening projects with less than significant impacts from further analysis. Consistent with the New Mexico Modeling Guidelines, NMED has the ability to issue permits to sources in areas that exceed the air quality standards with allowable emission increases that do not cause or contribute to nonattainment (i.e., ambient impacts are not significant).

NMED's modeling guidelines reflect a reasonable and educated judgment that there was no need to conduct ozone air quality analysis for minor sources, such as the Libby permit modification, as the results would be less than the significant ambient concentration (i.e., the project emission increases would not contribute to ozone exceedances in the area).

As explained in EPA's PSD guidance, NMED's permitting regulations, and NMED's

Modeling Guidelines, not every emissions increase causes or contributes to a violation of the NAAQS. Only those emissions increases that are projected to increase ambient concentrations of a particular pollutant by more than the significance level (e.g., New Mexico's significant ambient concentration or EPA's SIL) cause or contribute to a NAAQS violation. We do not agree with Dr. Sahu's statement that "it is reasonable to presume that *any* additional emissions of VOCs or NOx in Eddy and Lea counties, such as from the particular facilities at issue in this matter, will contribute to violations of the ozone NAAQS in the area." Sahu Direct at 22 (emphasis in original). His statement conflicts with applicable state and federal guidance and ignores the regulatory meaning of the term "cause or contribute."

(b) Procedures for Analyzing Single Source Ozone Impacts Under EPA's PSD Program

The EPA published its Guideline on Air Quality Models at 40 C.F.R. Part 51, Appendix W. Overall, EPA, states and project proposers use the guidelines at Appendix W as the basis for preparation and review of new or modified source permits and for other air quality assessments required under the CAA and EPA or state regulations. The Guideline was originally published and incorporated into the PSD regulations in 1978. EPA republished the Guideline as Appendix W in 1993 and has periodically updated it. On January 17, 2017, EPA revised Appendix W by publishing "Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter," 82 Fed. Reg. 5182. The 2017 revisions provide a methodology for PSD projects to model secondary pollutants that form in the atmosphere. "Ground-level ozone and a portion of PM2.5 are secondary pollutants formed through photochemical reactions." Appx. W § 5.1(a).

The air quality modeling techniques described in Appendix W "should be applied to State Implementation Plan (SIP) submittals and revisions, to New Source Review (NSR), including new or modifying sources under Prevention of Significant Deterioration (PSD), conformity analyses, and other air quality assessments required under EPA regulation." Appx. W § 1.0(a). Modeling is generally required for new and modified major sources. Under EPA's PSD program, modeling is not required for new and modified minor sources. New Mexico and other states do not require ozone impacts analysis for non-PSD NOx and VOC emission increases. This approach is consistent with EPA's PSD program and is reasonable and valid based on the extensive modeling developed for the Modeled Emission Rates for Precursors (MERP) analysis further described in (c) below.

Notwithstanding the lack of a need to conduct analysis for a minor source permit emission increase, the ozone air quality analysis requirements for major source PSD projects are defined in Appendix W Sections 5.2 "Recommendations" and 5.3.2 "Models for Single-Source Air Quality Assessments." EPA has clarified Appendix W in multiple guidance documents and drafts, including:

April 17, 2018 – EPA Memorandum – Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program (Exhibit 1).

August 4, 2017 – EPA Memorandum – Use of Photochemical Grid Models for Single-

Source Ozone and secondary PM2.5 Impacts for Permit Program Related Assessments and for NAAQS Attainment Demonstrations for Ozone, PM2.5, and Regional Haze (Exhibit 3).

April 30, 2019 – EPA Memorandum - Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 Under the PSD Permitting Program (Exhibit 4). Page 1 of the 2019 MERPs guidance clarifies that it describes how to conduct air quality modeling "under the Prevention of Significant Deterioration (PSD) permitting program." In other words, it applies to major source permitting.

As an initial matter, Appendix W Section 2.2 provides that "It is desirable to begin an air quality analysis by using simplified and conservative methods followed, as appropriate, by more complex and refined methods. The purpose of this approach is to streamline the process and sufficiently address regulatory requirements by eliminating the need for more detailed modeling when it is not necessary in a specific regulatory application. For example, in the context of a PSD permit application, a simplified and conservative analysis may be sufficient where it shows the proposed construction clearly will not cause or contribute to ambient concentrations in excess of the NAAQS."

Appendix W Section 5.2 recommends a two-tier approach for analyzing the ambient air quality impacts of proposed PSD projects with respect to secondary pollutants including ozone and $PM_{2.5}$. "The first tier consists of using existing technically credible and appropriate relationships between emissions and impacts developed from previous modeling that is deemed sufficient for evaluating a source's impacts. The second tier consists of more sophisticated case-specific modeling analyses." Appx. W § 5.2(e).

EPA completed modeling that can be used as a component of a first-tier ozone analysis and published it in the April 2019 MERPs Guidance. As explained in the guidance, "MERPs can be viewed as a type of Tier 1 demonstration tool under the Prevention of Significant Deterioration (PSD) permitting program that provides a simple way to relate maximum downwind impacts with a critical air quality threshold (e.g., a significant impact level or SIL)." Exhibit 4 at 5. EPA modeled the ambient impacts of increasing NOx and VOC emissions by 500, 1,000, or 3,000 tons per year at hypothetical sources around the country as shown in Figure 3-2 of the MERPs Guidance (shown below). The Guidance provides a method to allow PSD project emission increases to avoid more refined Tier 2 demonstrations.

Conceptually, a MERP is the rate of emissions (determined through modeling) from a hypothetical source that will cause an ambient air quality impact less than the SIL. EPA previously determined the ambient air quality impacts of numerous hypothetical sources at certain emission rates using a photochemical model. In order to complete a Tier 1 demonstration using the MERPs, the project proposer selects a hypothetical representative source based on proximity, elevation, emission release parameters, and other similarities to the project. Then, the ambient impacts of a proposed project are estimated by calculating the ratio of its allowable emissions rate to the representative source's emissions rate, then multiplying the representative hypothetical source's ambient impacts by this ratio.

(c) The Libby Permitted Emission Increases Do Not Cause or Contribute to Violations of the Ozone NAAQS

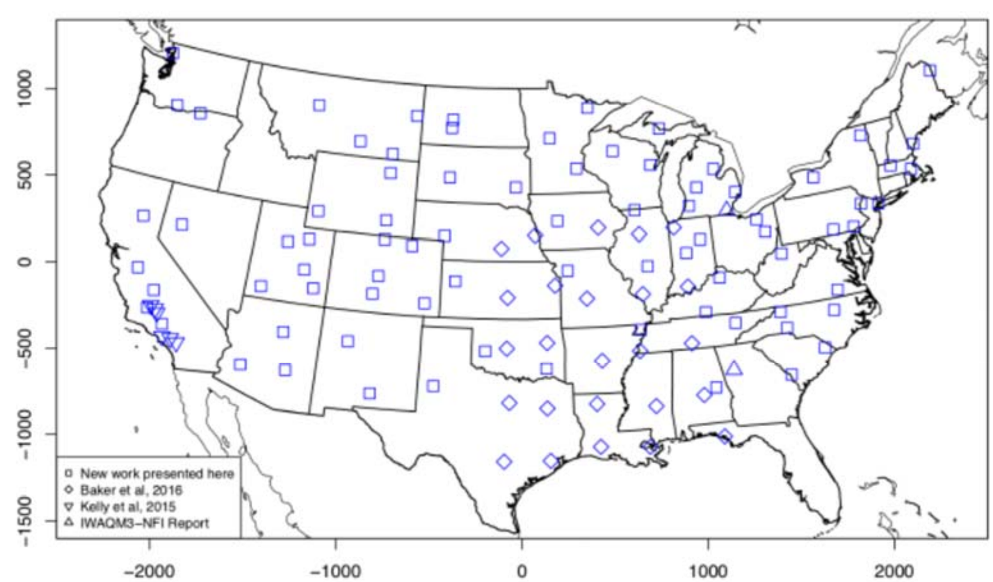
On page 15 of Dr. Sahu's direct testimony, he acknowledges that the MERPs Guidance is intended for major sources but asserts it may be applied to minor sources:

> EPA has provided guidance for determining so-called Modeled Emission Rates for Precursors (MERPs), specifically for individual sources. While this guidance was developed for Prevention of Significant Deterioration (PSD) sources, it can be directly applied as an analytical tool to estimate the contribution of any source.

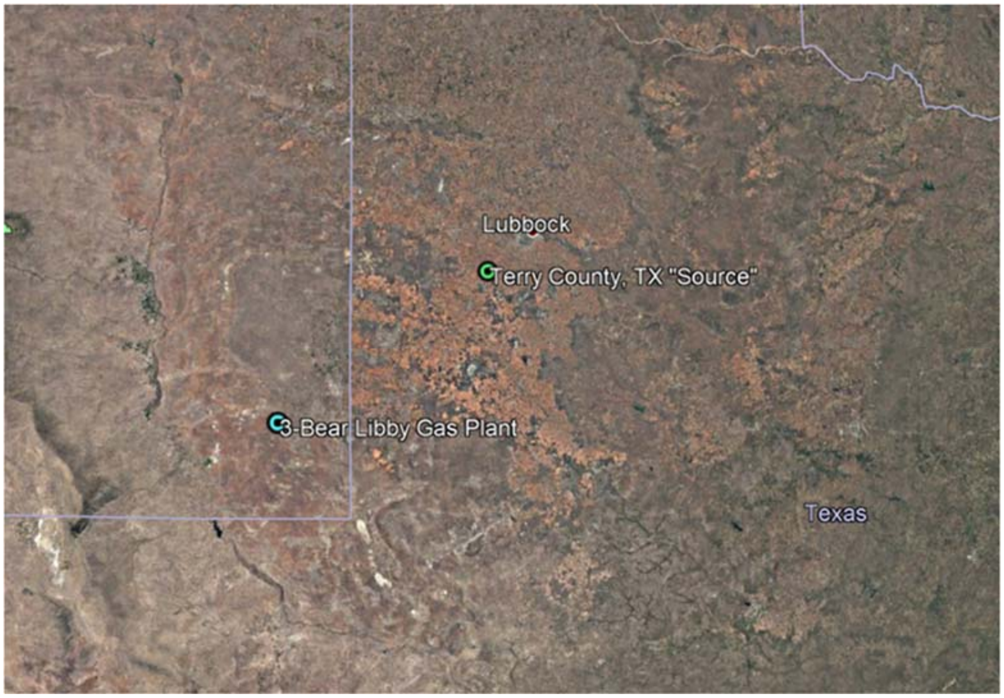
For purposes of comparison, our testimony applies the EPA's MERPs Guidance to evaluate Libby's impacts on ambient ozone concentrations. As detailed below, the analysis shows that Libby's allowable NOx emissions increase would result in ambient ozone impacts of 0.049 ppb and Libby's allowable VOC emissions increase would result in ambient ozone impacts of 0.004 ppb.

For the MERPs Guidance, EPA modeled the ambient impacts of hypothetical sources at multiple locations around the country. Figure 3-2 of the MERPs Guidance, reproduced below, shows the hypothetical source locations.

Figure 3-2. Location of hypothetical sources modeled for downwind secondary air quality impacts included in EPA's assessment.



The hypothetical source in western Texas, located approximately 150 km away in Terry County within the Permian Basin, appears to be the most representative source for Lea and Eddy Counties. The following map shows the relationship of EPA's hypothetical Terry County source to the Libby gas plant.



The results of EPA's MERPs analysis were obtained for this hypothetical source from the MERPs View Qlik website: https://www.epa.gov/scram/merps-view-qlik. We also considered the hypothetical source in southern New Mexico (Otero County, elevation around 9,000 feet), but selected the Terry County source because it is more representative (closer, similar elevations) and the results were more conservative.

The reported MERPs for a 500 tpy modeled emission increase at the Terry County hypothetical source are: 428 tpy NOx and 16,726 tpy VOC from the EPA Qlik Website. In other words, the modeling indicates that these emission rates would cause ambient ozone impacts of less than 1 ppb. Therefore, emission rates less than these amounts would result in ambient ozone impacts of less than 1 ppb, and therefore, would not cause or contribute to an ozone violation.

Using the ozone SIL concentration of 1 ppb and re-arranging Equation 1 from the MERPs guidance (shown below) results in the following impacts.

Eq.1 → MERP (tpy) = SIL (ppb) * Source Emission Rate (tpy) / Source Modeled Impact (ppb)

The modeled impacts from the Terry County hypothetical source are as follows:
NOx → Source ozone impact = 1 ppb * 500 tpy / 428 tpy = 1.168 ppb (per 500 tpy)
VOC → Source ozone impact = 1ppb * 500 tpy / 16,726 tpy = 0.030 ppb (per 500 tpy)

Applying the total increase in allowable emissions for the Libby project to the appropriate MERPs values results in the following estimated ambient ozone impacts of the Libby permit amendment:

Libby project increases = 21 tpy NOx and 72 tpy VOC

Estimated ozone impacts from Libby project increases:

Impact from NOx $\rightarrow$ 21 tpy / 500 tpy * 1.168 ppb = 0.049 ppb
Impact from VOC $\rightarrow$ 72 tpy / 500 tpy * 0.030 ppb = 0.004 ppb

Using this conservative screening technique, the resultant estimated impacts of the Libby permit amendment are approximately 5% of the significance level in the NMED modeling guideline and EPA's significant impact level (1.0 ppb). These results support the NMED modeling guideline statements that additional photochemical modeling is not necessary for non-PSD modeling projects generally and specifically for this project.

Using the MERPs guidance for all theoretical sources in the Continental United States, the minimum level of NOx emissions with a significant impact is 125 tpy and the minimum level of VOC emissions with a significant impact is 1,039 tpy. Since the emission increases from the Libby plant permit are below these thresholds, it suggests that this permit would not cause or contribute to violations anywhere in the United States.

Further, based on over 25 years of photochemical modeling experience for ozone, the predicted ozone impact of precursor emission increases an order of magnitude larger than those associated with the Libby permit modification would be negligible. Ultimately, the above MERP impacts results provide a conservative estimate of ozone impact and add quantitative credibility to the NMED programmatic exclusion of ozone impacts in their minor source permitting program.

3. Feasibility of Tier 2 Modeling of the Ambient Ozone Impacts for Individual Minor Sources

Dr. Sahu contends it is possible to model the ambient ozone impacts of any single source of NOx and VOC emissions, including minor source oil and gas facilities. Sahu Direct at 14-15. He asserts that "[a]gencies have been making ozone determinations from individual sources as well as from regional sources since at least the early 1980s. . . . EPA has provided guidance for determining so-called Modeled Emission Rates for Precursors (MERPs), specifically for individual sources." However, as Dr. Sahu acknowledges, the MERPs guidance was developed for Prevention of Significant Deterioration (PSD) major sources. *Id.* at 15. He provides several examples of regional ozone modeling but provides no examples of ozone modeling being performed for an individual source. *Id.* at 16-20. Notably, the EPA Region 5 Regional Modeler orally stated in early 2020 that no cumulative analysis has been conducted for any PSD ozone precursors (all permitted sources have screened out using the Tier 1 MERPs Guidance).

Dr. Sahu criticizes NMED for saying "it is not possible to do such source-specific modeling" of the Libby plant. Sahu Direct at 14, *quoting* NMED's Answer in EIB No. 20-21(A) (June 15, 2020). He asserts that source-specific modeling is technically possible if costs are not considered. Sahu Direct at 14 n.1. He also criticizes NMED for saying "it is impossible to make a finding in a particular permitting action that a single source emitting relatively miniscule amounts of ozone precursors is 'causing or contributing' to monitored exceedances of the NAAQS." Sahu Direct at 15, *quoting* NMED's Answer.

These criticisms are misplaced. Costs cannot be ignored. In addition, to specifically refute the criticisms related to ozone modeling, it is important to understand the steps and complexities related to this type of modeling. The EPA, regional planning organizations, state agencies, and researchers model ambient ozone concentrations using regional photochemical models such as the Comprehensive Air Quality Model with Extensions (CAMx). Photochemical models require several components including a statewide or regional inventory of emissions from all source categories, tools to allocate emissions geographically and temporally, boundary conditions (e.g., ozone and precursors from outside the modeling domain), and meteorological datasets. Developing and performing quality control for each of these components requires significant effort. Broadly speaking, modelers evaluate ambient ozone concentrations for a base year, compare the projections to actual values, and adjust the model and inputs as necessary to ensure adequate model performance. Relative response factors are developed to estimate the changes in ozone concentrations that result from changes in emissions. Future ozone concentrations are projected using the relative response factors and projected emissions inventories.

Therefore, it is intuitive that complex photochemical ozone modeling analysis requires significant time and resources. From a permitting time perspective, it is not feasible to perform photochemical ozone modeling for individual minor sources of NOx or VOCs. It takes approximately 18 months or more to complete a fully developed baseline photochemical evaluation. This 18-month timeline is much longer than the statutory time frame for issuing minor source permits in New Mexico (90 days under NSMA 1978, Section 74-2-7B(2)(a) (2003)) and it does not include any type of specific sensitivity analyses that would be necessary to understand the ozone impact of a single source. This timing disconnect lends credence to NMED's technical decision to not require additional ozone impacts analysis for non-PSD permit amendments.

4. WEG Incorrectly Argues That any Increase in Ozone Precursor Emissions "Causes or Contributes" to Violations of the Ozone NAAQS

WEG repeatedly makes the unsupported and incorrect claim that <u>any</u> increase in emissions contributes to a NAAQS violation. Dr. Sahu's direct testimony advocates for what amounts to a "one molecule" approach to contribution by stating that:

> Permitting any new source of emissions in this region will contribute to violations of the NAAQS. Sahu Direct at 2.
>
> [T]hese permits and registrations should not be issued at this time since they allow the emissions of more precursor NOx and VOC emissions while the area is clearly in ozone non-attainment based upon the monitored levels of ozone in the area monitors. Sahu Direct at 3.
>
> [T]here is no doubt that there will be some increase in ozone levels when NOx and VOC emissions are increased. Sahu Direct at 15.
>
> Regardless of whether NMED deems increased emissions to be "miniscule" it is technically reasonable to conclude that they are contributing to violations of the ozone NAAQS. Sahu Direct at 16.
>
> [I]n the absence of modeling or analytical data demonstrating otherwise, it is my professional judgment that it is reasonable to presume that any additional emissions of VOCs or NOx in Eddy and Lea counties, such as from the particular facilities at

issue in this matter, will contribute to violations of the ozone NAAQS in the area.
Sahu Direct at 22.

Dr. Sahu's claims are not technically valid for ozone. While NOx and VOCs are ozone precursors, the formation of ozone is a complex and non-linear process driven by precursor pollution and meteorological conditions. NOx increases can "titrate" or react with ozone, such that NOx increases may in some circumstances cause a decrease in ambient ozone levels. In addition, areas with low levels of NOx and high levels of VOCs can be "NOx limited," such that further increasing the VOC concentration has no impact on ambient ozone concentrations. EPA Final Ozone Regulatory Impact Analysis 2008 (Exhibit 5). This can also be seen in the EKMA diagram (which have been out of modeling practice since the early 1990s) reproduced on page 14 of Dr. Sahu's testimony, which includes some ambient concentration curves that remain flat as VOC concentrations increase. Dr. Sahu's simplistic assertion that any increase in NO_X and VOC emissions always increases the ambient concentration of ozone is technically incorrect for both precursors.

It is not technically reasonable to conclude that all individual sources are contributing to violations of the NAAQS as the definition of contribute has been provided through EPA guidance and as part of the New Mexico Modeling Guidelines. The regulatory "cause or contribute" provisions are related to sources that are found to have a contribution that is not de minimis and therefore need to take additional actions to avoid contributing to violations of a NAAQS. The finding that a source does not contribute can be based on previous evidence provided by the source, EPA or state agency judgment or guidance, or a number of other possibilities including a significant impact level evaluation. Many times in air quality management, permitting agencies decide that an emission increase is too small to consider for a particular regulatory requirement. For example, an emission of 0.002 lb/hr of PM10 from a small gas-fired heater does not require a construction permit. This is relevant because the level of ozone precursor emissions from the Libby permit amendment does not rise to the level of concern for evaluation of downwind ozone concentrations per EPA guidance (Exhibits 1 and 4; 40 C.F.R. Part 40 Appx. W) and NMED regulation and guidance.

A source of air emissions is deemed to "cause or contribute" to a NAAQS violation if it has the potential to emit a pollutant or precursor at a rate that is projected to cause ambient air quality impacts greater than an established significant impact level (SIL). Nothing in the federal Clean Air Act, the New Mexico Air Quality Control Act, or their implementing regulations supports Dr. Sahu's position that any source that emits any amount of a pollutant or precursor in an "actual nonattainment area" causes or contributes to a NAAQS violation. To the contrary, EPA and the states routinely issue permits to minor sources in nonattainment areas with the potential to emit pollutants or precursors in amounts that are not required to conduct any further analyses or that are modeled to cause ambient impacts less than the applicable SIL. Neither NMED nor EPA regulations and guidance support a 'one molecule' test for determining whether a source causes or contributes to a NAAQS violation.

5. WEG's Technical Exhibits and Testimony Cite Only Regional Ozone Impacts and not Single Source Impacts

Although WEG appealed certain individual facility permits, the appeal is actually based on concerns that industry-wide regional emissions contribute to a violation of the ozone NAAQS. The Libby permit appears to be relevant only to the extent that it is an example of an air permit for an oil and gas facility. Dr. Sahu acknowledges "the petitioners' contention that regional oil and gas activity, including the permitting of new and/or modified stationary sources, is a primary cause of the increasing ozone pollution levels in the area." Sahu Direct at 20 (emphasis added). He further acknowledges that the appeal challenges industry-wide emissions by stating "it does not make sense that NMED is continuing to issue general permit registrations and permit approvals for oil and gas sources (of which the three registrations and one permit modification in the appeals at issue in the current petitions are just examples) with allowable and actual NOx and VOC increases." Sahu Direct at 2 (emphasis added).

Consistent with the basis of WEG's appeal, Dr. Sahu's testimony and exhibits focus almost exclusively on industry-wide regional ozone impacts. His analysis of single-source ozone impacts is limited to saying that it can be performed using the MERPs Guidance or other unspecified means. Sahu Direct at 14-15. He offers no testimony specific to the Libby permit amendment or the impact of this particular facility on ozone concentrations. As described below, none of his exhibits evaluate single-source ozone impacts.

WEG Exhibit 1 is a legal notice regarding the issuance of the Libby permit. WEG Exhibits 2, 3 and 4 contain a projection of industry-wide emissions in this region, a modeling protocol, and a description of NMED's plans to address ozone. These documents do not model or evaluate the impact of these emissions on ozone concentrations, or whether oil and gas sources will cause or contribute to a NAAQS violation.

WEG Exhibit 5 is "URS, Air Resources Technical Support Document, Carlsbad Field Office (CFO), Oil and Gas Resource Management Plan Revision (April 2013). This document evaluates the air quality impacts of future region-wide oil and gas development and does not provide an argument for performing a single source analysis. It includes the emissions from over 30,000 projected cumulative wells. WEG Ex. 5, Table 1-1, RFD Oil and Gas Wells Counts for Study Mineral Ownership & Well Type Description.

Dr. Sahu's technical testimony uses the cited regional analysis to argue that design values are predicted to be well above of the NAAQS and claimed the analysis did not account for the tremendous increase in emissions due to the dramatic expansion in Permian oil and gas activity. Sahu Direct at 17. More recent projections by the Carlsbad Field office contradict Dr. Sahu's statement and show the level of oil and gas production in New Mexico projected by the URS analysis did not materialize to the levels analyzed. In fact, the more recent projections forecast about half the wells predicted in the URS report. Draft Resource Management Plan and Environmental Impact Statement, Carlsbad Field Office, Pecos District, New Mexico, Volume I Section 4.2.11.1, August 2018 (Draft RMP) (Exhibit 6).

Volume II, Appendix E Supplement to the Draft RMP dated November 2015 (Exhibit 7), addresses the 2015 ozone NAAQS (lowered to 70 ppb) and predicted exceedances of the ozone standard. This provides a practical illustration of a cause or contribute analysis. Future design value exceedances of the standard are identified for the Carlsbad Field Office planning area (72 ppb), for the monitors cited by Dr. Sahu (Sahu Direct at 18). The BLM concludes that the "Carlsbad Field Office RMP and cumulative emissions are not predicted to cause or contribute to violations of the ozone NAAQS" even though the BLM is projecting 3,538 to 6,044 oil and gas wells on BLM-administered lands. If WEG's 'one molecule' argument were correct, the BLM could not allow oil and gas leases under its administration, as it did in this case.

WEG Exhibit 6 is Fann, N., *et. al.*, "Assessing Human Health PM2.5 and Ozone Impacts from U.S. Oil and Natural Gas Sector," Office of Air Quality Planning and Standards, U.S. EPA, Environ Sci Technol. 2018 August 07; 52(15): 8095–8103. doi:10.1021/acs.est.8b02050. This document evaluates county-wide oil and gas emissions and looks at daily maximum 8-hour concentrations rather than fourth maximum concentrations and does not provide an argument for performing a single source analysis. WEG Ex. 6 at 3, 16.

WEG Exhibit 7 is Kemball-Cook, S., *et. al*., "Southern New Mexico Ozone Study, Technical Support Document," October 19, 2016. This document evaluates the sources contributing to ozone concentrations in Dona Ana County, not Lea or Eddy County. It evaluated emissions from the oil and gas industry as a whole and does not provide an argument for performing a single source analysis.

Finally, Dr. Sahu cites a National Park Service web page intended for tourists visiting Carlsbad Caverns National Park, which vaguely states "[t]here are numerous human-made pollution sources that may impact air quality at the park," including unspecified power plants, wells, and refineries. Sahu Direct at 21. This generic layman's assessment provides no technical information and is not relevant to this case.

6. WEG's Proposed "Actual Nonattainment" Test Cannot Be Feasibly Implemented as a Permitting Standard

(a) Monitored Ozone Concentrations and Design Values Fluctuate

Most of New Mexico, including Lea and Eddy Counties, is designated as an attainment area for purposes of the 2015 ozone NAAQS. Dr. Sahu does not dispute this but states that ozone concentrations in southeastern New Mexico exceed 70 ppb and the region will at some point be designated nonattainment. He describes ambient air quality monitoring data from three monitoring stations in southeast New Mexico as follows:

> Ozone data from three monitoring sites in southeast New Mexico—Carlsbad and Carlsbad Caverns National Park in Eddy County and Hobbs in Lea County—are currently in violation of 2015 ozone NAAQS of 70 parts per billion (ppb). While EPA has not yet formally designated the southeastern New Mexico area as ozone non-attainment, these monitors demonstrate non-attainment. It is my opinion that, given the data from these three monitors, the area is already out of compliance with the ozone standard and therefore should be considered to be in a state of actual non-attainment with the ozone NAAQS.

Sahu Direct at 2.

It is problematic to conclude that a monitor violates the NAAQS based on the design value at a single point in time because design values continue to change. In this circumstance, the Hobbs monitor in Lea County has a "current" design value (data through 9/1/2020) of 0.068 ppm. This is calculated using the average of the 4th highest daily 8-hour maximum concentrations with the methods contained in Appendix U to 40 CFR Part 50. To that end, the 4th highest concentrations since 2015 at the Hobbs monitor are as follows:

2015 – 0.067 ppm
2016 – 0.065 ppm
2017 – 0.069 ppm
2018 – 0.076 ppm
2019 – 0.070 ppm
2020 – 0.058 ppm (Year to Date)

These concentrations result in a three-year design value of 0.067 ppm for 2015-2017; 0.070 ppm for 2016-2018; 0.071 ppm for 2017-2019; and 0.068 ppm for 2018-2020. The current year (2018-2020) design value is not complete because the 2020 ozone season is not complete. However, the maximum calculated 8-hour concentration based on data from the New Mexico air quality monitoring Web site (http://nmaqinow.net/) is 0.060 ppm during 2020 at the Hobbs monitor. Calculations are provided as Exhibit 8.

In order to violate the standard for 2018-2020, the 4th highest maximum concentration would have to be 0.067 ppm but there are zero monitored concentrations in 2020 above that. This means that four daily maxima at or above 0.067 ppm would need to be recorded between September 2nd and December 31st, 2020. Based on the historical data, there have not been four values above 0.067 ppm after September 2nd in any of the last five years. Therefore, it is reasonable to expect that the design value for Lea County will not be in violation of the NAAQS in 2018-2020.

Further, this type of design value oscillation is frequent from year-to-year and is one of the reasons that a single design value over the standard at a monitor does not establish a nonattainment area without going through the formal designation process. This oscillation exemplifies the meteorologically dependent nature of ozone and the possibility that design values can change several ppb from year to year.

(b) Nonattainment Designations, Permitting Process Changes and Uncertainty

WEG's claim that NMED must deny applications for any permits that would allow an emissions increase whenever an area is in "actual nonattainment" of the NAAQS could not be feasibly implemented because it ignores the nonattainment area designation process.[1] WEG's position would require NMED to continually change its permitting procedures in response to fluctuations in monitored ozone concentrations. Dr. Sahu's statement that permits should not be issued "at this time" implicitly acknowledges that the requirements may fluctuate. Sahu Direct at 3. This approach could not be implemented without a change in NMED regulations and a process

[1] XTO Energy's direct testimony describes this process.

to ensure that all project proposers and other interested parties are on notice of the requirements in effect for a given area at any particular time.

Federal regulations provide a process to designate nonattainment area boundaries and establish the date upon which nonattainment NSR permitting rules take effect. The requirements applicable to ozone nonattainment areas may change if the area is reclassified. Federal regulations also provide a process to redesignate areas as attainment and establish a date after which the nonattainment NSR permitting rules cease to apply to a given area. This provides certainty. Fluctuations in monitored concentrations do not impact the applicable permitting requirements until a formal designation, redesignation, or reclassification is made. The absence of a similar process in NMED regulations and guidance indicates that the permitting program is not intended to operate in the manner WEG proposes.

7. Conclusion

WEG did not provide testimony that the permitted Libby Gas Plant emission increases cause or contribute to ozone NAAQS violations in southeastern New Mexico. Their direct testimony misapplies the regulatory “cause or contribute” standard and does not attempt to quantify the contribution of the Libby Gas Plant to regional ozone exceedances. As our rebuttal testimony demonstrates, using a conservative screening approach recommended by USEPA for PSD project increases and cited by Dr. Sahu, the Libby Gas Plant MERPs demonstration concludes the project will not cause or contribute to violations of the ozone NAAQS. Based on the MERPs demonstration and previous photochemical modeling experience, it is our conclusion that the impact of individual project ozone precursor emission increases permitted under the minor source program in New Mexico would not cause or contribute to violations of the NAAQS in Lea or Eddy Counties.

Our rebuttal testimony supports our original conclusions:

The application to modify NSR Permit 7482 contained all information required by New Mexico’s air quality regulations, including a regulatory compliance discussion demonstrating compliance with each applicable air quality regulation and ambient air quality standard. The Air Quality Bureau reviewed and approved the modeling for criteria pollutants including CO, NO_2, $PM_{2.5}$, PM_{10}, and SO_2. The applicable guidelines do not require modeling of ambient air quality impacts for ozone.

NMED appropriately determined that it is not necessary for minor sources of NOx and VOCs to analyze their potential impacts on ambient ozone concentrations. This decision is consistent with other state permitting programs and EPA regulations and guidance regarding secondary pollutant analysis for single sources.

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Jeffry Bennett, PE, Senior Air Quality Engineer, Barr Engineering
MO E-29380

Lori K Marquez, Senior Air Quality Consultant, Barr Engineering

CERTIFICATE OF SERVICE

This is to certify that I have duly served the above TESTIMONY OF JEFFRY D. BENNETT, PE, AND LORI MARQUEZ upon all parties herein by email this 2nd day of September, 2020, addressed as follows:

public.facilitator@state.nm.us
Administrator, Environmental Improvement Board

Karla Soloria
New Mexico Office of the Attorney General
P.O. Box 1508
Santa Fe, NM 87504
ksoloria@nmag.gov
Counsel for the Environmental Improvement Board

Lara Katz
New Mexico Environment Department
1190 S. St. Francis Drive
Santa Fe, NM 87505
lara.katz@state.nm.us
Counsel f or the New Mexico Environment Department

Daniel Timmons
WildEarth Guardians
301 N . Guadalupe Street, Suite 201
Santa Fe, NM. 87501
dtimmons@wildearthguardians.org
Counsel for Petitioner WildEarth Guardians

Samantha Ruscavage-Barz
WildEarth Guardians
301 N. Guadalupe Street, Suite 201
Santa Fe, NM. 87501
sruscavagebarz@wildearthguardians.org
Counsel for Petitioner WildEarth Guardians

Adam G. Rankin
Holland & Hart LLP
110 North Guadalupe, Suite 1
Santa Fe, NM 87501
agrankin@hollandhart.com
Counsel for Applicant Spur Energy Partners LLC

Jill Van Noord
Holland & Hart LLP
1800 Broadway, Suite 300

Boulder, CO 80302
jhvannoord@hollandhart.com
Counsel for Applicant Spur Energy Partners LLC

Louis W. Rose
Kari E. Olson
Post Office Box 2307
Santa Fe, New Mexico 87504-2307
(505) 982-3873
lrose@montand.com
kolson@montand.com
Counsel for Applicant XTO Energy Inc.

Andrew J. Torrant
Counsel, Environmental & Safety Law.
Exxon Mobil Corporation
Nl.4A.346
22777 Springwoods Village Parkway
Spring, TX 77389
(832) 624-6430
Andrew.j.torrant@exxonmobil.com
Counsel for Applicant XTO Energy Inc.

Chris Colclasure
____
Chris Colclasure
Counsel for 3 Bear Delaware Operating – NM, LLC

List of Exhibits

Exhibit 1: USEPA 2018, Memorandum, *Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program*, April 17, 2018.

Exhibit 2: NMAQB 2019, New Mexico Air Quality Bureau, *Air Dispersion Modeling Guidelines*, Revised June 6, 2019.

Exhibit 3: USEPA 2017, Memorandum, *Use of Photochemical Grid Models for Single-Source Ozone and Secondary $PM_{2.5}$ impacts for Permit Program Related Assessments and for NAAQS Attainment Demonstrations for Ozone, $PM_{2.5}$ and Regional Haze,* August 4, 2017.

Exhibit 4: USEPA 2019, Memorandum, *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program*, April 30, 2019.

Exhibit 5: USEPA 2008, EPA-452/R-08-003, *Final Ozone NAAQS Regulatory Impact Analysis*, March 2008.

Exhibit 6: BLM 2018, U.S. Department of the Interior Bureau of Land Management, *Draft Resource Management Plan and Environmental Impact Statement*, Carlsbad Field Office, Pecos District, New Mexico, Volume I, August 2018. Excerpt provided as rebuttal testimony.

Exhibit 7: BLM 2018, U.S. Department of the Interior Bureau of Land Management, *Draft Resource Management Plan and Environmental Impact Statement*, Carlsbad Field Office, Pecos District, New Mexico, Volume II, August 2018. Excerpt provided as rebuttal testimony.

Exhibit 8: Jeffry Bennett, Barr Engineering, 2020, *Design Value Calculations using raw monitor data*, August 2020.

EXHIBIT 1

Rebuttal Testimony of Lori Marquez and
Jeff Bennett

New Mexico EIB No. 20-21(A)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

APR 17 2018

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program

FROM: Peter Tsirigotis
Director

TO: Regional Air Division Directors, Regions 1-10

The purpose of the attached document is to provide guidance on compliance demonstration tools for use with ozone and fine particles (PM2.5) in the Prevention of Significant Deterioration (PSD) permitting program. The Environmental Protection Agency (EPA) has developed a new analytical approach and has used it to identify a significant impact level (SIL) for each ozone and $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) and for the $PM_{2.5}$ PSD increments. Permitting authorities may use these values to help determine whether a proposed PSD source causes or contributes to a violation of the corresponding NAAQS or PSD increments. Separately, we have developed a technical document that provides a detailed discussion of the technical analysis used in the development of these values and a legal memorandum that provides further detail on the legal basis that permitting authorities may choose to adopt to support using SILs to show that requirements for obtaining a PSD permit are satisfied.[1] This guidance provides a summary of the results of the technical analysis and information on the particular points in the PSD air quality analysis at which permitting authorities may decide to use these values on a case-by-case basis in the review of PSD permit applications. This guidance, and the technical and legal documents, are not final agency actions and do not create any binding requirements on permitting authorities, permit applicants or the public.

Please share this guidance with permitting authorities in your Region. If you have questions regarding the guidance, please contact Raj Rao at *rao.raj@epa.gov* or (919) 541-5344. For questions regarding the technical document, please contact Tyler Fox at *fox.tyler@epa.gov* or (919) 541-5562. For questions regarding the legal document, please contact Brian Doster at *doster.brian@epa.gov* or (202) 564-1932.

Attachment

[1] "Technical Basis for the EPA's Development of Significant Impact Thresholds for $PM_{2.5}$ and Ozone," EPA-454/R-18-001, April 2018; "Legal Memorandum: Application of Significant Impact Levels in the Air Quality Demonstration for Prevention of Significant Deterioration Permitting under the Clean Air Act," April 2018.

Attachment

Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program

I. INTRODUCTION

When a Prevention of Significant Deterioration (PSD) permit applicant has shown through air quality modeling that the projected air quality impact from a proposed source for a particular pollutant is not significant or meaningful, the EPA believes there is a valid analytical and legal basis in most cases for the permitting authority to conclude that the proposed source will not cause or contribute to a violation of a National Ambient Air Quality Standard (NAAQS) or PSD increment for that pollutant. To show that the proposed source will not have a significant or meaningful impact on air quality, permit applicants and permitting authorities may elect to use these Significant Impact Level (SIL) values (air quality concentration values) as a compliance demonstration tool. In this guidance and accompanying documents, the EPA has provided policy, technical and legal analyses that permitting authorities may choose to adopt in supporting the use of the SILs to make the required demonstration in particular PSD permitting actions. The use of SILs can help satisfy PSD requirements while expediting the permitting process and conserving resources for permit applicants and permitting authorities.

The EPA has previously issued guidance describing particular uses of SILs.[1,2,3,4] The EPA has also recognized that permitting authorities have the discretion to apply SILs on a case-by-case basis in the review of individual permit applications, provided such use is justified in the permitting record.[5] In an effort to reduce the need for case-by-case justification by permitting authorities, the EPA finalized a rule in 2010 to codify, among other things, particular $PM_{2.5}$ SIL values and specific

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[1] Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program," August 23, 2010.

[2] Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program," June 29, 2010.

[3] Memorandum from Stephen D. Page, EPA OAQPS, to OAQPS Personnel and EPA Regional Modelers, "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS," March 23, 2010.

[4] Memorandum from Gerald A. Emison, EPA OAQPS, to Thomas J. Maslany, EPA Air Management Division, EPA Region 3, "Air Quality Analysis for Prevention of Significant Deterioration (PSD)," July 5, 1988.

[5] Order Responding to Petitioner's Request that the Administrator Object to Issuance of a State Operating Permit, *In the Matter of CF&I Steel, L.P. dba EVRAZ Rocky Mountain Steel*, Petition Number VIII-2011-01, at 15-17 (May 31, 2012) (*"Rocky Mountain Steel Order"); In re: Mississippi Lime Company*, 15 E.A.D. 349, 375-379 (Environmental Appeals Board (EAB) 2011).

applications of those values ("2010 rulemaking").[6] However, in the course of subsequent litigation over this rule, the EPA conceded the regulation was flawed because it did not preserve the discretion of permitting authorities to require additional analysis in certain circumstances, and the court granted the EPA's request to vacate and remand the rule so that the EPA could address the flaw.[7]

Following the litigation, the EPA began developing a new rule to address the flaw identified in the 2010 rulemaking.[8] However, after further evaluation and the identification of a revised set of SIL values based on the technical and legal analyses described below, the EPA believes it should first obtain experience with the application of these values in the permitting program before establishing a generally applicable rule.[9] Thus, the EPA intends at this point to take a two-step approach.

First, the EPA is providing non-binding guidance so that we may gain valuable experience and information as permitting authorities use their discretion to apply and justify the application of the SIL values identified below on a case-by-case basis in the context of individual permitting decisions. We will be seeking to learn generally about permitting agencies' experiences in applying SILs in particular PSD permitting decisions. We will also be seeking more specific information, including how often and in what types of settings the application of a SIL at the single-source assessment and cumulative assessment stages of the PSD air quality analysis has made a critical difference in whether a conclusion was reached that the proposed source will not cause or contribute to a NAAQS or PSD increment violation. The EPA intends to obtain this information through its own PSD permitting activities in states that do not have SIP-approved PSD programs, regular discussions between our Regional offices and air agencies, regular conference calls with the permitting committees of national organizations of air agencies, and technical conferences of air quality modelers and others interested in permitting activities.

Second, the EPA will use this experience and information to assess, refine and, as appropriate, codify SIL values and specific applications of those values in a future, potentially binding rulemaking. During this second step, to assess whether it is appropriate to codify particular SIL

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[6] 75 FR 64864 (October 20, 2010).

[7] *Sierra Club v. EPA*, 705 F.3d 458, 463-66 (D.C. Cir. 2013). In its litigation brief at n. 10, the EPA stated an intent to issue guidance in the near future concerning $PM_{2.5}$ values remaining in 40 CFR 51.165(b)(2). The EPA issued such guidance in May 2014. Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance for $PM_{2.5}$ Permit Modeling," May 20, 2014.

[8] Fall 2015 Regulatory Agenda, USEPA, 80 FR 78024, December 15, 2015. Ozone and Fine Particulate Matter ($PM_{2.5}$) Significant Impact Levels (SILs) for Prevention of Significant Deterioration (PSD), RIN: 2060-AR28. *http://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201510&RIN=2060-AR28.*

[9] *See SEC v. Chenery Corp.,* 332 U.S. 194, 199-203 (1947) (recognizing that some principles may warrant further development before they are ready to be codified in a rule of general applicability).

values for ozone and $PM_{2.5}$, the EPA will consider whether permitting experience has confirmed that the recommended SIL values are suitable in all circumstances to show that an increase in air quality concentration below the value does not cause or contribute to a violation of the NAAQS or PSD increments.

Permitting authorities retain discretion to use or not to use these EPA-derived SILs in particular PSD permitting actions. If a permitting authority chooses to use these SIL values to support a case-by-case permitting decision, it must justify the values and their use in the administrative record for the permitting action.[10] Permitting authorities also have discretion to develop their own SIL values, provided that such values are properly supported in the record for permitting actions or decisions in which the values are used to make the required showing. Detailed technical guidance on the development of alternative SIL values is beyond the scope of this document; however, we provide a limited discussion later in this document (*see*, e.g., page 12). This guidance (including the legal and technical documents) supporting the EPA's recommended SIL values may be viewed as a model for permitting authorities that seek to develop alternative SIL values. Permitting authorities may elect to utilize alternative "confidence intervals" as well as regional or local factors in developing their own SIL values.[11]

Since the 2010 rulemaking, the EPA has examined the legal basis for using SIL values in PSD air quality impact analyses. In addition, the EPA has sought to develop a stronger analytical foundation for the EPA recommended SIL values. This guidance and supporting documents are the products of this effort. They identify specific SIL values for ozone and $PM_{2.5}$ and provide a supporting justification that permitting authorities may choose to apply on a case-by-case basis. The values and supporting justification are designed so that permitting authorities can choose to apply the SIL values to demonstrate that a proposed source does not cause or contribute to a violation of NAAQS or PSD increments. In contrast to the 2010 rulemaking, we have developed separate SIL values for the $PM_{2.5}$ NAAQS and PSD increments, and we have developed SILs for the ozone NAAQS. Since there are no PSD increments for ozone, the EPA has not developed SILs for ozone.

The EPA believes that the application of these SILs in the manner described below would be sufficient in most situations for a permitting authority to conclude that a proposed source will not cause or contribute to a violation of an ozone or $PM_{2.5}$ NAAQS or $PM_{2.5}$ PSD increments. However, this guidance is not a final agency action and does not reflect a final determination by the EPA that any particular proposed source with a projected impact below the recommended SIL value does not cause or contribute to a violation. A determination that a proposed source does not cause or contribute to a violation can only be made by a permitting authority on a permit-specific basis after consideration of the permit record. This guidance is not legally binding and does not affect the rights or obligations of permit applicants, permitting authorities, or others. The SIL

[10] *Rocky Mountain Steel Order* at 16-18, supra footnote 5. Such a justification may incorporate the information compiled by the EPA to support the SILs recommended in this memorandum.
[11] A description of the "confidence interval" is provided at page 12 of this document and in the technical document at section 2.2 (Statistical Methods and Assessing Significance Using Confidence Intervals).

values identified by the EPA have no practical effect unless and until permitting authorities decide to use those values in particular permitting actions. The experience of permitting authorities using these SILs on a case-by-case basis, or in choosing to limit or forego their use in specific situations, will be valuable information for the EPA to consider in a future rulemaking. Permitting authorities retain the discretion to apply and justify different approaches and to require additional information from the permit applicant to make the required air quality impact demonstration, consistent with the relevant PSD permitting requirements.

II. BACKGROUND

A PSD permit applicant must demonstrate that "emissions from construction or operation of such facility will not cause, or contribute to, air pollution in excess of any" NAAQS or PSD increment.[12] The EPA has reflected this requirement in its PSD regulations.[13] The Clean Air Act (Act) does not specify how a permit applicant or permitting authority is to make this demonstration, but section 165(e) authorizes the EPA to determine how the analysis is to be conducted, including the use of air quality models. In accordance with this authority, the EPA has promulgated regulations that identify such models and the conditions under which they may be used in the PSD program to make the demonstration required under the Act.[14]

Using the models identified in the EPA's regulations, there are two basic ways that a PSD permit applicant can demonstrate that the proposed source's emissions will not cause or contribute to a violation of a NAAQS or PSD increment. One way is to demonstrate that no such violation is occurring or projected to occur in the area affected by the emissions from the proposed source.[15] A second way is to demonstrate that the emissions from the proposed source do not cause or contribute to any identified violation of the NAAQS or PSD increments.[16]

The Act does not define "cause" or "contribute." Reading these terms in context, the EPA has historically interpreted this provision in section 165(a)(3) of the Act and associated regulations to mean that a source must have a "significant impact" on ambient air quality in order to cause or contribute to a violation.[17] Thus, the EPA and other permitting authorities have concluded that a

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[12] 42 U.S.C. 7475(a)(3) (section 165(a)(3) of the Act). The EPA interprets the phrase "in excess of" to mean a violation, not the exceedance described in 40 CFR 50.1(l).
[13] 40 CFR 51.166(k); 40 CFR 52.21(k).
[14] The PSD regulations at 40 CFR 51.166(l) and 52.21(l) require the use of "applicable models, data bases, and other requirements" specified in 40 CFR part 51, Appendix W, also known as the *Guideline on Air Quality Models (Guideline*).
[15] 1990 Draft New Source Review (NSR) Workshop Manual at C.51.
[16] 40 CFR part 51, App. W, § 9.2.3; 1990 Draft NSR Workshop Manual at C.52.
[17] *In re: Prairie State Generating Co*., 13 E.A.D. 1, 105 (EAB 2006). This EAB opinion includes a long discussion of the EPA's prior guidance with other examples.

proposed source may meet the requirements in section 165(a)(3) and the EPA's PSD regulations by showing that its projected impact on air quality at the site of a modeled violation is below a level of air quality impact considered to be significant.[18]

Historic Use of SILs

In the context of section 165(a)(3), the EPA has historically used pollutant-specific concentration levels known as "significant impact levels" to identify the degree of air quality impact that "causes, or contributes to" a violation of a NAAQS or PSD increment.[19] Consistent with the EPA guidance, proposed sources have met the requirement to demonstrate that they do not cause or contribute to a violation by showing that the ambient air quality impacts resulting from the proposed source's emissions would be below these concentration levels.[20] The SIL values have served as a compliance demonstration tool to make the required demonstration in the PSD program. They have helped to reduce the burden on permitting authorities and permit applicants to conduct often time-consuming and resource-intensive air dispersion modeling where such modeling was unnecessary to demonstrate that a permit applicant meets the requirements of section 165(a)(3), consistent with the procedures set forth originally in 1977 in the "Guidelines for Air Quality Maintenance Planning and Analysis, Volume 10 (Revised) and Procedures for Evaluating Air Quality Impact of New Stationary Sources."[21]

Recent Status of SILs for Ozone and $PM_{2.5}$

Since the inception of the PSD program, the EPA has faced technical challenges with providing compliance demonstration tools for those pollutants that are not directly emitted by sources (ozone and secondarily-formed $PM_{2.5}$) and which form through chemical reactions of precursor pollutants. In July 2010, the Sierra Club petitioned the EPA to initiate rulemaking regarding the establishment of air quality models for ozone and $PM_{2.5}$ for use by PSD permit applicants. In January 2012, the EPA granted the petition and committed to engage in rulemaking to evaluate whether updates to the *Guideline* are warranted and, as appropriate, incorporate new analytical techniques or models for ozone and secondarily-formed $PM_{2.5}$. In granting the petition, the EPA explained that the "complex chemistry of ozone and secondary formation of $PM_{2.5}$ are well-documented and have historically presented significant challenges to the designation of particular models for assessing

[18] 1990 Draft NSR Workshop Manual at C.52.
[19] 61 FR 38250, 38293 (July 23, 1996); 72 FR 54112, 54139 (September 21, 2007).
[20] 1990 Draft NSR Workshop Manual at C.51-C.52.
[21] October 1977, U.S. EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711. The 1977 document did not discuss SILs, but did identify procedures for air quality analyses pursuant to the PSD program.

the impacts of individual stationary sources on the formation of these air pollutants"[22] Because of these considerations, the EPA's past judgment had been that it was not technically sound to designate with particularity specific models that must be used to assess the impacts of a single source on ozone and secondarily-formed $PM_{2.5}$ concentrations. Instead, the EPA established a consultation process with permitting authorities for determining (on a permit-specific basis) the analytical techniques that should be used for single-source analyses for both ozone and secondarily-formed $PM_{2.5}$.

The EPA has responded to the Sierra Club petition by finalizing revisions to the EPA's *Guideline*.[23] As discussed in the preamble to the *Guideline*, recent technical advances have made it reasonable for the EPA to provide more specific guidelines that identify appropriate analytical techniques or models that may be used in compliance demonstrations for the ozone and $PM_{2.5}$ NAAQS and $PM_{2.5}$ PSD increments. The revisions to the *Guideline* include criteria and process steps for choosing single-source analytical techniques or models to estimate ozone impacts from precursor nitrogen oxide (NOx) and volatile organic compound (VOC) emissions and to assess concentrations of direct and secondarily-formed $PM_{2.5}$. The ozone and $PM_{2.5}$ SIL values recommended in this guidance are intended to complement the *Guideline* updates by providing thresholds that may be used to determine whether an increase in air pollutant concentration (impact) predicted by the chosen technique or model causes or contributes to a violation.

In the 2010 rulemaking, the EPA established SIL values for $PM_{2.5}$ in paragraph (k)(2) of the PSD regulations at 40 CFR 51.166 and 52.21. In January 2013, the U.S. Court of Appeals for the District of Columbia Circuit granted the EPA's request to vacate and remand the paragraph (k)(2) provision in both PSD regulations so the EPA could correct them.[24] Paragraph (k)(2) as promulgated in 2010 included numerical values of $PM_{2.5}$ SILs and statements about their role in completing an air quality impact analysis with regard to the $PM_{2.5}$ NAAQS and PSD increments. Specifically, the 52.21(k)(2) rule text stated that if the impact of a proposed source seeking a federal PSD permit was below the relevant SIL value(s), then the proposed source would be deemed to not cause or contribute to a violation. The 51.166(k)(2) rule text stated that a state's PSD rules could contain a similar provision. The EPA asked the court to vacate and remand the (k)(2) paragraphs of both PSD regulations so that the EPA could correct an inconsistency between (1) that rule text, which left no discretion for the permitting authority, and (2) our statements in the preamble to the 2010 rulemaking, which identified certain circumstances where it may not be

[22] Letter from Gina McCarthy, Assistant Administrator, EPA Office of Air and Radiation, to Robert Ukeiley, Sierra Club, January 4, 2012.
[23] 82 FR 5182 (January 17, 2017).
[24] *Sierra Club v. EPA*, 705 F.3d 458, 466 (D.C. Cir. 2013).

appropriate for a permitting authority to rely solely on the $PM_{2.5}$ SILs as a basis for concluding that a proposed source does not cause or contribute to a violation.[25]

The court left intact the $PM_{2.5}$ NAAQS significance levels separately promulgated at 40 CFR 51.165(b)(2), because the regulatory text in that section did not say that a proposed source that has an impact less than the significance level is always deemed to not cause or contribute to a violation. The regulatory text at 40 CFR 51.165(b)(2) says that a major source or major modification with a projected impact greater than the listed significance level at any location that does not or would not meet the applicable NAAQS will be considered to cause or contribute to a violation, but this provision does not compel the opposite conclusion for projected impacts equal to or below that level.[26]

III. RECOMMENDED SIL VALUES FOR USE IN AIR QUALITY IMPACT DEMONSTRATION REQUIRED TO OBTAIN A PSD PERMIT

As discussed above, the EPA has interpreted the phrase "cause, or contribute to" in section 165(a)(3) of the Act to mean that a proposed source will have a "significant impact" on air pollutant concentrations that violate the standards. In this context, the EPA believes permitting authorities may read the phrase "cause, or contribute to" in section 165(a)(3) to be inapplicable to an air quality impact that is insignificant. This interpretation is more fully explained in the legal memorandum. In the context of this section of the Act, the EPA believes an insignificant impact is an impact on air quality concentrations that is small and not meaningful (e.g., the EPA has often described such an impact as "trivial" or "*de minimis*").

As discussed in more detail in the legal memorandum, a permitting authority may conclude that a PSD permit applicant will "cause" a modeled violation of a NAAQS when the increased emissions from construction or modification of the proposed source are the reason for, responsible for, or the "but for" cause of the violation. However, a permitting authority must also consider whether emissions "contribute" to a violation in circumstances where a violation of the NAAQS is present before considering the proposed increase in emissions from a PSD construction project, or when

[25] These preamble statements were the following: "[N]otwithstanding the existence of a SIL, permitting authorities should determine when it may be appropriate to conclude that even a *de minimis* impact will 'cause or contribute to' an air quality problem and to seek remedial action from the proposed new source or modification." *See* 75 FR 64864, 64892. "[T]he use of a SIL may not be appropriate when a substantial portion of any NAAQS or increment is known to be consumed." *See* 75 FR 64864, 64894. "[W]e earlier provided an example of when it might be appropriate to require a modified source to mitigate its contribution to a violation of a NAAQS or increment even when the predicted ambient impact of the proposed emissions increase would result in what is normally considered to be *de minimis*." *See* 75 FR 64864, 64894.

[26] 40 CFR 51.165(b)(2) is phrased such that an impact equal to the listed value is treated the same as impacts below the listed value. This contrasts to the approach in former 40 CFR 51.166(k)(2) and 52.21(k)(2), and, in this guidance, that an impact equal to the SIL is treated the same as impacts above the SIL.

emissions from multiple sources may impact a particular area. In the absence of specific language in section 165(a)(3) regarding the degree of contribution that is required (such as the term "significantly"), a permitting authority has the discretion under this provision to exercise its judgment to determine the degree of impact that contributes to adverse air quality conditions based on the particular context in which the term contribute is used. A permitting authority may also identify criteria or factors that may be used to determine whether something contributes, including qualitative or quantitative criteria that are appropriate to the particular context.[27]

For purposes of implementing section 165(a)(3) of the Act, the EPA has found it more expedient and practical to use a quantitative threshold (expressed as a level of change in air quality concentration) to determine whether increased emissions from proposed construction or modification of a source will cause or contribute to air quality concentrations in violation of applicable standards. One of the goals of the development of SILs as a compliance demonstration tool is to ensure an appropriate balance between maintenance of air quality and PSD permit process streamlining. The EPA believes that the permitting process can be streamlined without compromising air quality if the EPA and permitting authorities are able to identify a quantitative threshold or dividing line between an insignificant and a significant impact on air pollutant concentrations. Using a quantitative threshold for this purpose is permissible as long as the EPA or the appropriate permitting authority provides a reasoned explanation for why impacts below that value do not cause or contribute to a violation in a particular context.

Historical Approach for Developing SILs

To determine what is (and is not) a significant impact in the context of section 165(a)(3) of the Act, the EPA has previously supported using the levels in 40 CFR 51.165(b)(2).[28] The EPA has

[27] *See Catawba County, N.C. v. EPA*, 571 F.3d 20, 39 (D.C. Cir. 2009). In this case interpreting the term "contributes" in section 107(d) of the Act, the court held that the EPA is not required to establish a quantitative or objective, bright-line test to define a contribution by sources to adverse air quality conditions in a nearby area in the context of designations with respect to attainment of a NAAQS. The court recognized that the EPA has the discretion to use a totality-of-the-circumstances test if the Agency defines and explains the criteria that it is applying. While this opinion said that a quantified threshold is not required to define "contribution" in the context of section 107(d), the court's reasoning does not preclude PSD permitting authorities from choosing to use a quantitative level of impact to represent a contribution to a violation of the NAAQS or PSD increment when implementing section 165(a)(3) of the Act.

[28] The Emison Memo, *supra* footnote 5, references 40 CFR 51.165(b)(2) for the purpose of defining "significant" in this context. The NSR Workshop Manual at C.26-C.28 lists values from 40 CFR 51.165(b)(2) for the purpose of defining the area of "significant ambient impact."

described these levels as "significance levels."[29] 40 CFR 51.165(b)(2) was originally promulgated by the EPA in 1987 as part of an offset provision permitting authorities could apply after it was determined that construction at a stationary source was predicted to cause or contribute to a violation of the NAAQS.[30] This regulation provides that a proposed source planning to locate in an attainment area will be considered to "cause or contribute to" a violation of the NAAQS if its impact would exceed specific values identified in the regulation. For example, 40 CFR 51.165(b)(2) states that a proposed source impact that is greater than 5 micrograms per cubic meter ($\mu g/m^3$) for the 24-hour sulfur dioxide (SO_2) NAAQS causes or contributes to a violation of that NAAQS. The section refers to these values as "significance levels." Values are not provided for every NAAQS, particularly ozone (and not for $PM_{2.5}$ until the 2010 rulemaking), but for those NAAQS covered in this regulation, the application is the same. Over time, these air quality concentration significance levels in 40 CFR 51.165(b)(2) have become known as "significant *impact* levels"[31] [emphasis added] in order to distinguish them from the significant *emissions rates* reflected in the definition of the term "significant," which serve a different function in the PSD program.[32] The EPA has also issued guidance memoranda that have provided recommended SIL values for the 1-hour nitrogen dioxide (NO_2) and SO_2 NAAQS, to be used for the purpose of determining what are (and are not) significant impacts for these pollutants in the context of the 1-hour standards.[33]

As referenced above, the EPA's values contained in 40 CFR 51.165(b)(2) originally were related to the level of protection afforded by the PSD increments that Congress established for Class I areas.[34] The EPA generally relied on that approach in 2010 by using the ratio of the $PM_{2.5}$ NAAQS

[29] The EPA initially promulgated these same concentration values in 1978 and described them as the "minimum amount of ambient impact that is significant." 43 FR 26380, 26398 (June 19, 1978). In the 1979 Emissions Offset Interpretative Ruling (Appendix S to 40 CFR part 51), the EPA used these values as the "significance levels" under which a source locating in the "clean" portion of a nonattainment area may be exempt from the preconstruction review requirements. 44 FR 3274, 3283 (January 16, 1979). Under Appendix S, as revised in 1980, the EPA considered a source to "cause or contribute to" a violation if the impact of the source or modification would exceed these significance levels at any locality that does not meet the NAAQS. 45 FR 31307, 31311 (May 13, 1980).

[30] 52 FR 24672, 24713 (July 1, 1987).

[31] The first reference to "significant impact levels" is in the 1980 NSR Workshop Manual, which the EPA subsequently updated in the 1990 draft. It is worth noting that the 1977 comments to the proposed Appendix W rule (45 FR 58543) addressed whether a single-source screening technique should be used to determine if a cumulative modeling analysis would be required in a preconstruction review; industry and state agency comments indicated both groups favored some use of a tool to alleviate resource burden.

[32] 40 CFR 52.21(b)(23) defines the term "significant" and applies discrete values for determining if the emissions increase from a proposed source will be significant. This regulation states that an increase in emissions of each ozone precursor (VOC and NOx) is significant if it equals or exceeds 40 tons per year (tpy) and, for direct emissions of $PM_{2.5}$ the significance level is 10 tpy. For $PM_{2.5}$ precursor emissions, the significance level is 40 tpy for SO_2 and 40 tpy for NOx.

[33] Page memoranda, *supra* footnotes 1 and 2 of this attachment.

[34] 43 FR 26380, 26398.

to the particulate matter 10 micrometers or less in diameter (PM_{10}) NAAQS as a multiplier to add $PM_{2.5}$ values to 40 CFR 51.165(b)(2) and to establish $PM_{2.5}$ SIL values in 40 CFR 51.166(k)(2) and 52.21(k)(2).[35] However, given limitations in the rationale supporting them, the EPA recognized in the preamble to the 2010 rulemaking that a permitting authority may not be able to apply the SIL values derived through this approach in every situation to show that proposed construction does not cause or contribute to a violation of standards. The EPA acknowledged that "the use of a SIL may not be appropriate when a substantial portion of any NAAQS or increment is known to be consumed." The EPA also said that "notwithstanding the existence of a SIL, permitting authorities should determine when it may be appropriate to conclude that even a *de minimis* impact will 'cause or contribute to' an air quality problem and to seek remedial action from the proposed new source or modification."[36] To guard against the improper use of the 2010 SILs for $PM_{2.5}$ in such circumstances, the EPA later recommended that permitting authorities use those SILs only where they could establish that the difference between background concentrations in a particular area and the NAAQS was greater than those SIL values.[37] This approach was intended to guard against misuse of the SILs in situations where the existing air quality was already close to the NAAQS.

Analytical Foundation for Recommended SILs

Since the May 2014 $PM_{2.5}$ modeling guidance was issued, the EPA has conducted a statistical analysis that provides an improved analytical foundation for the EPA's selection, based on the policy considerations described below, of a degree of change in concentration that permitting authorities may use to represent an insignificant impact on air pollutant concentrations for ozone and $PM_{2.5}$ in the context of PSD permitting. This technical method, referred to as the air quality variability approach, is described in the technical document. Given the improvements reflected in this method, the EPA does not see a need for permitting authorities to show that the difference between background concentrations and the relevant NAAQS is greater than the SIL value before applying one of the recommended $PM_{2.5}$ SIL values. The EPA's intention with this new method was to derive SIL values that are more universally applicable to a range of conditions, including those where a substantial portion of the NAAQS or PSD increment is known to be consumed. However, permitting authorities retain discretion whether to apply SILs as a general matter, or in particular permitting actions, based on information in the permit record.

In order for a specific change in air quality concentrations to be used to show that a proposed source does not cause or contribute to a violation of the NAAQS, the concentration change must

[35] 75 FR 64890.
[36] 75 FR 64864, 64892.
[37] Memorandum from Stephen D. Page, EPA OAQPS, to EPA Regional Air Division Directors, "Guidance for $PM_{2.5}$ Permit Modeling," May 20, 2014.

represent a level of impact on ambient air quality that is not significant or meaningful. The EPA's judgment is that values representing such a level can be selected from a statistical analysis of the variability of air quality, using data from the U.S. ambient monitoring network for ozone and $PM_{2.5}$. Due to fluctuating meteorological conditions and changes in day-to-day operations of all air pollution sources in an area, there is an inherent variability in the air quality in the area surrounding a monitoring site. This variability can be characterized through the application of a well-established statistical framework for quantifying uncertainty.[38,39] The analysis described in the technical document quantifies the inherent variability in pollutant concentrations (as measured by design values) and informs the EPA's choice of a value for a change in concentrations that the EPA does not consider significant or meaningful because changes of this magnitude are well within the inherent variability of observed design values.[40] Once the precautionary choices described below are built into the calculation, this degree of change in concentration is, thus, indistinguishable from the inherent variability in the measured atmosphere and may be observed even in the absence of the increased emissions from a new or modified source. Therefore, a permitting authority can reasonably conclude that emissions of a proposed source that have a projected impact below the SIL values provided in this memorandum are not the reason for, responsible for, or the "but for" cause of a NAAQS violation. Likewise, this indicates that changes in air quality within this range are not meaningful, and, thus, do not contribute to a violation of the NAAQS.

Before delving in detail into the technical and policy considerations that inform the EPA's choice of the SILs recommended in this document, it is important to point out that the discretion of the EPA and other permitting authorities is limited by the 2010 rulemaking. Specifically, since the EPA has established by regulation that a $PM_{2.5}$ impact greater than a certain value will be considered to cause or contribute to a violation of the relevant NAAQS, permitting authorities may not use a value higher than 1.2 $\mu g/m^3$ for the 24-hour $PM_{2.5}$ NAAQS or a value higher than 0.3 $\mu g/m^3$ for the annual $PM_{2.5}$ NAAQS. Because ozone is not addressed in 40 CFR 51.165(b)(2), permitting authorities are not precluded from developing a higher ozone NAAQS SIL value than recommended in this guidance. Likewise, 40 CFR 51.165(b)(2) does not address PSD increments and, thus, does not constrain the discretion of a permitting authority to develop a higher SIL value and use it for PSD increment purposes.

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[38] Efron, B. (1979); "Bootstrap methods: Another look at the jackknife". The Annals of Statistics 7 (1): 1–26. doi:10.1214/aos/1176344552.

[39] Efron, B. (2003); Second Thoughts on the Bootstrap. Stat. Sci., 18, 135-140.

[40] The EPA conducted an external peer review of the technical document containing the statistical analysis used for developing the SILs for ozone and $PM_{2.5}$. The peer review comments were supportive of the air quality variability method as being appropriate for application for SILs. The comments also suggested several considerations for improvements to the technical document and analyses to better support the application of the analysis to determine specific SIL values. Therefore, the EPA made a number of revisions to the technical document, including conducting new analyses to investigate issues raised by the reviewers, edits to a number of sections for clarity and accuracy, and updating the analysis to include the most recent data. A peer review report that outlines the subsequent changes to the technical analysis is available from the U.S. EPA library, library number EPA 454/S-18-001.

Basis for Development of Recommended SILs for Ozone and $PM_{2.5}$

In developing the recommended SILs for ozone and $PM_{2.5}$, we assessed the variability in pollutant concentrations, as determined by the national monitoring network, from the design value at each monitor (i.e., baseline value). The technical analysis uses traditional statistical techniques based on statistical significance testing to characterize the variability in air quality. The conceptual underpinnings of the analysis are an application of the concept of "statistical significance" to inform a policy decision regarding what represents an insignificant impact and, therefore, may serve as the basis for developing a SIL for use in the air quality impact analyses required for PSD permitting. More specifically, traditional statistics is based on the concept of identifying what constitutes a statistically significant change from a baseline value where the "baseline" is the statistic of interest, such as the mean or, in this case, the design value. Rather than focusing on statistically significant changes, the purpose of the analysis was to calculate changes in the design values that, once precautionary choices are applied, may be considered not significant or meaningful. To identify recommended SILs for the desired application in the PSD program, the EPA determined that the findings of the statistical analysis can be used to identify a change in the design value (i.e., an air quality impact) below which a permitting authority may reasonably conclude that the impact does not cause or contribute to a violation of a NAAQS. The principles of statistical significance testing do not by themselves provide a single, unique threshold for determining the statistical significance of a change in the design value. Statistical significance testing provides a range of concentration values that can be considered to represent a statistically significant change in air quality or, in this application, a change in air quality that is not statistically significant. Therefore, it is necessary to consider the function and application of SIL values in the context of the PSD program and to select a change in air quality that is reasonably representative of the showing that a proposed source will not cause or contribute to a NAAQS violation, as required by the Act and PSD regulations.

In making a recommendation for an appropriate SIL value, the EPA balanced two considerations: 1) the usefulness of the SIL as a compliance demonstration tool in the PSD permitting program, and 2) the likelihood of a SIL value representing an impact that is not significant. In balancing these considerations, the EPA made policy decisions concerning the confidence interval (CI) to represent the inherent variability for purposes of the NAAQS compliance demonstration, the approach used to scale local variability to the level of the NAAQS, the geographic extent of each summary value, and the design value year or years from which to use the variability results. As described below, for each of these factors, the EPA chose options that are precautionary, leading to SILs designed to ensure the protection of air quality.

Through the statistical analysis, we calculated CIs, which represent different assessments of the level of change in air quality based on the inherent variability in the air quality of an area. We then selected the recommended SIL values as a function of the CIs, the baseline value, and policy considerations. The selection of a CI in defining a particular SIL value required an exercise of judgment based on the technical and policy considerations (as described below) such that the selected value represents a level of change in air quality concentration that can be considered not significant or meaningful in the context of evaluating the impact of emissions from a proposed source. These policy considerations work in conjunction with the statistical analysis, to provide a rational basis to select values derived from the statistical analysis that can be applied as a tool for making the PSD compliance demonstration required by the Act and PSD regulations. For more information on the design and results of the technical analysis, please refer to the technical document.

The technical analysis relies upon data from the national ambient monitoring network for ozone and $PM_{2.5}$. Because these data generally are the basis for determining NAAQS attainment, they are an appropriate basis to characterize air quality, with the statistical analysis evaluating the variation in the design value at each monitoring site across the nation. This variability in air quality concentrations is described by the different CIs computed from the statistical analysis. The CIs identify a statistically significant deviation from the baseline value. As described in the technical document (Section 3.0), the EPA has calculated CIs at the 25 percent, 50 percent, 68 percent, 75 percent, and 95 percent intervals for consideration in defining SIL values for ozone and $PM_{2.5}$. The smallest CI that might be used to identify a statistically significant change would be a 68 percent CI, which corresponds to one standard deviation from the baseline value. Thus, any change in the design value larger than the variation represented by the 68 percent CI could be considered to be a statistically significant change. However, for purposes of the PSD program, we are seeking to identify a concentration value that constitutes an insignificant impact, meaning a change in the design value that does not reflect a meaningful difference in air quality based on the introduction of a new source. Thus, from a statistical perspective, the EPA believes that the CIs used in determining an appropriate SIL value should be below 68 percent, corresponding to a change of less than one standard deviation.

Very small SIL values would have limited use to permitting authorities (i.e., would lead to “false positives”), while larger values (closer to the air quality change represented by the 68 percent CI) would lead to “false negatives.” In weighing these competing considerations to select an appropriate SIL value, the EPA believes that air quality change represented by a 50 percent CI represents a protective approach for a SIL value because it is sufficiently within the 68 percent CI, while still being sufficiently higher than zero such that it can be a useful compliance demonstration tool for the PSD permitting process. Of the available choices, the 50 percent CI has more utility as a screening tool under the permitting program, while providing a value that adequately reflects a change in air quality concentrations that is not significant or meaningful.

The EPA chose to use the relative variability rather than the absolute variability in calculating the SILs because the technical analysis (Section 4.0) showed that the relative variability is fairly consistent across the range of design values, suggesting a commonality in the relative variability across a wide range of geographic regions, chemical regimes, and baseline air quality levels in the development of the SILs.

In order to promote national consistency, the EPA has historically provided national SIL values rather than regional or local values. The EPA considered whether a SIL value should be informed by the statistical analysis at the particular site of the proposed source or the central tendency across all monitored sites in the U.S., regardless of the proposed source’s planned location. The EPA continues to recommend using a national SIL value based on the variability aggregated across the nation rather than developing regional or local values. Findings from the statistical analysis indicate that while there are local spatial correlations, there are few instances of large scale (e.g., region-to-region) trends in ambient air variability. Thus, national numbers are supported by the spatial analysis and suitable for use here. Because NAAQS and PSD increments are set on a national basis, the EPA and permitting authorities have historically used national SILs in the PSD program. National SIL values are designed to be used for any location subject to PSD requirements and eliminate the need to determine local or regional approaches for developing a SIL value, including addressing the status of local air quality monitoring (which would be needed if regional or local SILs were to be determined). However, as noted above, local permitting authorities have the discretion to develop alternate SILs.[41] Having a national SIL value promotes consistency in implementation and prevents possible confusion or arbitrary choices that may arise with highly localized SIL values (i.e., determining which monitors to use for computations and other possible deviations from national protocol). Given these considerations, the EPA recommends continuing the practice of using national SIL values. Furthermore, as shown in the technical analysis (Section 4.0), because the median statistic is less influenced by high variability areas, the median statistic is preferred for use in selecting a SIL. Therefore, using the median statistic of the relative variability from the 50 percent CIs from the entire U.S. ambient monitoring network satisfies the policy needs for a SIL and is congruent with the physical and chemical processes that result in this variability.

Next, the EPA chose to use the most recently available years of ambient monitoring data (2012-2016) in the technical analysis to derive the recommended SILs. The SILs should reflect the most recent and representative state of the nation's atmosphere. In assessing the historical trends in ozone and $PM_{2.5}$ air quality levels across the nation, there are observable downward trends in concentrations that indicate more recent data are most appropriate. To have more confidence that the resulting values would not be unduly influenced by temporary circumstances or episodic events, the EPA's recommended SILs are based on an average of the most recent three design value years as a basis for ozone and $PM_{2.5}$ SIL development (i.e., 2012-2014, 2013-2015, 2014-2016).

[41] In the cases where a permitting authority is considering an alternative SIL(s) due to the characteristics of regional variability (e.g., if, based on the analysis presented in the technical document, a specific area appears to have more localized variability than the national average), it is important to understand the factors driving that apparent variability to fully support the application of alternative SIL(s). For example, the results presented in section 4.3 of the technical document show some areas with regional variability for the 24-hour $PM_{2.5}$ standard, though no regional trends were apparent for the annual $PM_{2.5}$ standard and the ozone standard. Furthermore, these regional trends for the 24-hour $PM_{2.5}$ standard were not apparent in the other data years shown in the appendix of the technical document. Additionally, the discussion in the technical document highlights potential causes for some of the variability in these regions (e.g., lower sampling frequency, that can lead to apparently higher variability than would otherwise be shown with higher sampling frequency). Similar issues are discussed in the technical document and can have important consequences for the results and conclusions drawn from more localized analyses of the ambient data and should be thoroughly vetted when considering alternative SILs.

SILs for NAAQS

Using the method described above, the EPA developed SIL values for the 8-hour ozone NAAQS and the annual and 24-hour $PM_{2.5}$ NAAQS. Table 1 lists these SIL values for the NAAQS. Each of these SIL values is based on the level, averaging period and statistical form of its corresponding NAAQS. For the reasons discussed in this guidance and supporting documents, we recommend that PSD permitting authorities use the following values as SILs on a case-by-case basis in the manner described in the next section.

Table 1. Recommended SIL Values for Ozone and $PM_{2.5}$ NAAQS

Criteria Pollutant (NAAQS level)	NAAQS SIL concentration
Ozone 8-hour (70 ppb)	1.0 ppb
$PM_{2.5}$ 24-hour (35 $\mu g/m^3$)	1.2 $\mu g/m^3$*
$PM_{2.5}$ annual (12 $\mu g/m^3$ or 15 $\mu g/m^3$)	0.2 $\mu g/m^3$

* The table accounts for the significance level for the 24-hour $PM_{2.5}$ NAAQS in 40 CFR 51.165(b)(2). Refer to the guidance discussion for details.

For the 8-hour ozone NAAQS, the SIL value we recommend is 1.0 part per billion (ppb). Consistent with the form of the NAAQS, this value is based on the annual 4th highest daily maximum 8-hour concentration, averaged over 3 years. The recommended SIL value for ozone is the same as the derived value from the air quality variability analysis.

For the 24-hour $PM_{2.5}$ NAAQS, the SIL value we recommend is 1.2 $\mu g/m^3$. The derived value from the air quality variability analysis is 1.5 $\mu g/m^3$ and is based on an analysis of the 98th percentile 24-hour concentrations averaged over 3 years. However, 40 CFR 51.165(b)(2) still lists 1.2 $\mu g/m^3$ as the significance level for the 24-hour $PM_{2.5}$ NAAQS. In the 2010 rulemaking, the EPA determined that an impact above this value will be considered to cause or contribute to a violation of the 24-hour $PM_{2.5}$ NAAQS at any location that does not meet this standard. In the same rule, the EPA also sought to establish that an impact below this value would not cause or contribute to a violation of this NAAQS but acknowledged that there could be circumstances where this conclusion was not always valid. Even though the ambient air quality variability approach indicates that an impact below 1.5 $\mu g/m^3$ is not significant, significance levels for $PM_{2.5}$ remain in the EPA's regulations at 40 CFR 51.165(b)(2) and the EPA is presently bound by its prior conclusion (that an impact above 1.2 $\mu g/m^3$ is significant and will cause or contribute to a violation of the 24-hour $PM_{2.5}$ NAAQS). Thus, the EPA cannot conclude at this time that an impact between 1.2 $\mu g/m^3$ and 1.5 $\mu g/m^3$ is an insignificant impact or an impact that will not cause or contribute to a violation of the NAAQS. However, based on the ambient air quality variability approach, the EPA can conclude that impacts below 1.2 μg/m^3 are insignificant at any location and will not cause or contribute to a violation of the NAAQS.[42]

For the annual $PM_{2.5}$ NAAQS, we recommend 0.2 μg/m^3 as the SIL value, which is the value based on a 3-year average of annual average concentrations. This value is lower than the value of 0.3 μg/m^3 listed in 40 CFR 51.165(b)(2). Since 40 CFR 51.165(b)(2) does not address whether an impact below 0.3 μg/m^3 causes or contributes to a violation of the NAAQS, the EPA and other permitting authorities retain the discretion under this provision to determine on a case-by-case basis whether an impact between 0.2 μg/m^3 and 0.3 μg/m^3 will cause or contribute to a violation of the annual $PM_{2.5}$ NAAQS. However, based on the ambient air quality variability approach, the EPA's judgment is that an impact below 0.2 μg/m^3 is not significant and should be considered to not cause or contribute to any violation of the annual $PM_{2.5}$ NAAQS that is identified.

We recommend that these SIL values apply to the NAAQS everywhere, regardless of the class of the airshed.[43] For $PM_{2.5}$, this recommendation is different than what was provided in the vacated (k)(2) paragraphs, where the SIL value that would be used for NAAQS purposes was different for Class I areas than for Class II and III areas. The EPA recognizes that, historically, Congress has provided special protections to Class I areas, as described below in the discussion of SILs for PSD increments. The EPA believes that because each ozone and $PM_{2.5}$ NAAQS is uniform throughout the class areas, no class-specific protection via SILs is necessary when assessing whether a source causes or contributes to a violation of the NAAQS.

<u>SILs for PSD Increments</u>

There are no PSD increments established for ozone and, thus, no ozone SIL values are needed for PSD increment compliance purposes. We used the air quality variability approach to develop PSD increment SILs for the $PM_{2.5}$ PSD increments (*see* Table 2), but in an indirect way. The SIL values

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[42] 40 CFR 51.165(b)(2) provides that a source impact higher than one of the listed significance levels is to be considered significant. A source impact exactly equal to a significance level need not be considered significant. In contrast, in this guidance, consistent with past guidance, we are recommending that a value exactly equal to a recommended SIL be considered significant. Thus, these two approaches treat a value equal to the stated level differently. In practice, we do not expect this to be a practical difference because it will be very unusual for a source's impact to exactly equal one of the recommended SIL values.

[43] When Congress established the PSD program requirements under the 1977 Act Amendments, it included specific numerical PSD increment levels for SO_2 and particulate matter (expressed at that time as "total suspended particulate") for Class I, II and III areas. Congress designated Class I areas (including certain national parks and wilderness areas) as areas of special national concern, where the need to prevent deterioration of air quality is the greatest. Consequently, the PSD increments are the smallest in Class I areas. The PSD increments of Class II areas are larger than those of Class I areas and allow for a moderate degree of emissions growth. Class III areas have the largest PSD increments, but to date no Class III areas have been designated. The EPA subsequently defined Class I, II and III PSD increments for NO_2 and PM_{10}, and $PM_{2.5}$ in multiple rulemakings.

for the $PM_{2.5}$ PSD increments are derived from the recommended NAAQS SIL values and reflect that, under the PSD regulations, the allowable PSD increment values are different for Class I, II and III areas. For Class II areas (which comprise most of the U.S.) and Class III areas (of which there are currently none), we recommend that the values of the NAAQS SILs also be used for PSD increment SILs. For Class I areas, we are recommending annual and 24-hour PSD increment SIL values that are lower than the NAAQS SIL values. This is because the EPA recognizes that Congress intended to establish special protection for Class I areas, as observed by the more stringent statutory Class I PSD increments, as well as provisions for use of air quality related values (including protection against visibility impairment).[44] To help reflect this additional protection, we applied the ratios of the Class I and Class II allowable PSD increments to the NAAQS SIL values derived in our technical analysis.[45] The EPA believes these values for Class I areas will continue to reflect this higher level of protection through the PSD increment SILs.

Table 2. Recommended SIL Values for $PM_{2.5}$ PSD Increments

Criteria Pollutant (averaging period)	PSD increment SIL concentration		
	Class I	Class II	Class III
$PM_{2.5}$ (24-hour)	0.27 $\mu g/m^3$	1.2 $\mu g/m^3$	1.2 $\mu g/m^3$
$PM_{2.5}$ (annual)	0.05 $\mu g/m^3$	0.2 $\mu g/m^3$	0.2 $\mu g/m^3$

IV. APPLICATION OF SILS

The EPA recommends that permitting authorities consider using these SIL values for ozone and $PM_{2.5}$ on a case-by-case basis at the same points in the PSD air quality analysis as SIL values historically have been used in the PSD program, as described below, with one exception regarding defining the spatial extent for modeling.

First, permitting authorities may elect to use the SIL values reflected in this guidance in a preliminary (single-source) analysis that considers only the impact of the proposed source in the permit application on air quality to determine whether a full (or cumulative) impact analysis is necessary before reaching a conclusion as to whether the proposed source would (or would not) cause or contribute to a violation.[46] A modeled result predicting that a proposed source's maximum impact will be below the corresponding SIL value recommended above generally may be considered to be a sufficient demonstration that the proposed source will not cause or contribute to a violation of the applicable NAAQS or PSD increment. If the single-source analysis shows that a proposed source will not have a significant impact on air quality, permitting authorities may

[44] Section 165(d)(2) of the Act sets forth procedures affording special protection against adverse air quality impacts in Class I areas. Also, section 169A of the Act declares a national goal of preventing future and remedying any existing impairment of visibility in Class I areas. 42 U.S.C. 7475 and 7491.

[45] To derive the Class I PSD increment SIL values, we started with the corresponding NAAQS SIL value as the base number and adjusted it by the ratio of the associated Class I and II PSD increments. For the annual $PM_{2.5}$ increment, we reduced the NAAQS SIL value by the ratio of 1:4, because the Class I PSD increment is 1 $\mu g/m^3$ and the Class II PSD increment is 4 $\mu g/m^3$. We used the ratio of 2:9 for the 24-hour $PM_{2.5}$ increment. For the 24-hour increment, we used the 40 CFR 51.165(b)(2) value of 1.2 $\mu g/m^3$ as our base number.

[46] 1990 Draft NSR Workshop Manual at C.24-C.25, C.51.

generally conclude there is no need to conduct a cumulative impact analysis to assess whether there will be any violations of the NAAQS or PSD increment. However, upon considering the permit record in an individual case, if a permitting authority has a basis for concern that a demonstration that a proposed source's impact is below the relevant SIL value at all locations is not sufficient to demonstrate that the proposed source will not cause or contribute to a violation, then the permitting authority should require additional information from the permit applicant to make the required air quality impact demonstration.

Second, where the preliminary analysis described in the prior paragraph shows a significant impact, permitting authorities may choose to use the recommended SIL values in a cumulative impact analysis for a NAAQS, which, in addition to the proposed new major stationary source or major modification, includes the impact of existing sources (onsite with the proposed major modification, as well as other existing sources), and the appropriate background concentration. The EPA has described this application of a SIL as a "culpability analysis."[47] Where a cumulative impact analysis predicts a NAAQS violation, the permitting authority may further evaluate whether the proposed source will cause or contribute to the violation by comparing the proposed source's modeled contribution to that violation to the corresponding SIL value. If the modeled impact is below the recommended SIL value at the violating receptor during the violation, the EPA believes this will be sufficient in most cases for a permitting authority to conclude that the source does not cause or contribute to (is not culpable for) the predicted violation. This demonstration would, thus, allow the permit to be issued if all other PSD requirements are satisfied. If the proposed source's modeled impact is higher than or equal to the recommended SIL value at the violating receptor during a violation, then a permit should not be issued unless (1) further modifications are made to the proposed source to reduce the proposed source's impact to a not significant level at the affected receptor during the violation, or (2) the proposed source obtains sufficient emissions reductions from other sources to compensate for its contribution to the violation.[48]

Third, permitting authorities may decide to use the SIL values recommended above in a cumulative impact analysis for a PSD increment. According to 40 CFR 51.166(c)(1) and 52.21(c), an allowable PSD increment based on an annual average may not be exceeded, and the allowable PSD increment for any other time period may be exceeded once per year at any one location. In either case, the PSD increment SILs recommended above may be used to determine if the proposed source will cause or contribute to that exceedance. If the cumulative impact analysis shows an annual average $PM_{2.5}$ PSD increment exceedance or a 24-hour PSD increment exceedance at a location, then the comparison of the proposed source's impact at that location during the exceedance to the corresponding SIL value may be used to determine whether the proposed source will cause or contribute to the exceedance(s) at that receptor. If the modeled impact is below the SIL for the relevant pollutant, then the permitting authority may conclude that the source does not cause or contribute to a violation of the PSD increment for that pollutant.

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[47] *Prairie State*, 13 E.A.D. at 100; Mississippi Lime, 15 E.A.D. at 374.

[48] 1990 Draft NSR Workshop Manual at C.52-C.53; this latter alternative is referred to as a PSD offset, and state implementation plans may include an offset program based on federal regulations at 40 CFR 51.165(b).

In the past, SILs have been used in defining the spatial extent of the modeling domain for a cumulative impact analysis. Because an impact from a proposed source below a SIL value is considered not to cause or contribute to a violation, the EPA has previously recognized that there was no informational value in placing modeling receptors farther from the proposed source than the most distant point at which the proposed source's impact is equal to or greater than the applicable SIL value. Streamlining the modeling demonstration to reduce the number of receptors to those of value in determining if the proposed source will cause or contribute to a violation of the applicable NAAQS or PSD increment has enabled permit applicants to complete the required modeling with a reasonable effort. As discussed earlier, the EPA recently updated its *Guideline*. The revisions include providing an appropriate, revised basis for determining the modeling domain for NAAQS and PSD increment assessments. Thus, the revised *Guideline* should be used when considering the extent of the modeling domain.

The SILs identified in this guidance should not influence Air Quality Related Values analyses in Class I areas, which are independent reviews by the Federal Land Managers during the application review process.

Subject to limitations described in this guidance, permitting authorities may use the values in the above tables on a case-by-case basis to support air quality analyses and demonstrations required for issuance of PSD permits. Since this guidance is neither a final determination nor a binding regulation, permitting authorities retain the discretion not to use SILs as described here, either in specific cases or programmatically.

The case-by-case use of SIL values should be justified in the record for each permit. To ensure an adequate record, any PSD permitting decision that is based on this guidance (including the technical and legal documents) should incorporate the information contained in them. The permitting authority should also consider any additional information in the record that is relevant to making the required demonstration.

Permitting authorities also retain the discretion to use other values that may be justified separately from this guidance as levels of insignificant impact, subject to one limitation for the $PM_{2.5}$ NAAQS. Since the EPA has established by regulation that a $PM_{2.5}$ impact greater than certain values will cause or contribute to a violation of the relevant NAAQS, permitting authorities may not use a value higher than 1.2 $\mu g/m^3$ for the 24-hour $PM_{2.5}$ NAAQS or a value higher than 0.3 $\mu g/m^3$ for the annual $PM_{2.5}$ NAAQS. Because the 2010 rulemaking constrains the discretion of state and local permitting authorities, the EPA is committed to reassessing 40 CFR 51.165(b)(2) through a future rulemaking process that will begin within 18 months.

Because ozone is not addressed in 40 CFR 51.165(b)(2), permitting authorities are not precluded from developing a higher ozone NAAQS SIL value than recommended in this guidance. Likewise, 40 CFR 51.165(b)(2) does not address PSD increments and, thus, does not constrain the discretion of a permitting authority to use a higher SIL value that a permitting authority may develop for PSD increment purposes. Permitting authorities are also not precluded from developing and using lower SIL values than recommended in this guidance. Permitting authorities may elect to utilize alternative CIs, based on regional or local factors, in developing their own SIL values. The case-by-case use of a SIL value should be supported by a comparable record in each instance that shows that the value represents a level below which a proposed source does not cause or contribute to a violation of the NAAQS or PSD increment.

EXHIBIT 2

Rebuttal Testimony of Lori Marquez and Jeff Bennett

New Mexico EIB No. 20-21(A)

New Mexico Air Quality Bureau

Air Dispersion Modeling Guidelines

Revised June 6, 2019

Recent changes to the Modeling Guidelines are described in Appendix A at the end of this document.

Notes:
EPA in-stack ratio database:
https://www.epa.gov/scram/nitrogen-dioxidenitrogen-oxide-stack-ratio-isr-database

Significance levels for PM2.5 and ozone:
https://www.epa.gov/sites/production/files/2016-08/documents/pm2_5_sils_and_ozone_draft_guidance.pdf
2017 Appendix W:
https://www3.epa.gov/ttn/scram/appendix_w/2016/AppendixW_2017.pdf

Bureau Modeling Staff:
Sufi Mustafa (505) 476-4318
Eric Peters (505) 476-4327
Angela Raso (505) 476-4345
Rhett Zyla (505) 476-4304

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1.0 INTRODUCTION

1.1 Introductory Comments

Air pollution has been proven to have serious adverse impacts on human health and the environment. In response, governments have developed air quality standards designed to protect health and secondary impacts. The only way to predict compliance with these standards by a facility or modification that does not yet exist is to use models to simulate the impacts of the project. Regulatory models strike a balance between cost-effectiveness and accuracy, though the field of air quality prediction is not necessarily an inexpensive or a highly accurate field. The regulatory model design is an attempt to apply requirements in a standard way such that all sources are treated equally and equitably.

It is the duty of the NMED/Air Quality Bureau (the Bureau) to review modeling protocols and the resulting modeling analyses to ensure that air quality standards are protected and to ensure that regulations are applied consistently. This document is an attempt to document clear and consistent modeling procedures in order to achieve these goals. Occasionally, a situation will arise when it makes sense to deviate from the guidelines because of special site-specific conditions. Suggested deviations from the guidelines should be documented in a modeling protocol and submitted to the Bureau for approval prior to submission of modeling.

In general, the procedures in the EPA document, Guideline On Air Quality Models[1] (EPA publication number EPA-450/2-78-027R (revised)) as modified by Supplements A, B, and C should be followed when conducting the modeling analysis. This EPA document provides complete guidance on appropriate model applications. The purpose of this document is to provide clarification, additional guidance, and to highlight differences between the EPA document and New Mexico State modeling requirements.

Please do not hesitate to call the Bureau modeling staff with any questions you have before you begin the analysis. We are here to help; however, we will not conduct modeling courses. There are many courses offered which teach the principles of dispersion modeling. These courses provide a much better forum for learning about modeling than the Bureau modeling staff can provide.

1.2 The Modeling Review Process

1.2.1 Modeling Protocol Review

A modeling protocol should be submitted and approved before submitting a permit application. The Bureau will make every attempt to approve, conditionally approve, or reject the protocol within two weeks. Details regarding the protocol are described in section 6.0, Modeling Protocols. Protocols will be archived in the modeling archives in the protocol section until they can be stored with the files for the application.

1.2.2 Permit Modeling Evaluation

When a permit application involving air dispersion modeling is received, modeling staff has 30 days to determine whether the modeling analysis is administratively complete. The modeling section staff will make a quick determination to see if the modeling analysis appears complete. This involves checking to see if

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[1] Environmental Protection Agency, 40 CFR Part 51, Revision to the Guideline on Air Quality Models http://www.epa.gov/ttn/scram/guidance/guide/appw_05.pdf

modeling files are attached and readable and verifying that application forms and modeling report are present. If the analysis is incomplete, the staff will inform the applicant of the deficiencies as quickly as possible. This will halt the permitting process until sufficient information is submitted. Deficiencies not resolved prior to the completeness determination deadline may result in ruling the application incomplete.

After the application has been ruled complete, Bureau staff will perform a complete review of the modeling files. This analysis includes a review to make sure that information in the modeling files are consistent with the information in the permit application and may involve the emission rate of each emission point, the elevation of sources, receptors, and buildings, evaluation and modification of DEM data, property fence line, or other aspects of the modeling inputs. If the dispersion modeling analysis submitted with the permit application adequately demonstrates that ambient air concentrations will be below air quality standards and/or Prevention of Significant Deterioration (PSD) increments, the Bureau modeler will summarize the findings and provide the information to the permit writer. If dispersion modeling predicts that the construction or modification causes or significantly contributes to an exceedance of a New Mexico or National Ambient Air Quality Standard (NMAAQS or NAAQS) or PSD increment, the permit cannot be issued under the normal permit process. For nonattainment modeling, refer to 20.2.72.216 NMAC, 20.2.79 NMAC, or contact the Bureau for further information.

The application (including modeling) is expected to be complete and in good order at the time it is received. However, the Bureau will accept general modifications or revisions to the modeling before the modeling is reviewed provided that the changes do not conflict with good modeling practices. Once the modeling review begins, only changes to correct problems or deficiencies uncovered during the review of the modeling will normally be accepted, and the Bureau will provide a deadline by which changes need to be submitted to allow for them to be reviewed and for the permit to be issued. No changes to modeling will be allowed after the review has been completed.

2.0 MODELING REQUIREMENTS AND STANDARDS

2.1 Regulatory Requirement for Modeling

The requirements to perform air dispersion modeling are detailed in New Mexico Administrative Code (NMAC) **20.2.70.300.D.10 NMAC** (Operating Permits), **20.2.72.203.A.4 NMAC** (Construction Permits), and **20.2.74.305 NMAC** (Permits - Prevention of Significant Deterioration), and 20.2.79 NMAC (Nonattainment). The language from these sections is listed below for easy reference.

Basically, with a construction permit application, an analysis of air quality standards is required, which normally requires air dispersion modeling. In some cases, previous modeling may satisfy this requirement. In these cases, the applicant may seek a modeling waiver from the Bureau. In any case, it is the responsibility of the applicant to provide the modeling, or the justification for the modeling waiver, or the air quality analysis for nonattainment areas. Title V sources that have not demonstrated compliance with a standard or increment are required to come into compliance with this applicable requirement. This may be accomplished by modeling to show the area is in attainment with this standard or increment. If they are not able to model compliance, then a compliance plan will be needed.

2.1.1 Title V Operating Permits

Federal air quality standards are applicable requirements for sources required to have an operating permit. Modeling is usually not required to issue a Title V operating permit. If a facility is not required to have a construction permit (e.g., some landfills and “Grandfathered” facilities) then it will need to model any new emissions or changes that could increase ambient pollutant concentrations.

Selected Title V regulatory language applying to modeling is copied below for easy reference.

20.2.70.7 NMAC DEFINITIONS: In addition to the terms defined in 20.2.2 NMAC (definitions), as used in this part the following definitions shall apply.

E. "Applicable requirement" means all of the following, as they apply to a Part 70 source or to an emissions unit at a Part 70 source (including requirements that have been promulgated or approved by the board or US EPA through rulemaking at the time of permit issuance but have future-effective compliance dates).

(11) Any national ambient air quality standard.

(12) Any increment or visibility requirement under Part C of Title I of the federal act, but only as it would apply to temporary sources permitted pursuant to Section 504(e) of the federal act.

20.2.70.201 NMAC REQUIREMENT FOR A PERMIT:

D, Requirement for permit under 20.2.72 NMAC.

(1) Part 70 sources that have an operating permit and do not have a permit issued under 20.2.72 NMAC or 20.2.74 NMAC shall submit a complete application for a permit under 20.2.72 NMAC within 180 days of September 6, 2006. The department shall consider and may grant reasonable requests for extension of this deadline on a case-by-case basis.

(2) Part 70 sources that do not have an operating permit or a permit under 20.2.72 NMAC upon the effective date of this subsection shall submit an application for a permit under 20.2.72 NMAC within 60 days after submittal of an application for an operating permit.

(3) Paragraphs 1 and 2 of this subsection shall not apply to sources that have demonstrated compliance with both the national and state ambient air quality standards through dispersion modeling or other method approved by the department and that have requested incorporation of conditions in their operating permit to ensure compliance with these standards.

20.2.70.300.D.10 NMAC
(10) Provide certification of compliance, including all of the following.
(a) A certification, by a responsible official consistent with Subsection E of 20.2.70.300 NMAC, of the source's compliance status for each applicable requirement. For national ambient air quality standards, certifications shall be based on the following.
(i) For first time applications, this certification shall be based on modeling submitted with the application for a permit under 20.2.72 NMAC.
(ii) For permit renewal applications, this certification shall be based on compliance with the relevant terms and conditions of the current operating permit.

2.1.2 New Source Review (NSR) Permitting for Minor Sources

For new permits, a demonstration of compliance with air quality standards, PSD increments, and toxic air pollutants subject to 20.2.72.403.A(2) is required for all pollutants emitted by the facility. For significant revisions, a demonstration of compliance with air quality standards, PSD increments, and toxic air pollutants subject to 20.2.72.403.A(2) is required for all pollutants affected by the modification or permit revision. For technical revisions involving like kind replacement, as specified in 20.2.72.219B(1)(d), a demonstration that the replacement unit has stack parameters which are at least as effective in the dispersion of air pollutants is required (provided previous modeling determined the area to be in compliance with air quality standards). Permits for sources not in attainment with standards should refer to 20.2.72.216 NMAC, NONATTAINMENT AREA REQUIREMENTS.

If previous modeling has demonstrated compliance for each averaging period of each pollutant with a state or federal ambient air quality standard or toxic air pollutant, and that modeling used current modeling practices and is up-to-date for that area, then a modeling waiver may be used as the discussion demonstrating compliance. Otherwise, new modeling is required. For other minor source permitting actions, modeling is not part of the permitting process. Modeling waivers do not apply to nonattainment areas.

Selected NSR regulatory language applying to modeling is copied below for easy reference.
Definition of modification:

20.2.72.7 **DEFINITIONS:** In addition to the terms defined in 20.2.2 NMAC (Definitions) as used in this Part:
P. "Modification" means any physical change in, or change in the method of operation of, a stationary source which results in an increase in the potential emission rate of any regulated air contaminant emitted by the source or which results in the emission of any regulated air contaminant not previously emitted, but does not include:
(1) a change in ownership of the source;
(2) routine maintenance, repair or replacement;
(3) installation of air pollution control equipment, and all related process equipment and materials necessary for its operation, undertaken for the purpose of complying with regulations adopted by the board or pursuant to the Federal Act; or
(4) unless previously limited by enforceable permit conditions:
(a) an increase in the production rate, if such increase does not exceed the operating design capacity of the source;
(b) an increase in the hours of operation; or
(c) use of an alternative fuel or raw material if, prior to January 6, 1975, the source was capable of accommodating such fuel or raw material, or if use of an alternate fuel or raw material is caused by any natural gas curtailment or emergency allocation or any other lack of supply of natural gas.

Requirements for permit:

20.2.72.200 APPLICATION FOR CONSTRUCTION, MODIFICATION, NSPS, AND NESHAP - PERMITS AND REVISIONS:

A. Permits must be obtained from the Department by:

(1) Any person constructing a stationary source which has a potential emission rate greater than 10 pounds per hour or 25 tons per year of any regulated air contaminant for which there is a National or New Mexico Ambient Air Quality Standard. If the specified threshold in this subsection is exceeded for any one regulated air contaminant, all regulated air contaminants with National or New Mexico Ambient Air Quality Standards emitted are subject to permit review. Within this subsection, the potential emission rate for nitrogen dioxide shall be based on total oxides of nitrogen;

(2) Any person modifying a stationary source when all of the pollutant emitting activities at the entire facility, either prior to or following the modification, emit a regulated air contaminant for which there is a National or New Mexico Ambient Air Quality Standard with a potential emission rate greater than 10 pounds per hour or 25 tons per year and the regulated air contaminant is emitted as a result of the modification. If the specified threshold in this subsection is exceeded for any one regulated air contaminant, all regulated air contaminants with National or New Mexico Ambient Air Quality Standards emitted by the modification are subject to permit review. Within this subsection, the potential emission rate for nitrogen dioxide shall be based on total oxides of nitrogen;

Like-kind-replacement required modeling:

20.2.72.219 PERMIT REVISIONS:

B. Technical Permit Revisions:

(1) Technical permit revision procedures may be used only for:

(d) Modifications that replace an emissions unit for which the allowable emissions limits have been established in the permit, provided that the new emissions unit:

(i) Is equivalent to the replaced emissions unit, and serves the same function within the facility and process;

(ii) Has the same or lower capacity and potential emission rates;

(iii) Has the same or higher control efficiency, and stack parameters which are at least as effective in the dispersion of air pollutants;

(vi) Would not, when operated under applicable permit conditions, cause or contribute to a violation of any National or New Mexico Ambient Air Quality Standard; and

Modeling requirements for new permits or significant revisions:

20.2.72.203.A.4 NMAC

Contain a regulatory compliance discussion demonstrating compliance with each applicable air quality regulation, ambient air quality standard, prevention of significant deterioration increment, and provision of 20.2.72.400 NMAC - 20.2.72.499 NMAC. The discussion must include an analysis, which may require use of US EPA-approved air dispersion model(s), to (1) demonstrate that emissions from routine operations will not violate any New Mexico or National Ambient Air Quality Standard or prevention of significant deterioration increment, and (2) if required by 20.2.72.400 NMAC - 20.2.72.499 NMAC, estimate ambient concentrations of toxic air pollutants.

2.1.3 NSR Permitting for PSD Major Sources

PSD major sources and major modifications have additional modeling requirements beyond those of minor sources. PSD major source modeling authority is contained here:

20.2.74.305 NMAC AMBIENT AIR QUALITY MODELING: All estimates of ambient concentrations required by this Part shall be based on applicable air quality models, data bases, and other requirements as specified in EPA's Guideline on Air Quality Models (EPA-450/2-78-027R, July, 1986), its revisions, or any superseding EPA document, and approved by the Department. Where an air quality impact model specified in the Guideline on Air Quality Models is inappropriate, the model may be modified or another model substituted. Any substitution or modification of a model must be approved by the Department. Notification shall be given by the Department of such a substitution or modification and the opportunity for public comment provided for in fulfilling the public notice requirements in subsection B of 20.2.74.400 NMAC. The Department will seek EPA approval of such substitutions or modifications.

2.2 Air pollutants

Emissions of Sulfur Dioxide (SO_2), Particulate matter with an aerodynamic diameter of less than or equal to 10 micrometers (PM_{10}), Particulate matter with an aerodynamic diameter of less than or equal to 2.5 micrometers ($PM_{2.5}$), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Lead (Pb), Hydrogen sulfide (H_2S), and air toxics as listed in 20.2.72 NMAC are pollutants that may require modeling. Ozone and Volatile Organic Compound (VOC) emissions do not currently require a modeling analysis for a PSD minor source. If NO_X or VOCs are subject to PSD review, you should contact NMED and the EPA Regional Office to determine current ozone modeling requirements.

2.3 Modeling Exemptions and Reductions

2.3.1 Modeling waivers

In some cases, the demonstration that ambient air quality standards and PSD increments will not be violated can be satisfied with a discussion of previous modeling. If emissions have been modeled using current modeling procedures and air quality standards, and this modeling is still valid for the current standards, then the modeling waiver form may be submitted to request approval of a modeling waiver. The Bureau will determine on a case-by-case basis if the modeling waiver can be granted. The waiver discussion and written waiver approval should be included in the modeling section of the application.

The Bureau has performed generic modeling to demonstrate that the following small sources do not need modeling. The application must include a modeling waiver form to document the basis of the waiver. Permitting staff must approve the total emission rates during the permitting process for any waiver to be valid.

Table 1. Very small emission rate modeling waiver requirements

Pollutant	If all emissions come from stacks 20 feet or greater in height and there are no horizontal stacks or raincaps (lb/hr)	If not all emissions come from stacks 20 feet or greater in height, or there are horizontal stacks, raincaps, volume, or area sources (lb/hr)
CO	50	2
H_2S (Pecos-Permian Basin)	0.1	0.02
H_2S (Not in Pecos-Permian Basin)	0.01	0.002
Lead	Waiver not available.	Waiver not available.
NO_2	2	0.025
PM2.5	0.3	0.015
PM10	1.0	0.05
SO_2	2	0.025
Reduced sulfur (Pecos-Permian Basin)	0.033	Waiver not available.
Reduced sulfur (Not in Pecos-Permian Basin)	Waiver not available.	Waiver not available.

2.3.2 General Construction Permits (GCPs)

General Construction Permits do not require modeling. General modeling was performed in the development of these permits.

2.3.3 Streamlined Compressor Station Modeling Requirements

Compressor stations may be eligible for streamlined permits under the authority of **20.2.72.300-399 NMAC**. Streamlined permits have reduced modeling analysis requirements.

Streamlined Compressor Station Location Requirements

Restrictions preventing use of streamlined permits in certain locations are listed in **20.2.72.301 NMAC**. Those restrictions dealing with location are described below.

According to **20.2.72.301.B.4 NMAC**, the facility cannot co-locate with petroleum refineries, chemical manufacturing plants, bulk gasoline terminals, natural gas processing plants, or at any facility containing sources in addition to IC engines and/or turbines for which an air quality permit is required through state or federal air quality regulations.

20.2.72.301.B.5 NMAC restricts the location of streamlined permit in areas predicted by air quality monitoring or modeling to have more than 80% of state or federal ambient air quality standards or PSD increments consumed. Table 2, below, is a list of these areas. This restriction means that any streamlined permit applicant wishing to locate in a nonattainment area or those areas listed in Table 2 must demonstrate, using air dispersion modeling, that the entire facility will not produce any concentrations above significance levels.

Table 2. Areas Where Streamlined Permits Are Restricted

County	Latitude	Longitude	Radius (m)
San Juan	36.73120	-107.9608189	3000
San Juan	36.48296	-108.1200487	1000

* Locations within 150 meters of a facility that emits 25 tons per year of NO_X are restricted areas for streamlined compressor station permits unless modeling is performed.

20.2.72.301.B.6 NMAC prohibits the location of streamline permit from use in areas if the nearest property boundary will be located less than:
(a) 1 kilometer (km) from a school, residence, office building, or occupied structure. Buildings and structures within the immediate industrial complex of the source are not included.
(b) 3 km from the property boundary of any state park, Class II wilderness area, Class II national wildlife refuge, national historic park, state recreation area, or community with a population of more than twenty thousand people.

Table 3. List of state parks, Class I areas, Class II wilderness areas, Class II national wildlife refuges, national historic parks, and state recreation areas

County	Name	Type	Min. Distance (km)
Bernalillo	Sandia Mountain Wilderness	State Wilderness	3
Catron	Gila Wilderness	Class I Area	30
Catron	Gila Cliff Dwelling	National Monuments	3
Catron	Datil Well	Recreation Sites	3
Chaves	Bottomless Lake	Class II State Parks	3
Chaves	Salt Creek Wilderness Area	Class I Area	30
Chaves	Bitter Lake National W.R.	Class II Wildlife Refuge	3
Cibola	Bluewater Lake	Class II State Parks	3
Cibola	El Malpais	National Monuments	3
Cibola	El Morro	National Monuments	3
Colfax	Cimarron Canyon	Class II State Parks	3
Colfax	Maxwell National W.R.	Class II Wildlife Refuge	3
Colfax	Capulin	National Monuments	3
DeBaca	Sumner Lake	Class II State Parks	3
DeBaca	Ft. Sumner	State Monuments	3
Dona Ana	Leesburg Dam	Class II State Parks	3
Dona Ana	Aguirre Springs	Recreation Sites	3
Dona Ana	Ft. Seldon	State Monuments	3
Eddy	Carlsbad Caverns National Park	Class I Area	30
Eddy	Living Desert	Class II State Parks	3
Grant	Gila Wilderness	Class I Area	30
Grant	City of Rocks	Class II State Parks	3
Guadalupe	Santa Rosa Lake	Class II State Parks	3
Harding	Chicosa Lakes	Class II State Parks	3
Harding	Kiowa National Grasslands	National Grasslands	3
Lea	Harry McAdams	Class II State Parks	3
Lincoln	White Mountain Wilderness	Class I Area	30
Lincoln	Valley of Fires	Class II State Parks	3
Lincoln	Lincoln	State Monuments	3

County	Name	Type	Min. Distance (km)
Luna	Pancho Villa	Class II State Parks	3
Luna	Rock Hound	Class II State Parks	3
McKinley	Red Rock	Class II State Parks	3
Mora	Coyote Creek	Class II State Parks	3
Mora	Ft. Union	National Monuments	3
Otero	Oliver Lee	Class II State Parks	3
Otero	White Sands	National Monuments	3
Otero	Three Rivers Petro	Recreation Sites	3
Quay	Ute Lake	Class II State Parks	3
Rio Arriba	San Pedro Parks Wilderness	Class I Area	30
Rio Arriba	El Vado Lake	Class II State Parks	3
Rio Arriba	Heron Lake	Class II State Parks	3
Rio Arriba	Navajo Lake (Sims)	Class II State Parks	3
Rio Arriba	Chama River Canyon Wilderness	State Wilderness	3
Roosevelt	Oasis	Class II State Parks	3
Roosevelt	Grulla National W. R.	Class II Wildlife Refuge	3
San Juan	Navajo (Pine)	Class II State Parks	3
San Juan	Chaco Canyon	National Historic Park	3
San Juan	Aztec Ruins	National Monuments	3
San Juan	Angel Peak (National)	Recreation Area	3
San Miguel	Conchas Lake	Class II State Parks	3
San Miguel	Storey Lake	Class II State Parks	3
San Miguel	Villanueva	Class II State Parks	3
San Miguel	Las Vegas National W. R.	Class II Wildlife Refuge	3
San Miguel	Pecos	National Monuments	3
Sandoval	Bandelier Wilderness	Class I Area	30
Sandoval	Coronado	Class II State Parks	3
Sandoval	Rio Grande Gorge/Fenton Lake	Class II State Parks	3
Sandoval	Bandelier	National Monuments	3
Sandoval	Sandia Crest (State)	Recreation Area	3
Sandoval	Coronado	State Monuments	3
Sandoval	Jemez	State Monuments	3
Sandoval	Sandia Mountain Wilderness	State Wilderness	3
Santa Fe	Hyde Memorial	Class II State Parks	3
Sierra	Caballo Lake	Class II State Parks	3
Sierra	Elephant Butte Lake	Class II State Parks	3
Sierra	Percha Dam	Class II State Parks	3
Socorro	Bosque del Apache Wilderness	Class I Area	30
Socorro	Sevillita National W.R.	Class II Wildlife Refuge	3
Taos	Pecos Wilderness	Class I Area	30
Taos	Wheeler Park Wilderness	Class I Area	30
Taos	Kit Carson	Class II State Parks	3
Taos	Rio Grande Gorge	Recreation Sites	3
Taos	Latir Peak Wilderness	State Wilderness	3
Torrance	Manzano Mountain	Class II State Parks	3
Torrance	Grand Guivira	National Monuments	3

County	Name	Type	Min. Distance (km)
Torrance	Quarai at Salinas	National Monuments	3
Torrance	Abo at Salinas	State Monuments	3
Torrance	Manzano Mountain Wilderness	State Wilderness	3
Union	Clayton Lake	Class II State Parks	3
Valencia	Sen. Willie Chavez	Class II State Parks	3
Valencia	Manzano Mountain Wilderness	State Wilderness	3

(c) 10 km from the boundary of any community with a population of more than forty-thousand people, or
(d) 30 km from the boundary of any Class I area;

20.2.72.301.B.7 NMAC prohibits the location of streamline permit in Bernalillo County or within 15 km of the Bernalillo County line.

<u>Streamlined Compressor Station Modeling and Public Notice Requirements</u>

Modeling and public notice requirements for streamlined compressor station permits depend on the amount of emissions from the facility. Refer to the table below, using the maximum of the Potential to Emit (PTE) of each regulated contaminant from all sources at the facility to determine applicability. The potential to emit for nitrogen dioxide shall be based on total oxides of nitrogen. The effects of building downwash shall be included in modeling if there are buildings at the site.

Table 4. Streamlined Permit Applicability Requirements for facilities with less than 200 tons/year PTE

Applicable Regulation	PTE (TPY)	Modeling Requirements (from 20.2.72.301 D NMAC)
20.2.72.301 D (1)	<40	• None
20.2.72.301 D (2)	<100	• The impact on ambient air from all sources at the facility shall be less than the ambient significance levels.
20.2.72.301 D (3)	<200	• Air quality impacts must be less than 50% of all applicable NAAQS, NMAAQS and PSD increments. • There shall be no adjacent sources emitting the same air contaminant(s) as the source within 2.5 km of the modeled NO_2 impact area. • The sum of all potential emissions for NO_X from all adjacent sources within 15 km of the NO_X ROI must be less than 740 tons/year. • The sum of all potential emissions for NO_X from all adjacent sources within 25 km of the NO_X ROI must be less than 1540 tons/year.

There are other criteria that must be met for streamlined permits for compressor stations. Please refer to **20.2.72.300-399 NMAC** for more information.

2.3.4 Minor NSR Exempt Equipment

Exempt equipment under 20.7.72.202 NMAC do not need to be included in modeling for 20.2.72 NMAC permits. The exemption does not exclude them from modeling requirements under other types of permits, such as 20.2.70 NMAC or 20.2.74 NMAC.

2.4 Levels of Protection

2.4.1 Significance Levels

Modeling significance levels are thresholds below which the source is not considered to contribute to any predicted exceedance of air quality standards or PSD increments. The definition of ‘source’ can apply to the whole facility or to the modifications at the facility. For a new facility or an unpermitted facility, NMED considers the entire facility to be the ‘source’. For other cases, ‘source’ includes only the new equipment or new emissions increases described in the current application. Equipment that replaces other equipment is part of the new equipment.

Example of source to model for permitting:
The entire facility was modeled for annual NO_2 and 1-hour and 8-hour CO in 1999 but was never modeled for 1-hour NO_2. The facility applies to replace a widget. If this widget emits only NO_2 and CO, then modeling review is applicable for these pollutants. For CO and for NO_2, the applicant may model only the replacement widget. If the impacts from the widget alone are below significance levels, then modeling is done for that pollutant/averaging period. If the impacts from the widget alone are above significance levels, then the entire facility plus nearby sources must be modeled for comparison with air quality standards and PSD increments.

Significance levels are listed in **20.2.72.500 NMAC** and are repeated in the sections below. Always use the maximum predicted concentration from the source for radius of impact/significance level determination. Even if the form of the standard allows it to be exceeded several times per period, that fraction is based on cumulative concentration and cannot be related to partial concentrations. If multiple years of meteorological data are used, then the average of those concentrations is compared with the significance level, except for $PM_{2.5}$ and 1-hour SO_2, for which the maximum across multiple years is compared with the significance level.

Use of the $PM_{2.5}$ significant ambient concentration level or significant monitoring concentration for PSD major modifications or new PSD major sources is not allowed. This significant ambient concentration level may still be used for minor source permitting.

2.4.2 Air Quality Standards

Air quality standards are maximum allowable concentrations that are designed to protect the most sensitive individuals from harm from airborne pollutants. National Ambient Air Quality Standards (NAAQS) and New Mexico Ambient Air Quality Standards (NMAAQS) are explained below. Unless otherwise noted, standards are not to be exceeded.

2.4.3 Prevention of Significant Deterioration (PSD) Increments

To prevent relatively clean areas from degrading to levels just barely in compliance with the air quality standards, limits on the change have been established in the form of PSD increments. Compliance demonstrations for PSD increments demonstrate that the deterioration is less than the allowable increment.

List of State air quality standards:
http://www.nmcpr.state.nm.us/nmac/parts/title20/20.002.0003.htm

2.5 Concentration Conversions

Many of the air quality standards are written in the form of parts per million (ppm) or parts per billion (ppb), but the models generally give output in units of micrograms per cubic meter ($\mu g/m^3$). EPA has verbally communicated to NMED that AERMOD output is expressed at Standard Temperature and Pressure (STP) conditions. Therefore, most air quality standards can be compared to modeled concentration without corrections for elevation (and associated low pressure). If a need for elevation correction arises, a method to adjust for elevation is listed below.

2.5.1 Gaseous Conversion Factor for Elevation and Temperature Correction

The following equation calculates the conversion from $\mu g/m^3$ to ppm, with corrections for temperature and pressure (elevation):

$$ppm = 4.553 \times 10^{-5} \times \frac{C \times T}{M_w} \times 10^{Z \times 1.598 \times 10^{-5}}$$

or, rearranged to calculate $\mu g/m^3$:

$$C = ppm \text{ x } M_W / (T \text{ x } (4.553 \text{ E } -5) \text{ x } (10^{Z \text{ x } 1.598 \text{ E } -5}))$$

where:

- C = component concentration in $\mu g/m^3$.
- T = average summer morning temperature in Rankin at site (typically 530 R).
- M_w = molecular weight of component.
- Z = site elevation, in feet.

2.5.2 Gaseous Conversion Factor at Standard Temperature and Pressure (STP) Conditions

Federal standards are expressed as mass per unit volume or ppm or ppb under standard temperature and pressure.

> "40 CFR 50.3 Reference conditions.
> All measurements of air quality that are expressed as mass per unit volume (e.g., micrograms per cubic meter) other than for particulate matter (PM2.5) standards contained in §§ 50.7 and 50.13 and lead standards contained in § 50.16 shall be corrected to a reference temperature of 25 (deg) C and a reference pressure of 760 millimeters of mercury (1,013.2 millibars)."

If a monitored or modeled concentration has been adjusted to STP, then the following equation calculates the conversion from ppm to $\mu g/m^3$ for NAAQS:

$$C = ppm \text{ x } M_w \text{ x } 40.8727$$

or, rearranged to calculate ppm:

ppm = C /(M_w x 40.8727)

where:

C = component concentration in µg/m^3.
M_w = molecular weight of component.

$$p = p_0 \cdot \left(1 - \frac{L \cdot h}{T_0}\right)^{\frac{g \cdot M}{R \cdot L}} \approx p_0 \cdot \exp\left(-\frac{g \cdot M \cdot h}{R \cdot T_0}\right),$$

Parameter	**Description**	**Value**
p_0	sea level standard atmospheric pressure	101325 Pa
L	temperature lapse rate	0.0065 K/m
T_0	sea level standard temperature	288.15 K
g	Earth-surface gravitational acceleration	9.80665 m/s^2
M	molar mass of dry air	0.0289644 kg/mol
R	universal gas constant	8.31447 J/(mol•K)

$[PM10]_{STP} = [PM10]_{modeled}\ (P_{standard})(T_{measured})/((P_{calculated\ by\ elevation})(T_{standard}))$

2.6 Modeling the Standards and Increments

Unless otherwise specified, the discussion of the standards assumes one year of representative meteorological data is used. For multiple years of data, some pollutants use the average of the values predicted for each year as the design value. Others (including PM2.5, CO, and Pb) use the maximum value from the multiple years of data. Verify the form of the standard in regulations and EPA memos if multiple years of meteorological data are being used. Background concentrations are averaged over three years unless otherwise specified.

In cases where all the emissions of the pollutant in question are emitted from permitted sources, the nearby sources may be modeled instead of adding the background concentration. CO, NO_2, and SO_2 may use this substitution if they are over 10 km from the center of Albuquerque and El Paso. To use this substitution, include all nearby sources.

2.6.1 Carbon Monoxide (CO) Standards

Table 5A: Carbon Monoxide Air Quality Standards

Averaging Period	Significance Level (μg/m^3)	NAAQS (ppm)	NAAQS (μg/m^3)	NMAAQS (ppm)	NMAAQS (μg/m^3)
8-hour	500	9	10,303.6	8.7	9,960.1
1-hour	2,000	35	40,069.6	13.1	14,997.5

2.6.1.1 Design value of CO standard.

CO NAAQS are not to be exceeded more than once per year. NMAAQS are not to be exceeded. Demonstration of compliance with CO NMAAQS automatically demonstrates compliance with NAAQS.

2.6.1.2 Modeling for the CO design value.

Tier 1, 1-hour NMAAQS: Model the entire facility to determine the high 1-hour concentration. Add the high 1-hour background concentration to the high 1-hour predicted concentration to determine the total design concentration for comparison to the 1-hour NMAAQS.

Tier 1, 8-hour NMAAQS: Model the entire facility to determine the high 8-hour concentration. Add the high 8-hour background concentration to the high 8-hour predicted concentration to determine the total design concentration for comparison to the 8-hour NMAAQS.

Optionally, all nearby sources may be modeled instead of adding a background concentration, if the facility is over 10 km from the center of Albuquerque and El Paso.

Tier 2: Hourly background concentrations may be added instead of the maximum concentrations for each averaging period.

2.6.2 Hydrogen sulfide (H_2S) Standards

Table 5B: Hydrogen Sulfide Air Quality Standards

Averaging Period	Significance Level (μg/m^3)	NMAAQS (ppm)	NMAAQS (μg/m^3)	Notes
1-hour	1.0	0.010	13.9	For the state, except for the Pecos-Permian Basin Intrastate AQCR. Not to be exceeded more than once per year.
1/2-hour	5.0	0.10	139.3	For the Pecos-Permian Basin Intrastate AQCR
1/2-hour	5.0	0.030	41.8	for within 5-miles of the corporate limits of municipalities within the Pecos-Permian Basin AQCR

Design value of standard: For modeling ½-hour H_2S NMAAQS, use the 1-hour averaging time because the models cannot resolve less than one-hour increments.

Model the entire facility and any nearby sources and compare the high 1-hour concentration to the standard for that region. No background concentration is added.

2.6.3 Lead (Pb) Standards

Table 5C: Lead Air Quality Standards

Averaging Period	Significance Level (μg/m^3)	NAAQS (μg/m^3)
Quarterly	0.03	0.15

Design value of standard: For modeling quarterly lead averages, use the monthly averaging period as a conservative approach, unless the model being used has a quarterly averaging period or post-processing is desired to calculate quarterly values. Model the entire facility without surrounding sources and compare the high month concentration to the standard. No background concentration is added.

2.6.4 Nitrogen Dioxide (NO_2) Standards

Table 5D: NO_2 Air Quality Standards

Averaging Period	Significance Level (μg/m^3)	NAAQS (ppb)	NAAQS (μg/m^3)	NMAAQS (ppb)	NMAAQS (μg/m^3)	Class II PSD Increment (μg/m^3)	Class I PSD Significance Level (μg/m^3)	Class I PSD Increment (μg/m^3)
annual	1.0	53	99.66	50	94.02	25	0.1[8]	2.5
24-hour	5.0			100	188.03			
1-hour	7.52[1]	100	188.03					

[1] EPA proposed significance level of 4 ppb corrected to a reference temperature of 25ºC and a reference pressure of 760 millimeters of mercury.

2.6.4.1 Design value of NO_2 standard

Demonstration of compliance with 1-hour standard is automatically a demonstration of compliance with the 24-hour NMAAQS. Otherwise, the 24-hour NO_2 standard is compared with the highest 24-hour average calculated by the model.

The annual NMAAQS design value is determined by modeling the entire facility and adding the annual background concentration. The total is compared to the standard. Optionally, to determine the total design value, the facility and all nearby sources may be modeled instead of adding a background concentration if the facility is over 10 km from the center of Albuquerque and El Paso.

The annual NO_2 PSD increment is compared with the annual average calculated by the model.

The 1-hour NO_2 standard is compared with the 3-year average of the 98th-percentile of the annual distribution of daily maximum 1-hour concentrations. If one year of on-site meteorological data is used, the 98th-percentile value associated with the 1-year period of meteorological data modeled is the design value. Each day of modeling, the maximum 1-hour concentration is determined for each receptor. The high-eighth-high value at each receptor is calculated, and the maximum of these is compared with the standard. If multiple years are modeled, the maximum value is averaged over the span of years before comparing with standards.

2.6.4.2 NO_2 Reactivity

Combustion processes emit nitrogen oxides in the forms of nitrogen oxide (NO) and nitrogen dioxide (NO_2). Only the concentration of NO_2 is regulated by air quality standards; however, emissions of nitrogen oxides ($NO_X = NO + NO_2$) must be modeled to estimate total NO_2 concentrations because nitrogen oxides change form in the atmosphere.

Two key reactions are most important in determining the equilibrium (or quasi-equilibrium) ratio of NO_2 to NO.

$$NO + O_3 \rightarrow NO_2 + O_2$$

$$NO_2 + h\nu \text{ (energy)} \rightarrow NO + O$$

Many other reactions participate in the determination of the atmospheric concentration of NO_2. As the plume travels away from the stack, more and more ozone diffuses into the plume, enabling the relatively quick reaction to form NO_2.

2.6.4.3 Estimating NO_2 concentrations

The Bureau has approved techniques, described below, for estimating NO_2 concentrations from NO_X point sources. Note that NO_2 emissions reported by the emissions inventory are actually NO_X emissions.

Tier 1, Total Conversion Technique: 100% conversion
This technique assumes all the NO_X is converted to NO_2. This simple technique is suitable for small facilities where compliance with standards is not a problem.

Tier 2, Ambient Ratio Method 2 (ARM2) Technique
ARM2 method is included as an option in AERMOD. This method is approved without the need for EPA approval. 0.5 is the national default for minimum ambient ratio. A minimum ambient ratio as low as 0.2 may be used by providing evidence that the in-stack ratio of the modeled emission units is equal to or lower than the minimum ambient ratio used. The default maximum ratio is 0.9.

Tier 3, Ozone Reaction Techniques
Two methods account for the ozone that mixes into the plumes and encourages NO_2 formation: Ozone Limiting Method (OLM) and Plume Volume Molar Ratio Method (PVMRM). Both these techniques are accepted and are built into AERMOD.
OLM assumes an NO_2 plume and an NO plume are each dispersing. The in-stack ratio of NO_2/NO_X is used to determine the amount of nitrogen dioxide initially in each plume. The concentration of NO at each receptor is assumed to react stoichiometrically with the background ozone concentration at that time to form NO_2. Contributions from both plumes are added to get the NO_2 concentration at that time.

PVMRM works similarly to OLM but uses the total volume of the plume by the time it reaches the receptor to calculate how much ozone is available for reaction. Both methods result in greater conversion with greater distance from the source but use different approximations for determining how much ozone has dispersed into the plume.

Both methods require additional information.
For the equilibrium NO_2/NO_X ratio, the value of 0.9 is approved.

For the in-stack NO_2/NO_X ratio, values lower than 0.5 must be justified with data. Combustion involving excess oxygen results in higher in-stack NO_2/NO_X ratios than do stoichiometric reactions. The facility may use an in-stack ratio of 0.5 without justification. Surrounding sources, if required, may be modeled with an in-stack ratio of 0.3 without justification.

Recent ozone data representative of the area should be used. See the section on background concentrations for more information.

Special techniques are required to model PSD increment with OLM or PVMRM if increment-expanding sources are being modeled. No negative emission rates can be used. See *ADDENDUM, USER'S GUIDE FOR THE AMS/EPA REGULATORY MODEL – AERMOD (EPA-454/B-03-001, September 2004),* Pg. 25, for more details on the PSDCREDIT option**.**
(http://www.rflee.com/RFL_Pages/AERMOD_USERGUIDE_ADDENDUM_06341.pdf)

Combined-Plume Option vs. Individual-Plume Option
AERMOD provides two options for calculating ozone-limited NO_2 concentrations, the "plume-by-plume" (INDVDL) calculation, and the combined plume (SRCGRP) calculation. The Bureau has accepted a general demonstration that if two plumes are impacting the same receptor at the same time, then the two plumes have merged. If the plumes do not impact the same receptor at the same time, then the plumes have not merged, but both options will calculate the same concentration for that hour. Therefore, the Bureau will accept either INDVL or SRCGP option without additional demonstrations.

2.6.4.4 Modeling for the 1-hour NO_2 design value

Model the entire facility and add the 98th percentile 1-hour background concentration to compare to the design value. Optionally, all nearby sources may be modeled instead of adding a background concentration if the facility is over 10 km from the center of Albuquerque and El Paso, Texas. Refined hourly background concentrations may be used instead of the maximum 1-hour concentration as described in the section on background concentrations.

Before attempting to calculate the design value, first locate the areas with highest overall concentrations. Place a few receptors in these areas and re-run the model in these areas. The maximums will occur in nearly the same places.

Maximum modeled concentration may also be used as a conservative approximation of the design value.

"The highest of the average 8th-highest (98th-percentile) concentrations across all receptors, based on the length of the meteorological data period, represents the modeled 1-hour NO_2 design value based on the form of the standard."

2.6.4.5 Modeling for the annual NO_2 NMAAQS design value

Model the entire facility and add the annual background concentration to compare to the design value. Optionally, all nearby sources may be modeled instead of adding a background concentration if the facility is over 10 km from the center of Albuquerque and El Paso, Texas. (Use of hourly background concentrations does not affect the result for an annual average).

2.6.4.6 Modeling for the annual NO_2 PSD increment design value

Model all increment-consuming parts of the facility and increment-consuming nearby sources of the facility (or nearby sources of the Class I area for Class I analysis). Compare the result to the design value. All sources (not just increment affecting sources) will need to be modeled in order to take credit for increment expanding sources using OLM or PVMRM. See the AERMOD User's Guide Addendum for more details.

2.6.5 Ozone (O_3) Standards

Ozone is normally only modeled for regional compliance demonstrations and does not need to be modeled for air quality permits. However, permit applicants for PSD applications that apply to NO_X or VOCs should contact NMED and the EPA Regional Office to determine how to complete the ozone ambient impact analysis.

Table 5E: O_3 Air Quality Standards

Averaging Period	**Significance Level** (μg/m^3)	**NAAQS (ppm)**	**NAAQS** (μg/m^3)
8-hour	1.96 [2]	0.07[1]	137.3

[1] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.07 ppm.
[2] 1.0 ppb, Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program, EPA, April 17, 2018

Ozone concentrations may be estimated using the following method derived from the MERP guidance[2].

[O3] = ((NO_X emission rate (tons/year) /184) + (VOC emission rate (tons/year) /1049)) x 1.96 μg/m^3

> "Simulation of ozone formation and transport is a highly complex and resource intensive exercise. Control agencies with jurisdiction over areas with ozone problems are encouraged to use photochemical grid models, such as the Models-3/Community Multi-scale Air Quality (CMAQ) modeling system, to evaluate the relationship between precursor species and ozone." --68234 Federal Register / Vol. 70, No. 216 / Wednesday, November 9, 2005 / Rules and Regulations

In accordance with this guidance, NMED performs ozone modeling on a regional scale as need arises, rather than requiring permit applicants to quantify their contribution to a regional ozone concentration. Comprehensive ozone modeling is too resource intensive to attach this expense to a typical permit application, and screening modeling on an affordable scale currently cannot quantify a source's impacts to ambient ozone concentrations.

Regional ozone modeling for the Four Corners area was done in 2009 (see http://www.nmenv.state.nm.us/aqb/4C/Modeling.html) and the Air Quality Bureau is continuing to analyze ozone in the region.

2.6.6 Particulate matter less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) Standards

[2] Guidance on the Development of Modeled Emission Rates for Precursors (MERPS) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program, Richard A. Wayland, EPA, December 2, 2016.

Table 5F: $PM_{2.5}$ Air Quality Standards[3]

Averaging Period	Significance Level [4] ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Class II PSD Increment[3] ($\mu g/m^3$)	Class I PSD Significance Level ($\mu g/m^3$)	Class I PSD Increment[3] ($\mu g/m^3$)
annual	0.2	12 [1]	4	0.05	1
24-hour	1.2	35 [2]	9	0.27	2

[1] To attain this standard, the 3-year average of the annual arithmetic mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 12.0 ug/m^3.
[2] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 ug/m^3.
[3] For any period other than an annual period, the applicable maximum allowable increase may be exceeded during one such period per year at any one location.
[4] Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program, EPA, April 17, 2018.

$PM_{2.5}$ secondary formation concentrations may be estimated using the following method derived from the MERP guidance[4].

$$[PM_{2.5}]_{annual} = ((NO_X \text{ emission rate (tons/year) }/3184) + (SO_2 \text{ emission rate (tons/year) }/2289)) \times 0.2\ \mu g/m^3$$

$$[PM_{2.5}]_{24\text{-hour}} = ((NO_X \text{ emission rate (tons/year) }/1155) + (SO_2 \text{ emission rate (tons/year) }/225)) \times 1.2\ \mu g/m^3$$

Secondary formation from the project should be added to the modeled value. Refined factors for certain geographic areas may be developed using the MERP guidance.

2.6.6.1 $PM_{2.5}$ design value

The 24-hour design value is the 98^{th} percentile of the combined concentrations from all sources. The annual design value is the annual average.

2.6.6.2 Modeling for the 24-hour $PM_{2.5}$ design value

AERMOD and current emissions inventories currently do not account for secondary formation of $PM_{2.5}$ in the atmosphere. Sources that emit at least 40 tons per year of NO_X or at least 40 tons per year of SO_2 are

[3] Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$) – Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC), ENVIRONMENTAL PROTECTION AGENCY
40 CFR Parts 51 and 52, RIN 2060-AO24 http://www.epa.gov/nsr/documents/20100929finalrule.pdf
[4] Guidance on the Development of Modeled Emission Rates for Precursors (MERPS) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program, Richard A. Wayland, EPA, December 2, 2016.

considered to emit significant amounts of precursors. Sources with significant increases of $PM_{2.5}$ precursors must qualitatively and/or quantitatively account for secondary formation of $PM_{2.5}$.[5]

Two tiers of modeling are available for $PM_{2.5}$ modeling. Both tiers include modeling the facility and nearby sources and adding secondary formation and a background concentration to that. Particulate sources typically have impacts in the immediate vicinity of the source that are not represented in background monitors, so double-counting of background concentrations is expected to be limited.

Add the design value of the modeled direct $PM_{2.5}$ to the design value of the secondary $PM_{2.5}$ and the design value of the background $PM_{2.5}$.

Tier 1: To the modeled concentration(s), add the secondary $PM_{2.5}$ and the 98th percentile 24-hour monitored background concentration.
Tier 2: Add the secondary $PM_{2.5}$ and the monthly or quarterly maximum background concentrations to daily modeled concentrations. Compare the high-eighth-high combined concentration with the 24-hour standard. If multiple years of meteorological data are used, then the high-eighth-high combined concentration is compared with the standard.

2.6.6.3 Modeling for the 24-hour $PM_{2.5}$ PSD increment design value

Model the high-second-high concentration of all increment-consuming sources at the facility and at nearby sources. Calculate secondary formation from NO_X and SO_2 increases after the appropriate baseline date and add that to the modeled concentration. Compare the total with the 24-hour PSD increment.

2.6.6.4 Modeling for the annual $PM_{2.5}$ PSD increment design value

Model all increment-consuming sources at the facility and at nearby sources. Calculate secondary formation from NO_X and SO_2 increases after the appropriate baseline date and add that to the modeled concentration. Compare the total predicted annual average concentration with the allowable increment.

2.6.7 Particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10}) Standards

Table 5G: PM_{10} Air Quality Standards

Averaging Period	Significance Level (μg/m³)	NAAQS (μg/m³)	PSD Increment[2] Class II (μg/m³)	PSD Class I Significance Level (μg/m³)	PSD Class I Increment[2] (μg/m³)
annual	1.0		17	0.2[1]	4
24-hour	5.0	150	30	0.3[1]	8

[1] EPA proposed significance level
[2] For any period other than an annual period, the applicable maximum allowable increase may be exceeded during one such period per year at any one location.

2.6.7.1 Modeling for the 24-hour PM_{10} NAAQS design value

[5] Guidance for PM2.5 Permit Modeling, Stephen D. Page, May 20, 2014. http://www.epa.gov/ttn/scram/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf

If PM2.5 emission rates are modeled as equal to PM10 emission rates, then the PM2.5 NAAQS demonstration will satisfy the requirement for demonstration of compliance with PM10 NAAQS. However, PM10 PSD increment demonstration is not necessarily satisfied by any PM2.5 modeling.

The 24-hour NAAQS is not to be exceeded more than once per year.
Use high second high and a single year of representative meteorological data. This is approximately equivalent to the high fourth high specified in the multi-year analysis.
"…[W]hen n years are modeled, the (n+1)th highest concentration over the n-year period is the design value, since this represents an average or expected exceedance rate of one per year."
http://www.epa.gov/ttn/scram/guidance/guide/appw_05.pdf

Two tiers of modeling are available for PM_{10} NAAQS modeling. Both tiers include modeling the facility and nearby sources and adding a background concentration to that. Particulate sources typically have impacts in the immediate vicinity of the source that are not represented in background monitors, so double-counting of background concentrations is expected to be limited.

Tier 1, option 1: Use highest predicted concentration (instead of the high second high) and a single year of representative meteorological data. To the modeled concentration, add the high second high 24-hour monitored background concentration.

Tier 1, option 2: Use high second high predicted concentration and a single year of representative meteorological data. To the modeled concentration, add the highest 24-hour monitored background concentration.

Tier 2: Add monthly maximum background concentrations to daily modeled concentrations. The high-second-high combined concentration may be compared with the 24-hour standard.

2.6.7.2 Modeling for the 24-hour PM_{10} PSD increment design value

Model all increment-consuming sources at the facility and at nearby sources. Compare the high-second-high predicted concentration with the allowable increment.

2.6.7.3 Modeling for the annual PM_{10} PSD increment design value

Model all increment-consuming sources at the facility and at nearby sources. Compare the predicted annual average concentration with the allowable increment.

2.6.8 Sulfur Dioxide (SO_2) Standards

Table 5I: SO_2 Air Quality Standards

Averaging Period	Significance Level (µg/m³)	NAAQS (ppb)	NAAQS (µg/m³)	NMAAQS (ppb)	NMAAQS (µg/m³)	PSD Class II Increment[3] (µg/m³)	PSD Class I Significance Level (µg/m³)	PSD Class I Increment[3] (µg/m³)
annual	1.0			20	52.4	20	0.1[2]	2
24-hour	5.0			100	261.9	91	0.2[2]	5
3-hour	25.0	500	1309.3			512	1.0[2]	25
1-hour	7.8[1]	75	196.4					

[1] EPA proposed 1-hour significance level of 3 ppb corrected to a reference temperature of 25ºC and a reference pressure of 760 millimeters of mercury.

[2] EPA proposed significance level.
[3] For any period other than an annual period, the applicable maximum allowable increase may be exceeded during one such period per year at any one location.

2.6.8.1 SO_2 design value

In NMAC, the SO_2 standards for the area within 3.5 miles of the Chino Mines Company smelter furnace stack at Hurley are set equal to the federal standards. However, since this stack no longer exists, the distance is irrelevant. The NMAAQS listed in table 5I apply for the entire state.
Demonstration of compliance with 1-hour standard will also demonstrate compliance with the other standards, but not necessarily the PSD increments.

The form is the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour average concentrations.

2.6.8.2 Modeling for the 1-hour SO_2 NAAQS

The standard is calculated similarly to the NO_2 1-hour standard instructions in section 2.6.4.4, but the fourth highest is used in place of the eighth highest (and 99th percentile is substituted for 98th percentile). All sulfur oxides are assumed to be in the form of SO_2. If multiple years are modeled, the resulting high-fourth-high values at each receptor are averaged over the years modeled and the maximum average value is compared with the standard.

Tier 1: Add the 99th percentile 1-hour background concentration to 99th percentile modeling for the entire facility (without neighboring sources) and compare the total with the 1-hour NAAQS. Optionally, to determine the total design value, the facility and all nearby sources may be modeled instead of adding a background concentration if the facility is over 10 km from the center of Albuquerque and El Paso.

Tier 2: Add the hourly 1-hour background concentrations (as described in the background concentration section) to each hour of the modeling results and compare the 99th percentile of the totals with the 1-hour NAAQS. Optionally, to determine the total design value, the facility and all nearby sources may be modeled instead of adding a background concentration if the facility is over 10 km from the center of Albuquerque and El Paso.

2.6.8.3 Modeling for the 3-hour SO_2 PSD increment

Model the increment consuming emissions at the facility and at nearby sources and compare the high-second-high 3-hour average with the allowable PSD increment.

2.6.8.4 Modeling for the 24-hour SO_2 PSD increment

Model the increment consuming emissions at the facility and at nearby sources and compare the high-second-high 24-hour average with the allowable PSD increment.

2.6.8.5 Modeling for the annual SO_2 PSD increment

Model the increment consuming emissions at the facility and at nearby sources and compare the predicted annual average with the allowable PSD increment.

2.6.9 Total Reduced Sulfur Except For Hydrogen Sulfide Standards

Table 5J: Total Reduced Sulfur except for H_2S Air Quality Standards

Averaging Period	NMAAQS (ppm)	Notes
1/2-hour	0.003	for the state, except for the Pecos-Permian Basin Intrastate AQCR
1/2-hour	0.010	for the Pecos-Permian Basin Intrastate AQCR
1/2-hour	0.003	For within corporate limits of municipalities within the Pecos-Permian Basin Intrastate Air Quality Control Region.
1/2-hour	0.003	For within five miles of the corporate limits of municipalities having a population of greater than twenty thousand and within the Pecos-Permian Basin Intrastate Air Quality Control Region

2.6.9.1 Total Reduced Sulfur design value

EPA test methods suggest that reduced sulfur compounds in some cases consist primarily of carbon disulfide (CS_2), carbonyl sulfide (COS), and hydrogen sulfide (H_2S). To calculate the parts per million of reduced sulfur, use the average molecular weight in the sample. For example, 1-heptanethiol ($CH_3[CH_2]6SH$) has a molecular weight of 132.3.

For modeling ½-hour total reduced sulfur NMAAQS, use the 1-hour averaging time because the models cannot resolve less than one hour increments.

2.6.9.2 Modeling the Total Reduced Sulfur ½-hour NMAAQS

Model the entire facility and compare the 1-hour predicted concentration with the ½-hour NMAAQS. Surrounding sources and background concentrations are not added.

Table 6A. Air Quality Standard Summary (Without Notes).

Pollutant	Avg. Period	Sig. Lev. ($\mu g/m^3$)	Class I Sig. Lev. ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	NMAAQS ($\mu g/m^3$ unless noted)	PSD Increment Class I ($\mu g/m^3$)	PSD Increment Class II ($\mu g/m^3$)
CO	8-hour	500		10,303.6	9,960.1		
	1-hour	2,000		40,069.6	14,997.5		
H_2S	1-hour	1.0			13.9		
	1/2-hour	5.0			139.3		
	1/2-hour	5.0			41.8		
Pb	Quarterly	0.03		0.15			
NO_2	annual	1.0	0.1	99.66	94.02	2.5	25
	24-hour	5.0			188.03		
	1-hour	7.52		188.03			
O_3	8-hour	1.96		137.3			
$PM_{2.5}$	annual	0.2	0.05	12		1	4
	24-hour	1.2	0.27	35		2	9
PM_{10}	annual	1.0	0.2			4	17
	24-hour	5.0	0.3	150		8	30
SO_2	annual	1.0	0.1		52.4	2	20
	24-hour	5.0	0.2		261.9	5	91
	3-hour	25.0	1.0	1309.3		25	512
	1-hour	7.8		196.4			
Reduced S	1/2-hour				3 ppb		
	1/2-hour				10 ppb		

Table 6B. Standards for which Modeling is not Required.

Standard not Modeled	Surrogate that Demonstrates Compliance
CO 8-hour NAAQS	CO 8-hour NMAAQS
CO 1-hour NAAQS	CO 1-hour NMAAQS
NO_2 annual NAAQS	NO_2 annual NMAAQS
NO_2 24-hour NMAAQS	NO_2 1-hour NAAQS
O_3 8-hour	Regional modeling
SO_2 annual NMAAQS	SO_2 1-hour NAAQS
SO_2 24-hour NMAAQS	SO_2 1-hour NAAQS
SO_2 3-hour NAAQS	SO_2 1-hour NAAQS

Table 6C. Modeling the Design Value Summary (Default Modeling).

Averaging Period	Add Nearby Sources?	Add Background Concentration?	Modeled Concentration
CO 8-hour NMAAQS	No* (Yes)	Yes* (high 8 hour) (No)	high 8 hour
CO 1-hour NMAAQS	No* (Yes)	Yes* (high 1 hour) (No)	high 1 hour
H_2S 1-hour or ½-hour NMAAQS	Yes	No	high 1 hour
Pb Quarterly NMAAQS	No	No	high month
NO_2 annual NMAAQS	No* (Yes)	Yes* (annual average) (No)	annual average
NO_2 annual PSD increment	Yes	No	annual average
NO_2 1-hour NAAQS	No* (Yes)	Yes* (1-hr 98^{th} percentile) (No)	98th-percentile 1 hour
$PM_{2.5}$ annual NAAQS	Yes	Yes (annual average)	annual average
$PM_{2.5}$ annual PSD increment	Yes	No	annual average
$PM_{2.5}$ 24-hour NAAQS	Yes	Yes (24-hr 98^{th} percentile)	98th-percentile 24 hour
$PM_{2.5}$ 24-hour PSD increment	Yes	No	high 24 hour
PM_{10} annual PSD increment	Yes	No	annual average
PM_{10} 24-hour NAAQS	Yes	Yes (high 24 hour)	high second high 24 hour
PM_{10} 24-hour PSD increment	Yes	No	high second high 24 hour
SO_2 annual PSD increment	Yes	No	annual average
SO_2 24-hour PSD increment	Yes	No	high second high 24 hour
SO_2 3-hour PSD increment	Yes	No	high second high 3 hour
SO_2 1-hour NAAQS	No* (Yes)	Yes* (high 1 hour) (No)	99th-percentile 1 hour
Reduced S ½-hour NMAAQS	No	No	high 1 hour

* Standards marked with an asterisk normally offer the choice to either model nearby sources or add a representative background concentration.

2.7 PSD Increment Modeling

2.7.1 Air Quality Control Regions and PSD Baseline Dates

Any facility that is required to provide an air dispersion modeling analysis with its construction permit application is required to submit a PSD increment consumption analysis unless none of its sources consume PSD increment. Table 7 serves as a tool to determine which sources to include in PSD increment modeling.

Table 7: PSD Increment Consumption and Expansion

Sources that do not consume PSD increment	• Temporary emissions (sources involved in a project that will be completed in a year or less). • Any facility or modification to a facility constructed before the PSD major source baseline date. • Any minor source constructed before the PSD minor source baseline date.
Sources that consume PSD increment	• Any new emissions or increase in emissions after the PSD Minor Source Baseline date (for that AQCR and pollutant). • Any new emissions or increase in emissions at a PSD Major source that occurs after the Major Source Baseline Date.
Sources that expand PSD increment	• A permanent reduction in actual emissions from a baseline source.

Notes:

- EPA memos written before the publication of the Draft NSR Workshop Manual indicate that PSD regulations were not intended to apply to temporary pilot projects. The memo clearly indicated that the pilot project did not need a PSD permit.
- If a minor source facility once existed but shut down before the minor source baseline date, then it would not be considered to be part of the baseline.
- Haul road emissions are treated the same way other sources of emissions are treated.
- An increase in emissions due to increased utilization of a facility, such as de-bottlenecking, are treated as any other increase in emissions.
- The Bureau interprets temporary emissions to mean emissions at the location that will occur for less than one year or emissions of standby or emergency equipment that operates less than 500 hours per year. For example, if a series of three gravel crushers operate at a mine for more than one year, PSD increment modeling should be performed because the mining operations at the location are not temporary in nature, even though none of the of individual crushers remained on-site for an entire year.

Table 8: Minor Source Baseline Dates by Air Quality Control Region

AQCR	NO_2 Date	SO_2 Date	PM_{10} Date	$PM_{2.5}$ Date
12	8/10/1995	8/10/1995	8/10/1995	Not established
14	6/6/1989	8/7/1978	8/7/1978	Not established
152	3/26/1997	5/14/1981	3/26/1997	2/11/2013
153	8/2/1995	Not established	6/16/2000	Not established
154	Not established	Not established	Not established	Not established
155	3/16/1988	7/28/1978	2/20/1979	11/13/2013
156	Not established	8/4/1978	8/4/1978	Not established
157	Not established	Not established	Not established	Not established

Table 9: Major Source Baseline Dates and Trigger Dates

Pollutant	Major Source Baseline Date	Trigger Date
PM	January 6, 1975	August 7, 1977
SO_2	January 6, 1975	August 7, 1977
NO_2	February 8, 1988	February 8, 1988
$PM_{2.5}$	October 20, 2010	October 20, 2011

2.7.2 PSD Class I Areas

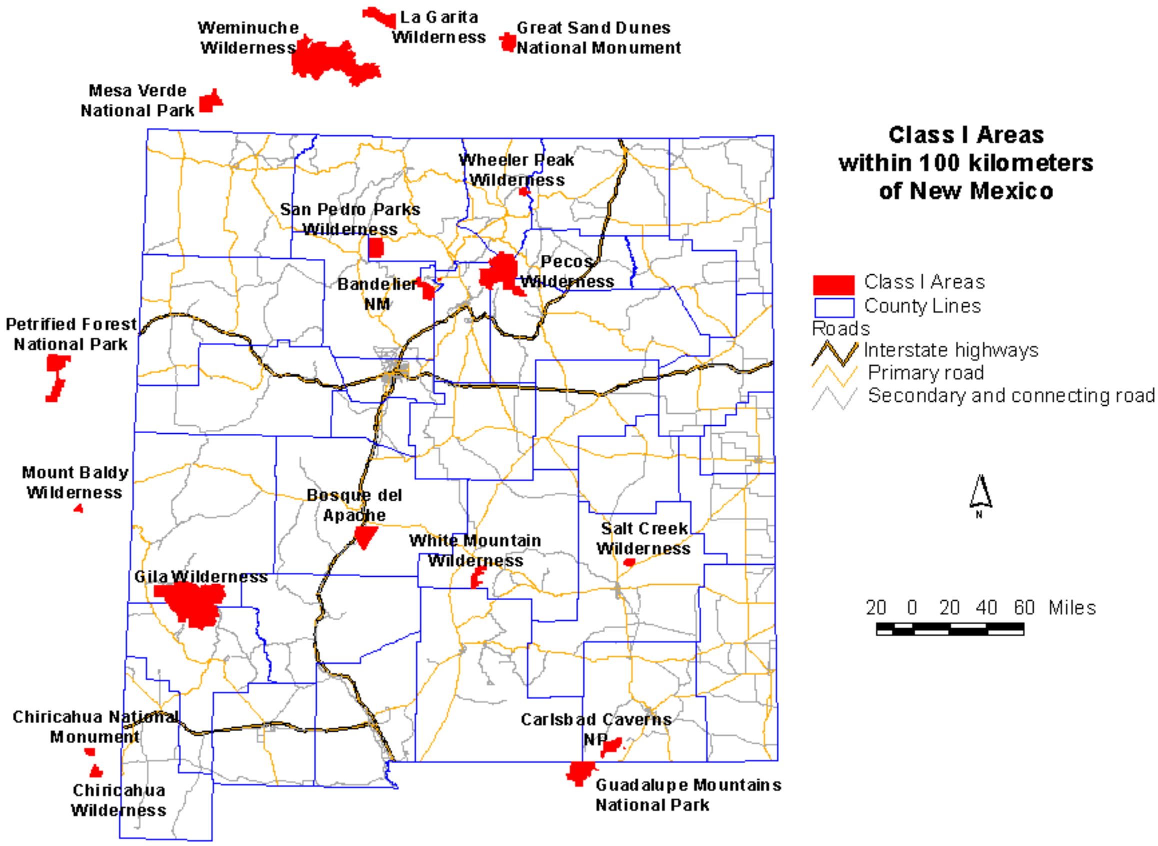

Figure 1: Class I areas

2.7.3 PSD Class I Area Proposed Significance Levels

The Environmental Protection Agency (EPA) has proposed significance levels for PSD Class I areas. No significance levels have been promulgated, but the Federal land managers (FLMs) are currently accepting the use of this value.

Table 10. Class I Prevention of Significant Deterioration Significance Levels

Pollutant	Averaging Period	Significance Level ($\mu g/m^3$)	PSD Class I Increment ($\mu g/m^3$)
Sulfur Dioxide (SO_2)	annual [a] 24-hour 3-hour	0.1 [b] 0.2 [b] 1.0 [b]	2 5 25
PM_{10}	annual [a] 24-hour	0.2 [b] 0.3 [b]	4 8
Nitrogen Dioxide (NO_2)	annual [a]	0.1 [b]	2.5
$PM_{2.5}$	annual 24-hour	0.06 0.07	1 2

[a] annual arithmetic mean
[b] EPA proposed significance level

2.8 New Mexico State Air Toxics Modeling

Modeling must be provided for any toxic air pollutant sources that may emit any toxic pollutant in excess of the emission levels specified in **20.2.72.502 NMAC -** Permits for Toxic Air Pollutants. Sources may use a correction factor based on release height for the purpose of determining whether modeling is required. Divide the emission rate for each release point by the correction factor for that release height on Table 11 and add the total values together to determine the total adjusted emission rate. If the total adjusted emission rate is higher than the emission rate in pounds per hour listed in **20.2.72.502 NMAC**, then modeling is required. The controlled emission rate (not the adjusted emission rate) of the toxic pollutant should be used for the dispersion modeling analysis.

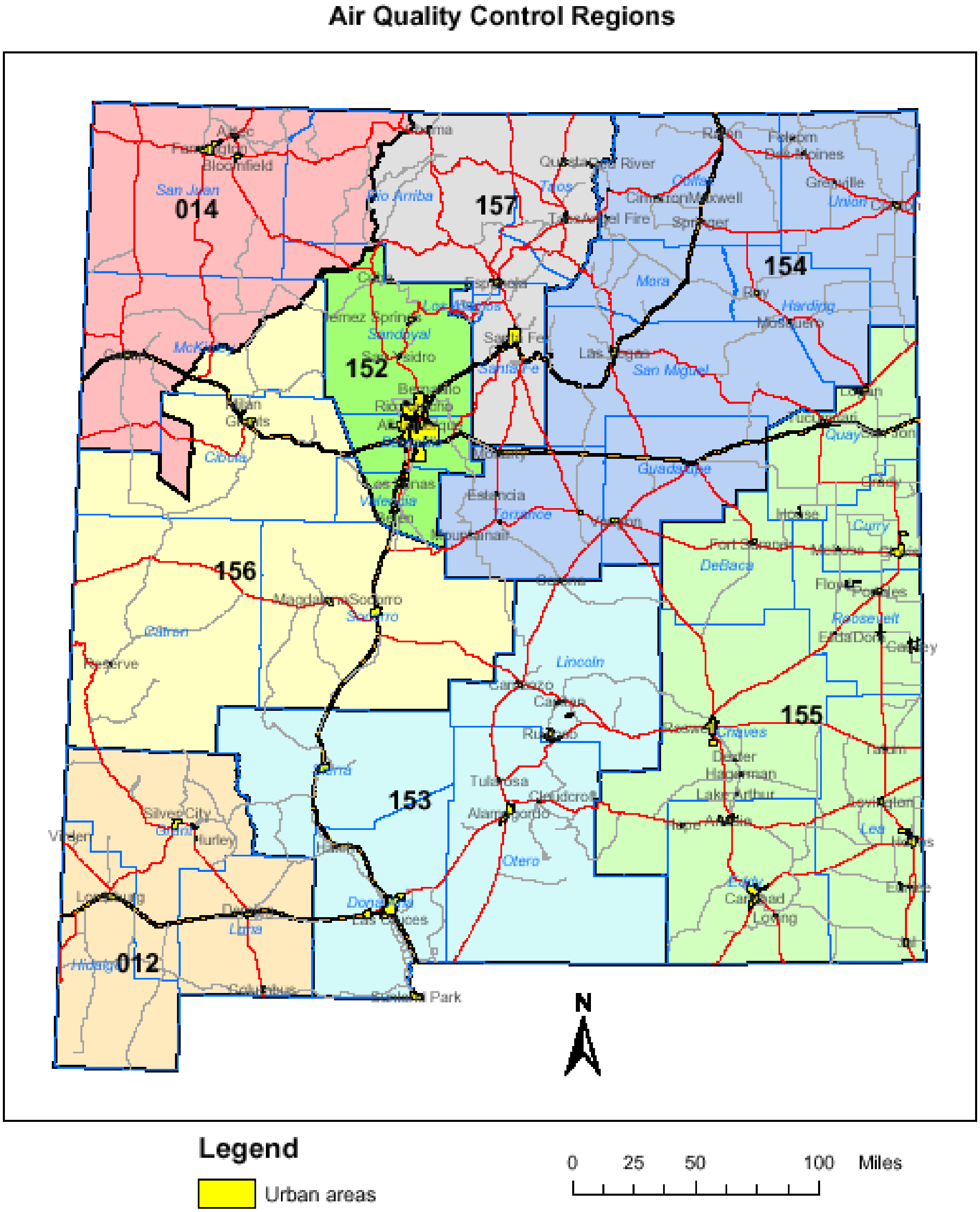

Figure 2: Air quality control regions (each AQCR has a different color)

Table 11: Stack Height Release Correction Factor (adapted from 20.2.72.502 NMAC)

Release Height in Meters	Correction Factor
0 to 9.9	1
10 to 19.9	5
20 to 29.9	19
30 to 39.9	41
40 to 49.9	71
50 to 59.9	108
60 to 69.9	152
70 to 79.9	202
80 to 89.9	255
90 to 99.9	317
100 to 109.9	378
110 to 119.9	451
120 to 129.9	533
130 to 139.9	617
140 to 149.9	690
150 to 159.9	781
160 to 169.9	837
170 to 179.9	902
180 to 189.9	1002
190 to 199.9	1066
200 or greater	1161

The table below lists a few of the commonly encountered State Air Toxics in New Mexico. This is not the complete list, which is too expansive to reprint here.

Table 12: A few common state air toxics and modeling thresholds (from 20.2.72.502 NMAC)

Pollutant	OEL (mg/m^3)	1% OEL ($\mu g/m^3$)	Emission Rate Screening Level (pounds/hour)
Ammonia	18	180	1.20
Asphalt (petroleum) fumes	5.00	50	0.333
Carbon black	3.50	35	0.233
Chromium metal	0.500	5.00	0.0333
Glutaraldehyde	0.700	7.0	0.0467
Nickel Metal	1.00	10.0	0.0667
Wood dust (certain hard woods as beech & oak)	1.00	10.0	0.0667
Wood dust (soft wood)	5.00	50.0	0.333

If modeling shows that the maximum eight-hour average concentration of each toxic pollutant is less than one one hundredth of its Occupational Exposure Level (OEL) listed in **20.2.72.502 NMAC**, then the analysis is finished. For a source of any known or suspected human carcinogens (per **20.2.72.502 NMAC**) which will cause an impact greater than one-one hundredth of the OEL, the source must demonstrate that best available control technology will be used to control the carcinogen. If modeling shows that the impact of a toxic which is not a known or suspected human carcinogen (per **20.2.72.502 NMAC**) is greater than one-one hundredth of the OEL, the application must contain a health assessment for the toxic pollutant that includes: source to potential receptor data and modeling, relevant environmental pathway and effects data, available health effects data, and an integrated assessment of the human health effects for projected exposures from the facility.

2.9 Hazardous Air Pollutants

Hazardous Air Pollutants (HAPs) do not require modeling, as they are regulated by means other than air quality standards. Sources should be aware of the Title V major source thresholds of 10 tons/year for any Hazardous Air Pollutants (HAP) and 25 tons/year for total HAPs, which will require an operating permit to be obtained from the department under **20.2.70 NMAC-** Operating Permits.

2.10 Nonattainment and Maintenance Areas

In nonattainment areas and for those sources outside of the nonattainment area that significantly contribute to concentrations in a nonattainment area, the modeling analysis required is a demonstration of an air quality benefit. Regular modeling is required in maintenance areas, however. Further information on nonattainment area modeling is in section 7.4, Nonattainment Area Requirements. Nonattainment areas are described at https://www.env.nm.gov/air-quality/nonattainment-areas/.

3.0 MODEL SELECTION

3.1 What dispersion models are available?

The Bureau accepts the use of EPA approved models for dispersion analysis. Commercial or parallel versions of these models are fine as long as they produce the same results. This section of the modeling guidelines is designed to describe the models that are available and provide some guidance on which situations are the most appropriate for which regulatory modeling situations.

Two types of models are currently in use for air dispersion modeling: probability density function (PDF) models, and puff models. Probability density function models apply a probability function from each emission release point to calculate the concentration at a receptor based on the location of the receptor, wind speed and direction, stability of the atmosphere, and other factors. The plume is assumed to extend all the way out to the most distant receptor, no matter how far that receptor is from the emission source. Because of this characteristic, PDF models suffer in accuracy when modeling distant concentrations or unstable conditions. SCREEN3, ISCST3, ISC_OLM, CTSCREEN, ISC-PRIME, and AERMOD are all PDF models. All but AERMOD use a Gaussian, or normal, distribution for their probability density function. AERMOD uses a PDF that varies depending on nearby terrain and other factors. Currently, AERMOD and CTSCREEN are EPA-approved models for near-field modeling. As of November 9, 2006, SCREEN3, ISCST3, and ISC_OLM are no longer considered EPA-approved models. The Federal Register notice detailing the promulgation of AERMOD is located at: http://www.epa.gov/scram001/guidance/guide/appw_05.pdf

CALPUFF is a puff model, meaning that it tracks puffs, or finite elements of pollution, after they are released from their source. This strategy makes the model ideal for tracking pollution over long distances or in conditions that are not stable, and also allows chemical reactions within the plume to be modeled. Unfortunately, puff models require large amounts of computing time. CALPUFF is an EPA-approved model for modeling long range transport and/or complex non-steady-state meteorological conditions.

3.2 EPA Modeling Conferences and Workshops

EPA Modeling Conference presented a wealth of information about recent regulatory modeling developments. The EPA web page with the details is http://www3.epa.gov/ttn/scram/conferenceindex.htm.

3.3 Models Most Commonly Used in New Mexico

Most analyses reviewed by the Bureau will begin with an AERMOD analysis, and possibly CALPUFF for Class I analyses. For dispersion modeling within 50 kilometers of the source, AERMOD should be used. CALPUFF should be used only for PSD Class I area analyses, per the Interagency Workgroup Air Quality Modeling (IWAQM) Phase II report, but may be approved for use on a case-by-case basis for other analyses.

3.3.1 AERMOD

- AERMOD is intended to be the standard regulatory model. The PRIME building downwash algorithm is used by the model. Both the Ozone Limiting Method (OLM) and the Plume Volume Molar Ratio Method (PVMRM) algorithms for nitrogen conversion are built into the model.
- AERMOD has greater accuracy in complex terrain than CTSCREEN.
- AERMOD is suggested for extremely complex terrain.

See the section on nitrogen oxides for more information and options.

3.3.2 CALPUFF

- CALPUFF is a puff model designed to calculate concentrations at distances up to and beyond 50 kilometers. The model is significantly more difficult to run than the other models discussed in these guidelines. Use of CALPUFF for NAAQS, NMAAQS, or PSD increment modeling must be approved by the Bureau before submitting the modeling.
- CALPUFF is required for additional impact analyses when Federal Land Managers require additional impact analyses for Class I areas near PSD major sources. Typically, CALPUFF light is used for this modeling.

3.3.3 CTSCREEN

- CTSCREEN is applicable only for modeling receptors above stack height.
- CTSCREEN is a difficult model to run because of the difficulty in obtaining hill contour profiles.
- CTSCREEN uses screening meteorology.
- AERMOD produced greater accuracy than CTDMPLUS (the full implementation of CTSCREEN) when modeling the data that was used to develop CTSCREEN/CTDMPLUS.
- CTSCREEN is typically used to model the terrain on top of a hill that did not pass when using AERMOD.

The following list can be used to correct 1-hour CTSCREEN concentrations to 3-hour, 24-hour and annual concentrations by multiplying by the appropriate conversion factor for the averaging period.

Table 13: CTSCREEN Correction factors for 1-hour concentration.

Averaging Period	Correction factor
3-hour	0.7
24-hour	0.15
Annual	0.03

3.3.4 AERSCREEN

- AERSCREEN is a screening version of AERMOD.

4.0 MODEL INPUTS AND ASSUMPTIONS

Models should be used with the technical options recommended in the Guideline on Air Quality Models (http://www.epa.gov/ttn/scram/guidance/guide/appw_05.pdf) except as noted in this document or approved by the Bureau.

Unless otherwise noted, information and procedures in this section refer to all of the models listed above.

4.1 Operating Scenarios

4.1.1 Emission Rates

All averaging periods shall be modeled using the maximum short-term emission rate allowed in the permit. The preferred method of modeling all averaging periods is to use maximum short-term emission rates and to use the hours of operation model input option to limit the facility's emissions.

4.1.2 Hours of Operation

If the facility is limited to operating certain hours of the day or has other operating restrictions, limiting the operating hours in the model can normally reduce the concentration produced by the model. Hours of operation can only be modeled by models that use actual meteorology, but not by screening models. Use screening models only to model facilities as if the maximum operating rate were emitting continuously.

4.1.3 Time Scenarios

Sometimes a facility has unusual operating times, for example, if the facility is allowed to operate 12 hours per day, but the hours are not specified. The facility may model as if it operates continuously, but as an option, the facility can model different time periods at the amount of time allowed per day as different operating scenarios, making sure that the maximums are modeled. In the 12 hour example, the facility might model three scenarios: 7AM to 7PM. 7PM to 7AM. And 5PM to 5AM. This way, all the hours of the day were modeled, and the modeler can be fairly certain that the maximum was modeled because the worst-case scenarios would occur when the calm blocks of time were modeled together. All scenarios should be modeled at maximum hourly emission rates.

4.1.4 Operating at Reduced Load

Some sources (like engines and boilers) can produce higher concentrations of pollution in ambient air when they are operating below maximum load than when they are at maximum load. The applicant shall analyze various feasible operating scenarios (100%, 75%, and 50% are typical) to determine the worst-case impacts, and then use that worst-case scenario for the entire modeling analysis. This requirement is in section 8.1 of Appendix W of EPA's Guideline.

4.1.5 Alternate Operating Scenario

If the permit application contains multiple operating scenarios (such as use of different fuels or different engines) then the applicant shall model each of the scenarios for the radius of impact analysis. Whichever scenario produces the greatest impacts on ambient air shall be used for the cumulative analysis, if required. If it is unclear which operating scenario produces the greatest impacts, each scenario shall be modeled for cumulative impact analysis.

4.1.6 Startup, Shutdown, Maintenance (SSM), and Other Short-term Emissions

If startup, shutdown, maintenance, or other temporary events have the potential for producing short-term impacts greater than the normal operating scenarios, then the applicant shall model each of the scenarios to demonstrate compliance with the ambient air quality standard.

If it is probable that an adjacent facility will have emissions higher than normal operation during the time the applicant's facility has increased emissions, then those emissions should also be accounted for in the modeling. Otherwise, model surrounding sources at their normal operating rate. Because of the short nature of the SSM emissions, modeling does not have to demonstrate compliance with annual standards or annual increment consumption. Highest hourly SSM emission rate should be modeled for NAAQS, NMAAQS and for increment consumption modeling.

Whichever scenario produces the greatest impacts on ambient air shall be used for the cumulative analysis, if required. If it is unclear which operating scenario produces the greatest impacts, each scenario shall be modeled for cumulative impact analysis.

4.2 Plume Depletion and Deposition

Dry plume depletion may be used to reduce concentrations of particulate matter. Appropriate particle characteristics for the specific type of source being modeled should be used. Check the web page for sample particle size distributions. Because of the length of time required to run a model with plume depletion, the Bureau recommends only applying plume depletion to receptors that are modeled to be above standards when the model is run without plume depletion.

The wet deposition option should not be used for the modeling analysis unless data are available and the use of wet deposition has been previously approved.

4.3 Meteorological Data.

4.3.1 Selecting Meteorological Data.

The meteorological data used in the modeling analysis should be representative of the meteorological conditions at the specific site of proposed construction or modification, or else use screening meteorological data, which contains worst-case data.

Representative, on-site data is obviously the best data to use; however, for many sources on-site data is not available. Bureau modeling staff can supply preferred meteorological data sets for various locations around the state. The National Weather Service also collects data throughout the country. These data sets are available through the National Climatic Data Center. It is mandatory that Bureau modeling staff approve the chosen meteorological data before the analysis is submitted. PSD permits contain more rigorous requirements relating to the collection of representative, on-site meteorological data. Either 1 year of representative data which serves as on-site data or 5 years of appropriate off-site data must be used. Please contact the Bureau as soon as possible if you anticipate the need to collect on-site meteorological or ambient monitoring data for a PSD permit.

Setback distance modeling for portable sources may require separate meteorological data than that used in the rest of the modeling for that facility. Preliminary analysis indicates that the Substation meteorological data set is appropriate for locations throughout the State. Contact the Bureau for guidance on relocation meteorological data selection.

The goal of modeling is to use site-specific meteorological data. In cases where the form of the standard allows the standard to be exceeded a number of times per year, this is based on site-specific data. If the equivalent of site-specific data is not available, then the highest concentration estimate should be considered the design value unless multiple years of data are used. (68238 Federal Register / Vol. 70, No. 216 / Wednesday, November 9, 2005 / Rules and Regulations)

For example, no meteorological monitoring stations are available near Raton, New Mexico, and there are terrain features that may make Raton meteorology different from other places. The Bureau will still recommend meteorological data to use for modeling in Raton, but the PM_{10} standard is not allowed to be exceeded at all because the meteorological data is not completely representative of the area.

For concentration monitoring data, proximity to the monitor is normally the driving factor for selection of a representative monitor. For meteorological data, the similarity of the terrain (including canyon and valley directions) is more important than finding the closest monitor. Unless otherwise noted, AQB staff will need the exact location of the facility to select or approve a set of meteorological data representative of the location. Staff will compare wind roses with prominent terrain features that influence drainage patterns or otherwise influence wind directions.

Processed meteorological data is available on the web page: https://www.env.nm.gov/air-quality/meteorological-data/.

4.4 Background Concentrations

> "Background concentrations should be determined for each critical (concentration) averaging time." (68242 Federal Register / Vol. 70, No. 216 / Wednesday, November 9, 2005 / Rules and Regulations)

The background concentrations listed below were derived from information downloaded from http://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html.

4.4.1 Uses of Background Concentrations

Background concentrations are added to the modeled concentrations or are used for stoichiometric modeling applications such as OLM or PVMRM. Normally, a background concentration associated with the averaging period being modeled is added after the model (with all facility and nearby sources) is completed. Sometimes this approach proves too conservative to demonstrate compliance with standards. If so, monthly, daily, or hourly concentration profiles can be developed using representative sets of monitoring data appropriate for the modeling domain. Adding refined background concentrations normally requires post-processing of hourly output files.

It is very important to use recent monitoring data, because concentration trends are likely to change over time (much more so than weather patterns). If hourly meteorological data does not match hourly monitoring data, then the following methods can be used to produce a concentration profile for the refined modeling exercise.

Choose the highest background for each period for the region that best describes the modeling domain, unless adequate justification can be made that a specific monitor is most representative. For rural areas that do not match the regional descriptions above, use a monitor from Eastern NM or Southwestern NM.

4.4.1.1 Refined background concentrations

Background concentrations may be refined to take into account patterns in daily and monthly fluctuations in concentration. Since background concentrations are added to the model after dispersion is complete, there is no point mathematically in determining refined background concentrations shorter than the averaging period of the air quality standard. 24-hour concentrations do not need 1-hour background concentrations (except for ozone limiting of NO_2 concentrations, which happens during dispersion).

4.4.1.2 Developing 24-hour refined background concentrations

Each of the 12 months is represented by the maximum 24-hour concentration occurring during that month. If three years of data are available, average the three values for each month and use the average for the background. If a given month has a low maximum concentration due to the small number of samples collected that month, then the concentration from that month is not used and the average of the maximums of the two other years will be used as the 24-hour background for that month.

Example: Roswell $PM_{2.5}$ (This example uses outdated data and should not be used for new modeling).

$PM_{2.5}$ has a 24-hour averaging period and an annual averaging period. The annual average uses the annual value in the standard background tables, but it is appropriate to use refined background concentrations for the 24-hour period. The Partisol sampler in Roswell is a Federal Reference Method sampler for $PM_{2.5}$. The filters are collected about every three days, so there is not data available for every day. Over three years of data are available, and 2007 through 2009 are presented in the following table.

January, 2007 had a maximum reported concentration of 10.0 $\mu g/m^3$. January 2008 and 2009 had maximum concentrations of 18.0 and 11.7, respectively. The average of these three values is 13.2. After the model has run, every day in January adds a background concentration of 13.2 $\mu g/m^3$. Care must be taken to identify the greatest sum of modeled concentration plus background, since background concentration varies each month – the highest modeled concentration may no longer be the highest when the background values are added.

Table 14: Roswell $PM_{2.5}$ Monitoring Data (2007-2009)

Year	**Month**	**$PM_{2.5}$ concentration. ($\mu g/m^3$)**											Max	3-year avg.
2007	1	2.33	3.67	9.50	6.25	10.00	6.25	4.67	5.58	7.25			10.00	**13.2**
2007	2	5.92	5.50	25.5	9.00	13.75	2.67	2.42	5.67	2.25			25.50	**14.7**
2007	3	1.67	2.92	4.42	4.17	3.42	12.25	8.00	9.29	2.67	5.58	2.67	12.25	**12.8**
2007	4	4.75	9.58	4.83	5.86	3.67	5.75	8.00	2.75	5.83	6.00		9.58	**9.2**
2007	5	4.58	3.42	4.00	8.33	6.08	4.00	3.75	4.33				8.33	**10.0**
2007	6	7.00	6.92	8.25	4.00	5.19	5.67	9.29	13.7	6.58			13.67	**11.5**
2007	7	8.58	8.28	8.17	5.75	7.92	8.67	7.33	7.28				8.67	**9.2**
2007	8	11.92	3.08	7.50	11.83	18.50	8.67	7.92	6.33	6.00	7.83		18.50	**13.2**
2007	9	11.75	4.00	4.75	6.75	9.17	4.08	4.08	3.17	4.42	4.08		11.75	**11.1**
2007	10	5.25	6.00	6.08	6.92	4.33	5.08						6.92	**7.0**
2007	11	7.75	7.58	8.75	7.25	5.42	8.33	7.83	7.25	18.58	8.33		18.58	**10.4**
2007	12	3.17	4.08	4.25	3.17	5.83	10.50	5.58	4.33	2.25			10.50	**10.8**
2008	1	5.3	8.2	3.6	4.4	3.0	4.9	18.0	13.4	4.2	2.6		18.0	
2008	2	2.2	3.8	3.3	3.3	7.4	3.5	9.3	4.6				9.3	
2008	3	6.8	3.7	14.8	4.9	5.8	5.8						14.8	
2008	4	3.7	5.5	10.7	2.9	6.7	6.2	5.2	9.5				10.7	
2008	5	6.8	7.4	4.3	5.2	11.6	6.2	6	5.3				11.6	
2008	6	6.3	7.1	4.8	5.2	6.3	14	4.9	4.9				14.0	
2008	7	6.7	6.4	4.8	4.0	7.0	6.1	9.2	9.2	9.8			9.8	
2008	8	6.5	6.7	9.2	3.6	5.6	4.3	5.2	7.8				9.2	
2008	9	7.6	7.6	2.3	4.8	5.0	8.8	8.8	11.1	8.9			11.1	
2008	10	7.2	2.8	4.6	4.8	3.2	4.3	7.9	3.5	4.0			7.9	
2008	11	5.5	6.2	4.1									6.2	
2008	12	3.8	4.6	7.8	5.2								7.8	
2009	1	5.2	3.7	1.8	11.7	10.0	5.6	4.1	7.3				11.7	
2009	2	5.8	5.6	9.3	3.4	8.1	9.0	4.2	5.4	4.7			9.3	
2009	3	4.1	6.0	11.4	2.8	4.1	3.8	11.3	6.2	9.7	4.0	4.2	11.4	
2009	4	7.2	4.4	6.2	1.8	4.8	1.8	3.1	6.6				7.2	
2009	5	6.4	3.2	10.0	6.7	3.9							10.0	
2009	6	6.4	3.9	4.7	5.0	6.7	5.3						6.7	
2009	7	4.8	8.9	4.5	5.7	6.0	8.6	9.2	5.8	8.5	8.1	8.4	9.2	
2009	8	8.4	10.5	7.6	5.0	6.1	11.8	7.0	4.3				11.8	
2009	9	7.9	3.9	4.9	5.3	10.3	1.7	6.5					10.3	
2009	10	2.2	6.2	1.9	1.9	3.0	3.6						6.2	
2009	11	6.2	5.3	6.1	2.8	5.5	5.0	6.3	2.6				6.3	
2009	12	14.2	5.5	4.3	7.7	4.9	5.3						14.2	

4.4.1.3 Developing 1-hour refined background concentrations

From the geographically nearest full set of monitoring data to the facility to be modeled, determine the maximum one-hour concentration that occurs during each hour of the day for each month. The result will be twelve different 24-hour profiles that will be repeated for the entire month that each represents. This profile can be used for all averaging periods. If three years of data are available, average the three values for each month and use the average for the background. POST files may be used to add hourly background concentrations to receptors.

Example: Determine the maximum concentration for hour 1 (midnight to 1AM) in January. Use this for hour 1 for each day in January. Determine the maximum concentration for hour 2 (1AM to 2AM) in January. Use this for hour 2 for each day in January. … Determine the maximum concentration for hour 24 (11PM to midnight) in December. Use this for hour 24 for each day in December. Complete the entire year in this manner, with hour and month-specific data.

4.4.1.4 Eliminating double-counting of emissions in background

In some cases the addition of a background concentration may result in double-counting of some of the emissions, if the reference monitor is very close to the modeling domain. This effect may be reduced by placing a receptor at the monitor location and modeling the sources in the model that existed at the time of the monitoring. The modeled concentration at the monitor may be subtracted from the background (with a minimum background of zero). The averaging period should be the same as the one used for the background calculation, and must be temporally correlated if the maximum monitored concentration is not being used.

4.4.2 CO Background Concentration

Ambient CO monitors to represent New Mexico are very limited. Concentrations near Sunland Park are best represented by monitors in El Paso. Monitors operated by Albuquerque should be conservative for the rest of New Mexico.

Table 15: Carbon Monoxide Background Concentration

Region	ID	Location	1-hour ($\mu g/m^3$)	8-hour ($\mu g/m^3$)	Latitude	Longitude	Notes
The rest of New Mexico	350010023	Del Norte High School	2203	1524	35.1343	-106.585	4700a San Mateo NE, Albuquerque, NM
Albuquerque	350010029	South Valley	2746	1566	35.01708	-106.657	201 Prosperity SE, Albuquerque, NM
Sunland Park	481410044	El Paso Chamizal	4677	2834	31.76569	-106.455	800 S San Marcial Street, El Paso, TX

Concentrations are the average of the maximum concentrations for 2015-2017.

4.4.3 H_2S Background Concentration

NMED has no H_2S monitors. The standards are generally designed to protect against noticeable changes in concentration above the background concentration for the region, and no background concentration is added.

4.4.4 Lead Background Concentration

Reformulation of gasoline and other control measures have virtually eliminated ambient lead concentrations. NMED has no lead monitors. Treat as zero background.

4.4.5 NO_2 Background Concentration

Note: No 24-hour averages were calculated. Compliance with 1-hour NAAQS automatically demonstrates compliance with 24-hour NMAAQS.

Table 16: NO_2 Background Concentration

Region	ID	Location	1-hour Background (µg/m^3)	1-hour 98th %ile (µg/m^3)	Annual Background (µg/m^3)	Latitude	Longitude	Address
4-Corners	1ZB, 350450009	Bloomfield	85.1	67.3	19.6	36.74222	-107.977	162 Hwy 544, Bloomfield NM 87413
4-Corners	1NL, 350450018	Navajo Dam	62.2	52.1	11.0	36.80973	-107.652	423 Hwy 539, Navajo Dam, NM 87419
4-Corners	350451233	Dine College	73.3	54.9	11.3	36.8071	-108.695	Dine College, GIS Lab
Albuquerque	350010023	Del Norte High School	94.2	83.8	20.2	35.1343	-106.585	4700A San Mateo NE
South Central	6ZM, 350130021	Sunland Park	100.4	85.7	12.5	31.79611	-106.584	5935A Valle Vista, Sunland Park, NM
South Central	6ZN, 350130022	US-Mexico Border Crossing	102.9	77.5	8.5	31.78778	-106.683	104-2 Santa Teresa International Blvd, NM
Eastern NM	5ZR, 350151005	Outside Carlsbad	60.3	38.7	5.0	32.38	-104.262	Holland St, SE of Water Tank, Carlsbad, NM
Eastern NM	5ZS, 350250008	Hobbs-Jefferson	83.2	64.2	8.1	32.72666	-103.123	2320 N. Jefferson St, Hobbs, NM
Southwestern NM[1]	7E, 350290003	Deming	62.052	53.277	6.966	32.2558	-107.723	310 Airport Road, Deming, NM88030

Annual background is the average of three annual averages of monitoring data from 2015 to 2017. The maximum 1-hour NO_2 concentrations from each of three years were averaged to determine the 1-hour background concentration, using monitoring data from 2015 to 2017
Refined 1-hour background profiles may be developed using the guidance described in "Refined Background Concentrations", above.
[1]Based on 2013 -2015 averages.

4.4.6 Total Reduced Sulfur Background Concentration

NMED has no total reduced sulfur monitors. The standards are generally designed to protect against noticeable changes in concentration above the background concentration for the region, and no background concentration is added.

4.4.7 Ozone Background Concentration

Ozone background concentrations are required for NO_2 modeling using PVMRM or OLM.

Table 17: Ozone Background Concentration

Region	ID	Location	1-hour Background (µg/m^3)	Latitude	Longitude	Address
4-Corners	1ZB, 350450009	Bloomfield	146.1	36.74222	-107.977	162 Hwy 544, Bloomfield NM 87413
4-Corners	1NL, 350450018	Navajo Dam	156.9	36.80973	-107.652	423 Hwy 539, Navajo Dam, NM 87419
4-Corners[1]	350450020	Chaco Culture National Historical Park	144.8	36.03022	-107.910	1808 County Road 7950, Nageezi, NM 87037
4-Corners	1H, 350451005	Shiprock Substation	145.4	36.79667	-108.473	Usbr Shiprock Substation (Farmington)
4-Corners	350451233	Dine College	151.8	36.8071	-108.695	Dine College, GIS Lab
Albuquerque	2ZJ, 350431001	Highway Department, Bernalillo	148.6	35.29944	-106.548	Highway Dept. Yard Near Bernalillo
Albuquerque	2LL, 350610008	Los Lunas	140.4	34.8147	-106.74	1000 W. Main St, Los Lunas, NM 87031
Albuquerque	350010023	Del Norte High School	153.1	35.1343	-106.585	4700A San Mateo NE
Albuquerque	350010029	South Valley	145.4	35.01708	-106.657	201 Prosperity SE
Albuquerque	350011012	Foothills	152.4	35.1852	-106.508	8901 Lowell NE
South Central	6O, 350013008	La Union	161.3	31.93056	-106.631	St Lukes Episcopal Ch Rt 1 (La Union)
South Central	6ZK, 350130020	Chaparral Middle School	170.2	32.04111	-106.409	680 McCombs, Chaparral, NM
South Central	6ZM, 350130021	Desert View Elementary School	175.9	31.79611	-106.584	5935A Valle Vista, Sunland Park
South Central	6ZN, 350130022	US-Mexico Border Crossing	169.0	31.78778	-106.683	104-2 Santa Teresa International Blvd, NM
South Central	6ZQ, 350130023	NM Highway Dept. Yards In Las Cruces	149.9	32.3175	-106.768	750 N. Solano Drive, Las Cruces, NM
Southwestern NM[2]	7T, 350171003	Hurley Smelter	139.294	32.69194	-108.124	Chino Blvd near Hurley Park, Hurley, NM
Eastern NM	5ZS, 350025008	Hobbs-Jefferson	150.5	32.72666	-103.123	2320 N. Jefferson St, Hobbs, NM
Eastern NM	5ZR, 350151005	Outside Carlsbad	155.6	32.38	-104.262	Holland St, SE of Water Tank, Carlsbad, NM
Eastern NM	350153001	Carlsbad Caverns	145.4	32.1783	-104.441	Carlsbad Caverns National Park
North Central	350390026	Coyote	140.4	36.18774	-106.698	21 New Mexico 96, Coyote, NM, 87012
North Central	3SFA, 350490021	Santa Fe Airport	139.7	35.61975	-106.08	2001 Aviation Drive, Santa Fe, New Mexico 87507

[1]Based on 2017 only
[2]Based on 2013-2015 averages.

The hourly maximum ozone concentration from the nearest ozone monitor may be used for ozone limiting. Unless otherwise noted, the maximum 1-hour O_3 concentrations from each of three years were averaged to determine the 1-hour background concentration, using monitoring data from 2015 to 2017.

Refined 1-hour background profiles may be developed using the guidance described in "Refined Background Concentrations", above. Ozone files typically use the format, "(4I2,5X,F8.3)". Hourly concentrations use µg/m^3 to avoid elevation errors.

4.4.8 $PM_{2.5}$ Background Concentration

Table 18: $PM_{2.5}$ Background Concentration

Region	ID	Location	24-hour Background 100th%ile (µg/m³)	24-hour Background 98th%ile (µg/m³)	Annual Background (µg/m³)	Latitude	Longitude	Address
Albuquerque	350010023	Del Norte High School	11.5	10.8	4.6	35.1343	-106.5852	4700A San Mateo NE
Albuquerque[1]	350010029	South Valley	22.6	18.20	7.43	35.01708	-106.6574	201 Prosperity SE
South Central[2]	6CM, 350130016	Anthony	18.4	17.0	7.6	32.00361	-106.5992	SE Corner Of Anthony Elem. School Yard
South Central	6ZM, 350130021	Sunland Park	25.9	24.3	7.3	31.79611	-106.5839	5935A Valle Vista, Sunland Park
South Central	6Q, 350130025	Las Cruces District Office of NMED	16.1	14.9	5.1	32.32194	-106.7678	2301 Entrada Del Sol, Las Cruces
Eastern NM	5ZS, 350250008	Hobbs-Jefferson	15.8	13.4	5.9	32.72666	-103.1229	2320 N. Jefferson St, Hobbs
4-Corners[1]	1FO, 350450019	Farmington Environment Department Office	14.13	11.77	4.19	36.77416	-108.165	3400 Messina Drive Suite 5000 Farmington
North Central[1]	3HM, 350490020	Santa Fe	16.55	9.45	4.32	35.67111	-105.9536	Runnels Bldg. 1190 St. Francis Dr.

[1]Based on 2013-2015 averages

[2]Based on average of 2013, 2014, and 2017

Concentrations are the average of three years of maximum data from 2015 to 2017. Some monitors may not represent background concentrations. Anomalously high values were eliminated before calculating aggregate concentrations. Use the highest 98th percentile background concentration from the region in which the facility is located, unless another monitor is more representative of the local area. Refined 24-hour background profiles may be developed using the guidance described in "Refined Background Concentrations", above.

Monthly background concentrations for Southeastern New Mexico from Hobbs are listed below. These were collected from January 2015 to December 2018.

Table 18B: Hobbs Refined $PM_{2.5}$ Background Concentration

Month	Monthly 24-hour Maximum ($\mu g/m^3$)
1	**12.1**
2	**10.2**
3	**21.1**
4	**17.5**
5	**16.5**
6	**16.1**
7	**17.6**
8	**13.3**
9	**15.6**
10	**10.3**
11	**13.2**
12	**17.7**

4.4.9 PM_{10} Background Concentration

Table 19: PM_{10} Background Concentration

Region	ID	Location	Annual Background (μg/m³)	24-hour Background Maximum (μg/m³)	24-hour Background Second High (μg/m³)	Latitude	Longitude	Address
Albuquerque	350010026	Jefferson	24.3	74.0	70.3	35.1443	-106.6047	3700 Singer
Albuquerque	350010029	South Valley	33.7	152.0	132.2	35.01708	-106.6574	201 Prosperity SE
4-Corners[1]	1ZB, 350450009	Bloomfield	13.0	55.0	50.0	36.74222	-107.977	162 Hwy 544, Bloomfield NM 87413
South Central	6CM, 350130016	Anthony	22.0	50.7	44.7	32.003611	-106.5992	SE Corner of Anthony Elem. School Yard
South Central	6ZK, 350130020	Chaparral Middle School	25.3	120.0	112.3	32.041111	-106.4092	680 McCombs, Chaparral
South Central[1]	6ZM, 350130021	Sunland Park	26.0	78.0	73.0	31.796111	-106.5839	5935A Valle Vista, Sunland Park
South Central	6WM, 350130024	Las Cruces City Well #46	15.3	94.7	83.3	32.278056	-106.8644	South of I-10 at Las Cruces Well #46
Southwestern[2]	7D, 350029001	Deming	16.2	56.5	46.5	32.267222	-107.7553	Post Office Pine St
Southwestern[2]	7E, 350029003	Deming Airport	22.7	128.7	109.3	32.2558	-107.7227	310 Airport Road, Deming
Eastern NM	5ZS, 350250008	Hobbs-Jefferson	24.0	100.7	37.3	32.726656	-103.1229	2320 N. Jefferson St, Hobbs
North Central[2]	3HM, 350490020	Santa Fe	9.0	23.0	20.7	35.671111	-105.9536	Runnels Bldg. 1190 St. Francis Dr.
North Central[2]	3ZD, 350055005	Taos	14.2	52.0	40.5	36.383333	-105.5833	Fire Station Santiago Road

Concentrations are averaged from 2015 to 2017. Some monitors, such as 350010026 and 350010029, are located near industrial sources or in disturbed areas and do not represent ambient background concentrations.

[1]Monitor 350450009 was missing 2015 data. Monitor 350130021 was missing 2016 data. These monitors used two year averages.

[2]Based on 2013-2015 averages

Refined 24-hour background profiles may be developed using the guidance described in “Refined Background Concentrations”, above.

Anomalously high values were eliminated before calculating aggregate concentrations.

Monthly background concentrations for Southeastern New Mexico from Hobbs are listed below. These were collected from July 2011 to June 2014. The monitor was discontinued after June 2014.

Table 20: Hobbs Refined PM_{10} Background Concentration

Month	**Monthly 24-hour Maximum** (μg/m^3)
1	43.0
2	46.0
3	62.7
4	58.0
5	62.3
6	82.3
7	86.7
8	61.3
9	60.0
10	74.3
11	48.7
12	39.7

4.4.10 SO_2 Background Concentration

Table 21: SO_2 Background Concentrations

Region	ID	Location	1-hour Background ($\mu g/m^3$)	1-hour Background 99th Percentile ($\mu g/m^3$)	Annual ($\mu g/m^3$)	Latitude	Longitude	Address
Albuquerque	350010023	Del Norte High School	15.8	13.2	1.75	35.1343	-106.585	4700A San Mateo NE
Southwest New Mexico[1]	7T, 350171003	Hurley Smelter	6.11	1.75	0.0183	32.69194	-108.124	Chino Blvd Near Hurley Park, Hurley, NM
The rest of New Mexico	1ZB, 350450009	Bloomfield	8.84	5.31	0.219	36.74222	-107.977	162 Hwy 544, Bloomfield NM 87413
Between Farmington and Shiprock	1H, 350451005	Shiprock Substation	41.6	22.1	0.389	36.79667	-108.473	Usbr Shiprock Substation (Farmington)
4-Corners west of Shiprock	350451233	Dine College	37.3	19.5	1.48	36.8071	-108.695	Dine College, GIS Lab
Eastern New Mexico	483751025	Amarillo, 24th Ave	68.3	47.0	0.670	35.2367	-101.787	4205 NE 24th Ave, Amarillo TX

Background concentrations are from 2015 to 2017
[1]Based on 2013-2015 averages

Refined 1-hour background profiles may be developed using the guidance described in "Refined Background Concentrations", above.

4.5 Location and Elevation

Important: Use the same UTM zone and datum for the entire facility. Facilities on the border between two UTM zones must convert all information into one zone or the other.

Make sure that the source location and parameters are the same as those listed in the application form!! This is the most common mistake we see.

4.5.1 Terrain Use

Terrain classifications are defined as follows:

- **Flat terrain** – Terrain with all elevations equal to the base of the source
- **Simple terrain** – Terrain with elevations below stack height
- **Complex terrain** – Terrain with elevations above stack height

- **Intermediate (Complex) terrain** – Terrain with elevations between stack height and plume height (a subset of complex terrain).

Flat terrain should be used if the source base is higher than all the surrounding terrain or if the facility consists primarily of non-buoyant fugitive sources. Simple and complex terrain should be used for all other scenarios.

4.5.2 Obtaining Elevation

Elevation data for receptors, sources, and buildings should be obtained from Digital Elevation Model (DEM) files or National Elevation Dataset (NED) files with a resolution of 30 meters or better. USGS DEMs are available for New Mexico in either 7.5-minute or 1-degree formats. It is strongly suggested that the 7.5-minute data be used in dispersion modeling rather than the coarse resolution 1-degree data. Keep in mind that the USGS DEMs can be in one of two horizontal datums. Older DEMs were commonly in NAD27 (North American Datum of 1927) while many of the latest versions in NAD83 (North American Datum of 1983). It is important to use the same source of data for all elevations. Even USGS 7.5-minute maps and USGS 7.5-minute DEM data may differ. Surrounding sources' elevations provided by the Bureau have been determined using 7.5-minute DEM data (NAD83), where available, and 1-degree DEM data elsewhere.

Elevations should be included for at least all receptors within 10 km of your facility or within your facility's ROI (whichever is smaller). Your source's elevation may be used for receptors beyond 10 km, but it may be wiser to use actual DEM elevations for the entire ROI because surrounding sources are provided with actual elevations.

4.6 Receptor Placement

4.6.1 Elevated Receptors on Buildings

Elevated receptors should be placed on nearby buildings at points of public access where elevated concentrations may be predicted. Use flagpole receptors in areas with multi-story buildings to model state and federal standards. In cases where nearby buildings have publicly accessible balconies, rooftops, or similar areas, the applicant should consult with the Bureau modeling staff to ensure proper receptor placement. PSD increment receptors are limited to locations at ground level.[6]

4.6.2 Ambient Air

Ambient air is defined as any location at or beyond the fence line of the facility. The fence line must restrict public access by a continuous physical barrier, such as a fence or a wall. If plant property is accessible to the public or if any residence is located within the restricted area, receptors should be located on-property.[7] Public access is interpreted to include housing, schools, hospitals, and similar areas that are frequented by family members of employees, but the remainder of the restricted area is excluded from public access if such family members do not have access to excluded areas. For example, receptors would not be placed in dormitories on military bases, but would be placed in family housing areas.

4.6.3 Receptor Grids

"Receptor sites for refined modeling should be utilized in sufficient detail to estimate the highest concentrations and possible violations of a NAAQS or a PSD increment. In designing a receptor network,

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[6] NSR Workshop Manual, page C.42
[7] NSR Workshop Manual, Page C.42

the emphasis should be placed on receptor resolution and location, not total number of receptors." (68238 Federal Register / Vol. 70, No. 216 / Wednesday, November 9, 2005 / Rules and Regulations)

The modeling domain can be defined using a Cartesian grid with 1000 meter spacing. Fine grids or fence line receptors with 50 to 100 meter spacing should fill any areas of the domain with potential to contain the highest concentration and/or any possible exceedances of NMAAQS, NAAQS, or PSD increment for the refined modeling. 50 meter spacing is recommended for fence line receptors for most sources, but 100 meters is recommended for expansive sources like coal mines, copper mines, or large military bases. (Grids with 50 meter spacing and 2 km side width are recommended for medium or large neighboring point sources. 50 meter spacing and 1 km width grids are recommended for hilltops or small neighboring sources.) Once these areas of potential high concentrations have been refined, the remaining receptors may be discarded.

For sources with an ROI greater than 50 kilometers, the grid should not extend beyond 50 km, as is noted in the NSR Workshop Manual.

4.6.4 PSD Class I Area Receptors

A modeling analysis of the PSD increment consumed at the nearest Class I areas must be performed by increment-consuming sources in AQCRs where the PSD minor source baseline date has been established, or in any AQCR where a new PSD-major source is to be installed. One receptor at the near boundary of the Class I area is normally sufficient for modeling to compare with Class I significance levels. 1000 meter spacing is recommended within the Class I areas for facilities with significant concentrations. If concentrations are above 75% of the PSD increment, then 50 to 100 meter spacing should be used near the hot spots. See Figure 1 for locations of Class I areas.

4.6.5 PSD Class II Area Receptors

Other than areas that are designated as PSD Class I areas, the entire state of New Mexico is a Class II area. The receptor grid for the PSD Class II increment analysis should be the same as the one for the cumulative run.

4.7 Building Downwash and Cavity Concentrations

Building downwash should be included in the analysis when stack height is less than good engineering practice (GEP) stack height and there are buildings, tanks, fans or other obstacles near the facility. All buildings and structures should be identified and analyzed for potential downwash effects. NMED requires the use of BPIP-Prime or equivalent for this analysis. GEP stack height should be determined as per 40 CFR 51.100. For receptors very near buildings, a cavity region analysis may be required. Modelers should consult with the Bureau modeling staff.

As summarized from 40 CFR 51.100:
GEP stack height is the greater of:
1) 65 meters, measured from the ground-level elevation at the base of the stack
or
2) H + 1.5L
Where
H = Height of nearby structure(s) measured from the ground-level elevation at the base of the stack.

L = The lesser of the height or the projected width (width seen by the stack) of nearby structures. Nearby structures can be as far as 5 times the lesser of the width or height dimension of the structure, but not greater than 0.8 km.
Stacks taller than GEP stack height should be modeled as if they were GEP stack height.

4.8 Neighboring Sources/Emission Inventory Requirements

> "The number of nearby sources to be explicitly modeled in the air quality analysis is expected to be few except in unusual situations. In most cases, the few nearby sources will be located within the first 10 to 20 km from the source(s) under consideration." (Federal Register / Vol. 82, No. 10 / Tuesday, January 17, 2017 / Rules and Regulations)

4.8.1 Neighboring Sources Data

The Emissions Inventory of neighboring sources is used as input data in air quality models. This data will be provided by the Bureau within a few days of request. E-mail the UTM coordinates of the location(s) to be modeled to the Bureau to request source data.

4.8.1.1 Determining which sources to include

This section functions as a definition for "nearby sources" as used in this document. The definition varies based on context, as illustrated below.

The contributions of distant sources are included in the background concentration. If the background concentration is added and includes all neighboring sources or a conservative approximation of them, then surrounding source modeling is not required for modeling of NAAQS or NMAAQS. For particulate matter or cases where the background concentration does not include all neighboring sources, then include all sources within 10 km of the facility in the model, and discard sources beyond 10 km from the facility. PSD increment is modeled, not monitored. (PSD increment may optionally add a background concentration instead of modeling the more distant sources.) For cases where background concentrations are not added, retain all sources within 25 km of the facility, plus sources emitting over 1000 pounds per hour within 50 km of the facility. For PSD Class I increment analysis, retain all sources within 25 km of the Class I area, plus sources emitting over 1000 pounds per hour within 50 km of the Class I area.

Table 22: Surrounding Source Retention Example for a Source Near Bloomfield.

Pollutant and averaging period	Neighboring source notes:
NO_2 1-hour NAAQS	Do not include surrounding sources. (Optionally, instead of adding background concentrations, include all sources within 25 km of the facility, plus sources emitting over 1000 pounds per hour within 50 km of the facility.)
$PM_{2.5}$ 24-hour NAAQS	Retain sources within 10 km of facility.
NO_2 annual Class II PSD increment	Retain sources within 25 km of the facility, plus sources emitting over 1000 pounds per hour within 50 km of the facility..
NO_2 annual Class I PSD increment	Retain sources within 25 km of Mesa Verde National Park, plus sources emitting over 1000 pounds per hour within 50 km of Mesa Verde.

4.8.1.2 Surrounding source format

The Bureau provides AERMOD input files with the surrounding sources (*.INP) and reference tables (*.XLS) to describe the sources in more detail. The AERMOD input files can be imported in GUI programs or edited manually. The Excel files are for reference only, and should not be used as the basis for modeling.

Sources numbered 0-49,999 belong in the NAAQS/NMAAQS analysis. Sources numbered 10,000 and above belong in the PSD increment analysis. (Notice overlap of two groups). Numbering in the reference tables may not include the 50,… or 10,… prefix for the counting numbers.

Unless otherwise noted, units of measure used in the surrounding sources files are the metric units associated with model input format. Emissions designated as NO_2 are actually total oxides of nitrogen (NO_X).

4.8.1.3 Handling errors in surrounding source files

Please contact the Bureau if you see suspicious data in the inventory. We know that there are errors in our database and we would like to correct them.

If you find a piece of equipment that has unusual stack parameters, document the error and corrected values in your modeling report. Please also report the error to Joe Kimbrell (Joseph.Kimbrell@state.nm.us) as well for database correction. Include MASTER_AI_ID, SUBJECT_ITEM_CATEGORY_CODE, and SUBJECT_ITEM_ID in the documentation.
Please document the reason the error is suspected.

The following parameters may be substituted for missing or invalid data. Determine the type of source that best matches the types below. For example, engines use the “other” category. Find the smallest emission rate in the table that is greater than or equal to the emission rate of the emission unit. That column contains the parameters that may be used for the parameters that are missing. (These parameters are based on modeling for general construction permits or on existing source data for control devices.)

Table 23: Missing Stack Parameter Substitutions for Turbines.

NO_2 Rate (lb/hr)	Height (m)	Temperature (K)	Velocity (m/s)	Diameter (m)
21.7	7	588	10	0.7
21	6	588	10	0.7
20	5	588	10	0.7
19	5	588	10	0.6
18	4.5	588	10	0.6
17	4.5	588	10	0.6
16	4.5	588	10	0.5
15	4.5	588	10	0.5
14	4.5	588	10	0.5
13	4	588	10	0.5
12	4	588	10	0.5

NO_2 Rate (lb/hr)	Height (m)	Temperature (K)	Velocity (m/s)	Diameter (m)
11	3.5	588	10	0.5
10	3.5	588	10	0.5
9	3.5	588	10	0.5
8	3.5	588	10	0.4
7	3	588	10	0.4
6	3	588	10	0.4
5	2.5	588	10	0.4
4	2.5	588	10	0.4
3	2	588	10	0.35
2	1.8	588	10	0.24
1	1.8	588	10	0.24

Table 24: Missing Stack Parameter Substitutions for Flares.

SO_2 Rate (lb/hr)	Height (m)	Temperature (K)	Velocity (m/s)	Diameter (m)
5000	18	1273	20	20.80618
4500	16	1273	20	19.73848
4000	14	1273	20	18.60962
3500	12	1273	20	17.4077
3000	9	1273	20	16.1164
2500	6	1273	20	14.71219
2100	6	1273	20	13.48395
2000	6	1273	20	13.15899
1900	6	1273	20	12.82579
1800	6	1273	20	12.48371
1700	6	1273	20	12.13198
1600	6	1273	20	11.76975
1500	6	1273	20	11.39602
1400	6	1273	20	11.0096
1300	6	1273	20	10.60911
1200	6	1273	20	10.19291
1100	6	1273	20	9.758965
1050	6	1273	20	9.534591
1000	6	1273	20	9.304808
950	6	1273	20	9.069204
900	6	1273	20	8.827315
850	6	1273	20	8.578609
800	6	1273	20	8.322474
750	6	1273	20	8.0582
700	6	1273	20	7.784961
650	6	1273	20	7.501776
600	6	1273	20	7.207473
550	6	1273	20	6.90063
500	6	1273	20	6.579493
450	6	1273	20	6.241855
400	6	1273	20	5.884877
350	6	1273	20	5.504798
300	6	1273	20	5.096453
250	6	1273	20	4.652404
200	6	1273	20	4.161237
150	6	1273	20	3.603737
100	6	1273	20	2.942439
90	6	1273	20	2.791442
80	6	1273	20	2.631797
70	6	1273	20	2.461821
60	6	1273	20	2.279203
50	6	1273	20	2.080618
40	6	1273	20	1.860962
30	6	1273	20	1.61164
29	6	1273	20	1.584552
28	6	1273	20	1.556992
27	6	1273	20	1.528936
26	6	1273	20	1.500355
25	6	1273	20	1.471219
24	6	1273	20	1.441495
23	6	1273	20	1.411144
22	6	1273	20	1.380126
21	6	1273	20	1.348395
20	6	1273	20	1.315899
19	4	1273	20	1.282579
18	4	1273	20	1.248371
17	4	1273	20	1.213199
16	4	1273	20	1.176975
15	4	1273	20	1.139602
14	4	1273	20	1.10096
13	4	1273	20	1.060911
12	4	1273	20	1.019291
11	4	1273	20	0.9758965
10	4	1273	20	0.9304808
9	3.5	1273	20	0.8827316
8	3.5	1273	20	0.8322473
7	3.5	1273	20	0.7784961
6	3.5	1273	20	0.7207473
5	3.5	1273	20	0.6579493
4	3	1273	20	0.5884877
3	3	1273	20	0.5096453
2	2.5	1273	20	0.4161237
1	2	1273	20	0.2942439

Table 25: Missing Stack Parameter Substitutions for Particulate Control Devices.

PM10 Rate (lb/hr)	Height (m)	Temperature (K)	Velocity (m/s)	Diameter (m)
22	19	0	28	4.6
21	18	0	27	4.6
20	17	0	26	4.4
19	16	0	25	4.2
18	15	0	24	4
17	14	0	23	3.8
16	14	0	22	3.6
15	13	0	21	3.4
14	13	0	20	3.2
13	12	0	19	3
12	12	0	18	2.8
11	11	0	17	2.6
10	11	0	16	2.4
9	10	0	15	2.2
8	10	0	14	2
7	10	0	13	1.8
6	9	0	12	1.6
5	9	0	11	1.4
4	9	0	10	1.2
3	9	0	9	1
2	9	0	8	0.8
1	9	0	7	0.6

Table 26: Missing Stack Parameter Substitutions for Other Point Sources.

NO_2 Rate (lb/hr)	Height (m)	Temperature (K)	Velocity (m/s)	Diameter (m)
21.7	7	730	28	0.3
21	6	730	28	0.3
20	5.5	730	28	0.3
19	4.5	730	28	0.3
18	4.5	730	27	0.3
17	4.5	730	27	0.3
16	4.5	730	27	0.25
15	4.5	730	27	0.25
14	4.5	700	22	0.25
13	4.5	700	22	0.25
12	4.5	700	22	0.2
11	4.5	700	22	0.2
10	4.5	700	22	0.2
9	4.5	700	20	0.2
8	4.5	700	18	0.2
7	4.5	700	14	0.2
6	4.5	650	14	0.2
5	4.5	500	5	0.2
4	4	500	5	0.1
3	3.5	500	5	0.1
2	3	500	5	0.0762
1	2	500	5	0.0762

For GCP 2, 3, and 5 permits with 95 tons/year of $PM_{2.5}$ emissions, use the following values:
TSP emission rate = 95 TPY
PM_{10} emission rate = 71.25 TPY (TSP X 0.75)
$PM_{2.5}$ emission rate = 17.875 TPY (PM_{10} X 0.25) = (TSP X 0.1875)

For volume sources with missing parameters:
Maximum release height = 10 m
Minimum release height = 1 m
Missing release height = PM10 Rate x 20 m/(lb/hr)
Initial vertical dimension = release height x 0.93
No limit to the maximum lateral dimension.
Lateral dimension = PM10Rate x 10 m/(lb/hr)
Minimum Lateral Dimension = 0.47 m

4.8.1.4 Refining Surrounding Sources

In some cases, it will be possible to use actual emissions to model surrounding sources instead of the maximum values allowed in the permit. If actual emission rates from the most recent two years is available, then the following optional technique may be used.

Annual averaging period: For the most recent two consecutive years of operation, if that period is representative of normal operation, the emission rate for each hour (in pounds per hour) is the total tons emitted for those two years divided by 8.76 (lb x year/ton x hour).

Other averaging periods: The unit is assumed to operate continuously unless there is a permit condition or physical limitation that prevents it from operating certain hours of the day or days of the year. If data is available for the most recent two years (Continuous Emissions Monitoring (CEM) data, for example) then a temporally representative level when operating may be used. For example, a generator that provides more power during peak hours could be modeled such that the maximum emission rate would be emitted during the peak hours of the day and the minimum operating emission rate would be emitted during the lowest-demand hours and the hours the unit would normally be off.[8]

4.8.2 Source Groups

It often saves considerable analysis time to set the model up to run with multiple source groups. The following groups are recommended.

- **Source alone group** – contains the sources at the facility that are used to compare with significance levels for the pollutant and averaging period being modeled. This group determines if the facility is above significance levels at the location and time.
- **Cumulative sources group** – contains all allowable emissions of the source and surrounding sources. This group is used to determine compliance with NAAQS and NMAAQS.
- **PSD sources group** – contains all sources that consume or expand PSD increment. This group is used to determine compliance with PSD increment regulations.

Impacts from different groups can be compared to determine if a source contributes significant concentrations if there is a problem complying with air quality standards.

4.8.3 Co-location with a GCP for aggregate processing facilities, asphalt plants, or concrete batch plants

At this time, General Construction Permits (GCPs) for aggregate processing facilities, asphalt plants, and concrete batch plants currently have the requirement that no visible emissions shall cross the fence line, which has been demonstrated to show compliance with all particulate matter air quality standards and PSD increments. NMED has allowed co-located facilities operating under a GCP to rely upon the GCP modeling demonstration for when co-located facilities operate at the same time, since all facilities at the location are required to have the same, no visible emissions, requirement at the fence line. However, if a source operating under a regular construction permit, and not a GCP, co-locates with a GCP source, it must show compliance with all particulate matter air quality standards through air dispersion modeling. The modeling for the source operating under a regular construction permit shall include all sources other than the co-located GCP sources. Gaseous pollutant modeling shall include the co-located GCP(s).

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[8] **Federal Register,** Vol. 82, No. 10, pg. **5220** / Tuesday, January 17, 2017 / Rules and Regulations

5.0 EMISSIONS SOURCE INPUTS

This section describes appropriate modeling for many types of sources. Additional guidance can be found in the User's Guide for the AMS/EPA Regulatory Model - AERMOD (EPA, 2004, http://www.epa.gov/scram001/dispersion_prefrec.htm).

5.1 Emission Sources

There are two general types of sources:

Sources that come from a stack or vent – stack sources, or point sources;
And sources that don't – fugitive sources.

5.2 Stack Emissions/Point Sources

All stacks should be modeled as point sources, as detailed below.

5.2.1 Vertical Stacks

Stacks that vent emissions vertically should be modeled as point sources with stack parameters that will simulate the manner in which emissions are released to the atmosphere:

Stack exit velocity, V_s = average upward velocity of emissions at the top of the stack;
Stack diameter, d_s = stack exit diameter;
Stack exit temperature, T_s = average temperature of emissions at the top of the stack;
Stack height, H_s = stack release height.

5.2.2 Stacks with Rain Caps and Horizontal Stacks

Stacks that vent emissions horizontally and/or have rain caps should be modeled as point sources with stack parameters that will simulate the manner in which emissions are released to the atmosphere:

Stack exit velocity, V_s = 0.001 m/s;
Stack diameter, d_s = 1m;
Stack exit temperature, T_s = 0 K, or optionally actual temperature for stacks with high temperature;
Stack height, H_s = release height.

AERMOD will set the temperature to ambient temperature if the stack exit temperature is set to 0 K. If the model being used does not do this, then set the temperature to ambient temperature or to a close approximation thereof.

If modeling only horizontal stacks that are not capped, turn stack tip downwash off, whether there are buildings or not. Stack tip downwash calculations are inappropriate for horizontal stacks. If only some stacks have rain caps or are horizontal and others release upward without caps, use stack tip downwash.

Optionally, for modeling only vertical stacks that are capped, turn stack tip downwash off and reduce the stack height by three times the actual stack diameter. The cap will probably force stack tip downwash most of the time. The maximum amount of the stack tip downwash (as calculated in ISC2) is three times the stack diameter. Reducing the stack height by this amount, while turning off the stack tip downwash option, causes the maximum stack tip downwash effect. (Joseph A. Tikvart, 1993)

AERMOD beta options using the POINTCAP and POINTHOR may also be used.

5.2.3 Flares

Both process and emergency flares should be modeled for comparisons with NAAQS and NMAAQS. If parts of the facility will be shut down when the flare operates then those emission units may be omitted from the flare modeling.

Flares should be treated as point sources with the following parameters:

Stack velocity = 20 m/s = 65.617 ft/s
Stack temperature = 1000°C = 1832°F
Stack height = height of the flare in meters
Effective stack diameter in meters= $D = \sqrt{10^{-6} q_n}$
where $q_n = q(1 - 0.048\sqrt{MW})$
and q is the gross heat release in cal/sec
MW is the weighted by volume average molecular weight of the mixture being burned.
(SCREEN3 Model User's Guide, 1995)

Flares in the surrounding sources inventory from the Bureau should already have an effective diameter calculated; so the parameters in the inventory can be entered directly into your model input "as is". There are other methods for analyzing impacts of flares; if you wish to use another method, check with the Bureau modeling staff first.

NOTE: The NAAQS cannot be violated, even during upset conditions. All emergency flares should be modeled to show compliance with the NAAQS short-term standards under upset conditions. Emergency flares should be modeled with surrounding sources, but not including neighboring emergency flares and other sources that operate less than 500 hours per year.

5.3 Fugitive Sources

5.3.1 Aggregate Handling

Aggregate handling emissions consist of three separate activities, namely: loading material to and from piles, transportation of material between work areas, and wind erosion of storage piles.

Loading material to and from piles should be modeled as volume sources representative of the loading or unloading operation. Emissions for loading and unloading are calculated using AP-42 Section 13.2.4. The loading and unloading each involve dropping the material onto a receiving surface, whether being dropped by a dump truck, a front-end loader, or a conveyor. Each drop should be modeled as described in Fugitive Equipment Sources, below.

Transportation of material between work areas should be modeled according to haul road methodology if vehicles are used to transport the material, or using transfer point methodology if conveyors are used to transport the material, as described in Fugitive Equipment Sources, below.

Modeling of wind erosion of storage piles is optional, as it says in AP42 not to use the equations for wind erosion in a steady state model.

For the following example facility, aggregate is handled 6 times:

1- a pile in front of the mine face is created,
2- a pile in front of the mine face is loaded into trucks or conveyors,

3- a pile in front of the processing equipment (crusher or HMA) is created,
4- loading the equipment (crusher or HMA),
5- a pile after the equipment, and
6- loading the truck

1 and 2 would not apply if on-site mining does not occur.
5 may be considered a transfer point (conveyor) instead of aggregate handling if controls are applied.
5 and 6 may not apply for HMA plant, as material is bound in asphalt.
6 would not apply if the waste pile is left on site.

5.3.2 Fugitive Equipment Sources

Emissions coming from equipment such as crushers, screens, or material transfer points should be modeled as volume sources. Emission rates are normally calculated using AP42 factors.

The release height (H) is the distance from the center of the volume to the surface of the ground. The base of each volume source must be square. For elongated sources, use a series of volume sources with square bases. Determine the apparent size of a volume source by estimating how large the plume would look to an observer. Consider the movement of the plume source during the course of an hour when determining the apparent size. For example, if the source of emissions is from disturbances on a pile, and the entire pile is disturbed at some point in the hour, then use the size of the pile as the apparent size instead of the area of the pile that would be disturbed at any one instant. The reason for this is that the model operates in one-hour blocks of time, so using instantaneous sizes could inaccurately target nearby receptors with elevated emission concentrations.

For a single volume source, divide the apparent length by 4.3 to determine the initial lateral dimension (σ_{Yo}) to input into the model. For a line source represented by a series of volume sources, divide the distance between the centers of adjacent sources by 2.15 to determine σ_{Yo}.

For a source on the ground, divide the vertical dimension of the source by 2.15 to determine the initial vertical dimension (σ_{Zo}) to input into the model. For a source on or connected to a building, divide the height of the building by 2.15 to determine the σ_{Zo}. For an isolated elevated source, divide the vertical dimension of the source by 4.3 to determine the σ_{Zo}.

Example sources are described in the table below. Some sources will vary from the characteristics listed in the table.

Table 27: Example Dimensions of Fugitive Sources

Source Type	Height of Volume (m)	σ_{Zo} (m)	Release Height (m)	Width of Volume (m)	σ_{Yo} (m)
Crusher	5	2.33	6	5	1.16
Screen	5	2.33	4	5	1.16
Transfer point	2	0.93	2	2	0.47
Elevated transfer point	4	0.93	4	2	0.47
High Elevated transfer point	4	0.93	8	2	0.47
Concrete truck loading	5	2.33	4	5	1.16

5.3.3 Haul Roads

Traffic carrying materials mined or processed at the facility must be modeled as part of the facility. Haul roads to be modeled include the portion of roads that are not publicly accessible. The Bureau recommends haul road modeling to be consistent with Regional/State/Local Haul Road Workgroup Recommendations, as described below. Haul road emissions should be modeled as a series of adjacent volume sources, except that area sources should be used for modeling haul roads where receptors located within source dimensions are important. A procedure to develop model input parameters follows. The applicant can use other procedures on a case-by-case basis but must demonstrate that those procedures would be appropriate.

Road Source Characterization: Follow the instructions described below.

Plume height:

The height of the volume (H) or plume height will be equal to 1.7 times the height of the vehicle generating the emissions. Use the same for top of plume height for area sources.
The initial vertical sigma (σ_{Zo}) is determined by dividing the height of the plume by 2.15.
The release height is determined by dividing the height of the volume by two. This point is in the center of the volume.

Table 28: Example Haul Road Vertical Dimensions

Vehicle size	Truck Height	Height of Volume	σ_{Zo}	Release Height
Large trucks	4 m (13.1 ft)	6.8 m (22.3 ft)	3.16 m (10.4 ft)	3.4 m (11.1 ft)
Small trucks	2 m (6.6 ft)	3.4 m (11.2 ft)	1.58 m (5.2 ft)	1.7 m (5.6 ft)

RH = H/2 = Release Height above the ground (m). It's the center of the volume source. Also use this for the source height of the area source, if using the area source alternative.
σ_{Zo} = H/2.15 = initial vertical dimension of the volume (m)

Road width:

The adjusted width of the road (W) is the actual width of the road plus 6 meters. The additional width represents turbulence caused by the vehicle as it moves along the road. This width will represent a side of the base of the volume. Use W for the width of the area source, if using the area source alternative.

The initial horizontal sigma (σ_{Yo}) for each volume is determined as follows:

- If the road is represented by a single volume, divide W by 4.3.
- If the road is represented by adjacent volumes, divide W by 2.15.
- If the road is represented by alternating volumes, divide the distance between the center point of one volume to the center point of the next volume by 2.15. $\sigma_{Yo} =$ 2W/2.15 This representation is only recommended for very long roads.
- If using area sources, the aspect ratio (i.e., length/width) should be less than 100 to 1. Subdivide the sources if they are too long.
- If using area sources, model each road segment as a straight line. Do not create a road segment with a bend in the road – divide the road into different segments when bends occur.

Road length:

The sum of the length of all volume sources should be about equal to the actual road length, unless the road is very long and half the segments are skipped to save time. The volume sources should be evenly spaced along the road and should be of equal size for a given road. It is acceptable to artificially end the haul road up to 50 meters before the intersection with a public road. The reduced length of the road is due to the observation that vehicles normally slow down or stop before exiting the property. All emissions from haul roads must be modeled, however. Emissions from the reduced road length are added to other road segments.

The two lateral dimensions (length and width) of a volume source should be equal. The number of volume sources, N, is determined by dividing the length of the road (optionally minus 50 meters) by W. The result is the maximum number of volume sources that could be used to represent the road. If N is very large, modeling time can be reduced by using alternating volume sources to reduce the number of sources.

Table 29: Example Haul Road Horizontal Dimensions

Vehicle size	Width of Volume	Length of Volume	σ_{Yo}
Large trucks	13 m (42.65 ft)	13 m (42.65 ft)	W/2.15 = 6.05 m (19.85 ft)
Small trucks	10 m (32.8 ft)	10 m (32.8 ft)	W/2.15 = 4.65 m (15.26 ft)

Road location:

The UTM coordinates for the volume source are in the center of the base of the volume. This location must be at least one meter from the nearest receptor.

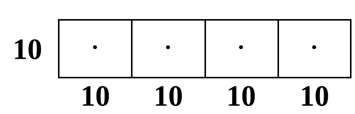
Emission Rate:

Divide the total emission rate equally among the individual volumes used to represent the road, unless there is a known spatial variation in emissions. Use the emissions calculated from the entire road length, even if you artificially end the road volume sources early before exiting the facility.

Example sources:

Use of the following modeling parameters should result in acceptable haul road modeling. Different facilities have different sized trucks, roads, and other variables. It is acceptable to use facility-specific parameters

Example One-Way Road Source



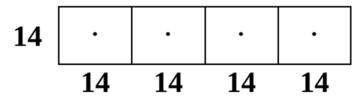
(looking from above)

Width = W = 10 m (32.8 ft)

σ_{Yo} = W/2.15 = 4.65 m (15.26 ft)

Figure 3: One-Way Road Source

Two-Way Road Source



(looking from above)
Width = W = 14 m (45.9 ft)
σ_{Yo} = W/2.15 = 6.51 m (21.4 ft)

Figure 4: Two-Way Road Source

Additional guidance can be found in Volume II of the User's Guide for ISC3 model (EPA, 1995).

5.3.4 Area Sources

Sources that have little plume rise may be modeled as area sources. Examples are: storage pile emissions, waste lagoon emissions, or gaseous emissions from landfills. Area source types include rectangle, circle, and irregularly shaped polygon. The model uses only the portion of the area source that is upwind of the receptor for calculating emissions for the hour, so it is safe to put receptors inside the area source without overly magnifying concentrations. The ISC input file uses emissions per area, but front-end programs for developing input files may calculate this for you based on total emissions from the source. For additional information, see the ISC User’s Guide (EPA, 1995d).

Extremely long or odd-shaped (like a giant “L”) area sources should be broken up into smaller area sources or modeled as a series of volume sources, because they may misrepresent emissions. Area sources, such as AREACIRC sources, may require many times as long to run the model as do volume or point sources in AERMOD.

5.3.5 Open Pits

The open pit source type should only be used to model open pits (not elevated trash dumpsters or anything else that somewhat resembles an open pit). The elevation of the pit entered into the model is the elevation of the top of the pit, which should be ground level.

The model calculates the effective depth of the pit by dividing the pit volume by the length and width of the pit. Release height above the base of the pit must be smaller than this value. Emissions from the bottom of the pit are expressed with a release height of zero.

Pit length should be less than 10 times the pit width. However, a pit cannot be sub-divided because the model needs to calculate mixing done throughout the pit. If the pit is irregular in shape, use the actual area of the top of the pit to calculate a rectangular shape with the same area.

Do not place receptors inside a pit.

The model input file requires pit emission rates to be expressed in mass per time per area [i.e., g/(s·m^2)]. Model input front-end programs may convert actual emission rate into area-based emission rates automatically, however.

5.3.6 Landfill Offgas

Decomposition of landfill material can result in the release of gasses such as H_2S. If these gases are not collected using a negative pressure system and flared, then the area of the landfill that is releasing gas can be modeled as an area or a circular area source. If gas is collected by a negative pressure collection system and flared, then model the flare the same way other flares are modeled. Place large area sources in areas that have little effect from the negative pressure collection system. In either case, elevation of the source should be equal to that of the surface, and release height should be zero because they are released from the ground and are not significantly affected by turbulence caused by vehicles traveling over the off-gasses.

6.0 MODELING PROTOCOLS

6.1 Submittal of Modeling Protocol

A modeling protocol should be submitted prior to the performance of a dispersion modeling analysis. For PSD applications, a modeling protocol is mandatory, and must be sent to NMED/AQB for review and comment. Consultation with Bureau modeling staff regarding appropriate model options, meteorological data, background concentrations, and neighboring sources is recommended for minor sources also, and can be accomplished in writing or by phone. The applicant should allow two weeks for the Bureau to review and respond to the written protocol. To avoid delays caused by misinterpretation or misunderstanding, we strongly recommend consultation with our staff on the following topics:

a.) Choice of models;
b.) Model input options;
c.) Terrain classification (flat or simple and complex);
d.) Receptor grids;
e.) Source inventory data;
f.) Minor source baseline dates for modeling increment consumption;
g.) Nearby Class I areas;
h.) Appropriate meteorological data;
i.) Background concentrations;
j.) Setback distance calculation if a proposed facility is a portable fugitive source;
k.) Any possible sources of disagreement;

Important: Modeling that substantially deviates from guidelines may be rejected if it is not accompanied by a written approved modeling protocol.

The input data to the models will be unique to the source. Data will usually consist of 1) emission rates and stack parameters for the proposed source at maximum load capacity and at reduced load capacity; 2) emission parameters of sources in the area; 3) model options; 4) suitable meteorological data; 5) definition of source operation which creates the greatest air quality impacts if other than maximum load conditions; and 6) terrain information, if applicable. Very important: **The emission parameters used in the modeling analysis of the proposed source are normally the same as those in the permit application. Any difference between the two should be clearly documented and explained.** Failure to adhere to this rule may result in an incomplete analysis.

6.2 Protocol ingredients

The shortest acceptable modeling protocol would be a statement that the modeling guidelines will be followed and a statement of what meteorological data will be used. Ask the modeling section or check the web page for the latest sample protocols.

6.3 How to submit the protocol

E-mail the modeling protocol to the modeling manager: Sufi.Mustafa@state.nm.us

7.0 DISPERSION MODELING PROCEDURE

Note: The basic steps for performing the modeling are presented in sequential format. Sometimes, it will make sense to perform some of the steps out of order. The sequential modeling steps are designed as an aid to modeling, not a mandatory requirement.

It is important to have an approved modeling protocol before proceeding. Modeling that substantially deviates from guidelines may be rejected if it is not accompanied by a written approved modeling protocol.

7.1 Step 1: Determining the Radius of Impact

A facility's significance area is defined as all locations outside of its fence line where the source produces concentrations that are above the significance levels listed in Table 6. The source is deemed culpable for concentrations that exceed air quality standards or PSD increments that occur at a receptor if the source's contribution is above the significance level at the same time that the exceedance of air quality standards or PSD increments occurs.

The Bureau uses the Radius of Impact (ROI) to make sure the entire significance area is analyzed. The ROI is defined as the greatest distance from the center of the facility to the most distant receptor where concentrations are greater than significance levels.

An illustration of determining an ROI from modeling output is shown in Figure 5, below. Note that the entire ROI is completely contained within the receptor grid, as required.

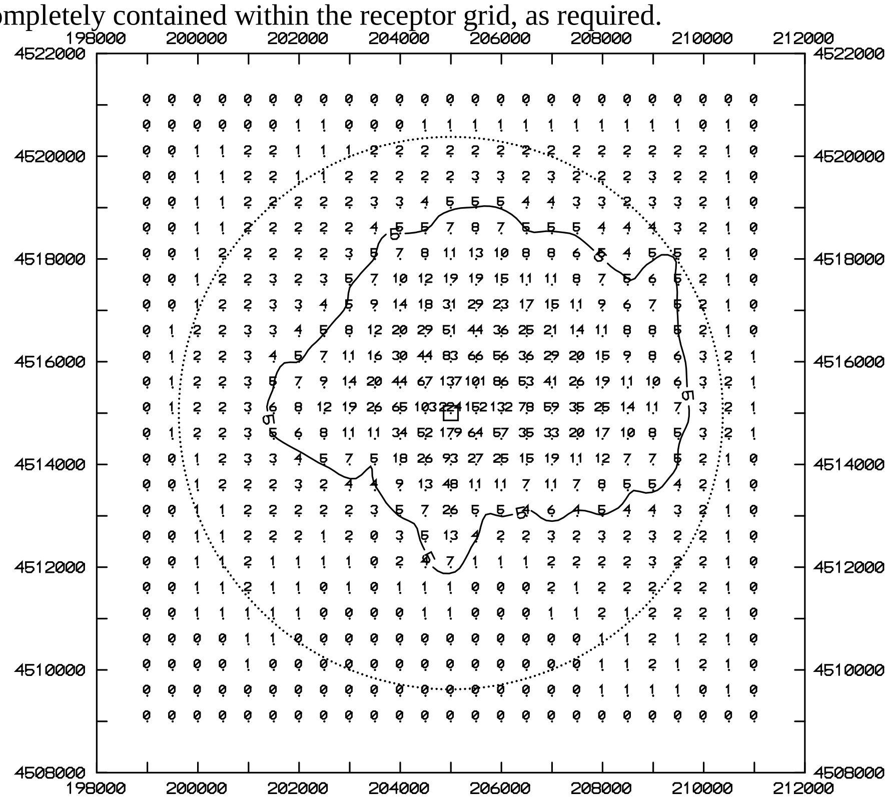


Figure 5. Plot of pollutant concentrations showing the 5 μg/m^3 significance level and the radius of impact (dashed line circle), determined from the greatest lineal extent of the significance level from the source.

7.1.1 Prepare the ROI analysis as follows:

I. Select the model that will be used for the analysis. It is usually quicker in the long run to use the same model for the radius of impact analysis as will be used for the refined analysis.
II. Model the entire source, as defined in section 2.4.1. Suggestion: Plot your sources to verify locations and identify typographical errors.
III. Set up the receptors as described above. Make sure the receptor grid extends far enough in every direction to capture the entire ROI, subject to the maximum radius of 50km.
IV. Optional step: Calculate the elevations of all sources, receptors, and buildings. This complex terrain analysis is optional for the ROI run, but it may save time to do it now.
V. Optional step: Add buildings and analyze them with BPIP or equivalent programs. This building downwash analysis is optional for the ROI run, but it may save time to do it now.
VI. Choose modeling options, as appropriate.
VII. Make sure that all sources and operating scenarios are modeled according to the guidelines in sections 4 and 5, above.
VIII. Run the model.

7.1.2 Analyze modeling results to determine ROI

I. Determine a radius of impact for each pollutant for each applicable averaging period. The largest ROI may be designated as the ROI for that pollutant, or each averaging period determined independently.
II. The ROI for NO_2 may be determined using Ambient Ratio Method 2 (ARM2).
III. Concentrations inside the facility's fence line can be ignored when determining the ROI.
IV. If no concentrations of a pollutant are above the significance levels for that pollutant, then the ROI for that pollutant is 0. Skip to Step 3 for that pollutant.
V. It is acceptable to scale impacts from one pollutant to determine impacts from another pollutant if several pollutants vent from the same stack and the ratios of emission rates and the averaging periods are the same.

Proceed to Step 2 for each pollutant with an ROI greater than zero.

7.2 Step 2: Refined Analysis

The entire area of significance must be included in the analyses for all averaging periods for each pollutant. If the ROI was determined using coarse grids, then add fine grid spacing to the potential areas of maximum concentration or concentrations above standards. If the ROI was determined using appropriate grid spacing, elevations, and building downwash (if applicable), then only the significant receptors need to be modeled for the refined analysis.

Once the ROI is determined for a specific source, neighboring sources need to be included and a cumulative impact analysis needs to be performed. As the ROI analysis is concerned with significance levels, the refined analysis is concerned with NAAQS, NMAAQS, and PSD Class I and Class II increments. The concentrations produced by the facility plus surrounding sources must be demonstrated to be below these levels in order to issue a permit under the regular permitting process.

7.2.1 Prepare the Refined Analysis as Follows:

I. If a screening model was used to determine ROI, the modeler may wish to use a refined model to reduce the area of significant impact. If so, return to *Step 1* and repeat the step with the new model.
II. Prepare a new modeling input file from the ROI file.

III. Fill the ROI with receptors with appropriate spacing (or discard receptors below significance levels if appropriate spacing was used for the ROI analysis).

IV. Add receptors near areas of high concentration if these areas are not contained within a fine grid. The modeling run must definitively demonstrate that the maximum impact has been identified. Concentrations should “fall off” from the center of the fine grid.

V. Add surrounding sources to the input file, if appropriate, as described in *Neighboring Sources/Emission Inventory Requirements*, above. Include $PM_{2.5}$ surrounding sources if particulate modeling is required. Suggestion: set up source groups so that impacts from the source alone, from the PSD increment consuming sources, and from all sources can be analyzed in a single run and compared with each other for determination of culpability.

VI. Building downwash analysis must be included in the refined analysis, if applicable.

VII. Terrain elevations must be included in the refined analysis, if applicable.

7.2.2 Analyze the Refined Modeling Results

I. Make sure the maximum impacts for each averaging period fall within a fine enough receptor grid to identify true maximums. Include fine grids near adjacent sources and in “hot spots”.

II. Compare the highest short-term and annual impacts from all sources with NAAQS and NMAAQS.

III. Determine if there is an exceedance of PSD Class II increment within the area defined by the radius of impact by the group containing all PSD increment consuming sources.

IV. Determine if there is an exceedance of PSD Class I increment within any Class I area.

V. If the facility alone will violate any NAAQS, NMAAQS, or PSD increment, then the permit cannot be issued through the normal process. Please contact the Bureau for further information.

VI. If there are exceedances of the NMAAQS or NAAQS at any receptors within the ROI, the next step is to determine if the facility being modeled significantly contributes (see significance levels in Table 6) to the exceedance at those receptors during the same time period(s) that the exceedance occurs. If so, the permit cannot be issued through the normal process. See nonattainment area requirements, below.

VII. If no exceedances are found, or if the facility does not contribute amounts above significance levels to the exceedances, then the facility can be permitted per the modeling analysis.

7.2.3 NMAAQS and NAAQS

All sources are required to submit NMAAQS and NAAQS modeling. The total concentrations of all facilities and background sources are required to be below the NAAQS. The steps required for this analysis are outlined above.

7.2.4 PSD Class II increment

PSD Increment modeling applies to both minor and major sources. If the minor source baseline date has been established in the Air Quality Control Region (AQCR) in which the facility will be located, then PSD increment consumption modeling must be performed. If the minor source baseline date has not been established in that region, then only PSD major sources must perform this analysis.

Portable sources that are not located at a single location continuously for more than one year are not required to model PSD increment consumption.

The steps required for this analysis are outlined above.
The same significance levels that apply to NAAQS and NMAAQS standards are assumed to apply to PSD Class II increment as well.

7.2.5 PSD Class I increment

If a PSD Class II increment analysis is required and the proposed construction of a minor source is within 50 km of a Class I area (see Figure 1), then PSD increment consumption at the Class I area(s) must be determined and compared with the Class I PSD increment. If the proposed construction of a PSD major source is within 100 km of a Class I area, then PSD increment consumption at the Class I area(s) must be determined and compared with the Class I PSD increment. The PSD permit process requires a more thorough Class I analysis, which is described in *Step 6*.

See *Receptor Placement*, above, for receptor instructions.

Proceed with the Class I area analysis similarly to the other analyses described above. Class I significance levels apply for determining whether or not a facility contributes significantly to an exceedance in a PSD Class I area and for determining the Class I ROI.

7.3 Step 3: Portable Source Fence Line Distance Requirements for Initial Location and Relocation

Skip this step if the facility is not a portable source.

Portable sources should model fence line distance requirements for relocation purposes and for setback distances within the initial property. If the facility wants to be able to move equipment around within the property, or move to a new location, permit conditions will be required to ensure the facility continues to demonstrate compliance with air quality standards as it moves. For this modeling, use meteorological data that the Bureau has approved for relocation modeling, which may be different from that used for the rest of the modeling for the facility. Model the facility with a haul road length at least as long as the setback distance and a number of truck trips equal in number to the count at the original location. Surrounding sources may be ignored, but include co-located facilities if the desire is to be able to co-locate with other facilities at the new locations. To determine setback distance, draw a line connecting the concentrations where they drop off to the point that are just under the ambient air standard or PSD increment. Make sure to add background concentration before determining the isopleths for ambient air standards. From each point on the isopleth line, determine the distance to the nearest source (excluding haul road sources). The setback distance is the largest of these distances. Setback distance is typically rounded up to the nearest meter that is above the calculated value. An example setback distance determination is pictured in Figure 6, below.

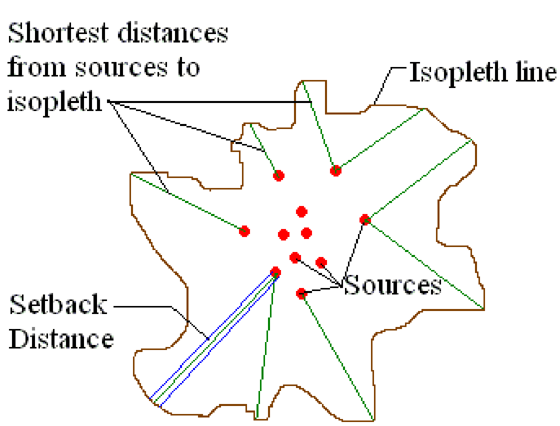


Figure 6: Setback Distance Calculation

Fine spacing is suggested within the property boundary for relocation requirement modeling.

If the applicant does not perform fence line distance modeling, relocation distance will be assumed to be the distance from the edge of a facility operations to the most distant point on the initial fence line. An irregular or elongated fence line shape can result in relocation requirements that require very large properties to be fenced off in order to relocate there without submitting modeling for each new location of the facility.

7.4 Step 4: Nonattainment Area Requirements

Skip this step if all modeled concentrations are below NAAQS, NMAAQS, and PSD Increments.

If the modeling analysis of a source predicts that the impact from any regulated air contaminant will exceed the significance level concentrations at any receptor which does not meet the NMAAQS or NAAQS, the source will be required to demonstrate a net air quality benefit and meet the requirements of 20.2.72.216 NMAC or 20.2.79 NMAC. The net air quality benefit is a reduction of at least 20% of the maximum modeled concentration from the facility or the emission sources being modified. The 20 percent reduction shall be calculated as the projected impact subtracted from the existing impact divided by the existing impact. The existing impact for the net air quality benefit must be based on the lowest enforceable emission rate, or the actual emission rate if a unit has no enforceable emission rate. The offsets used to meet the net air quality benefit must be quantifiable, enforceable, and permanent. For more information regarding nonattainment permit requirements, see **20.2.72.216 NMAC** and **20.2.79 NMAC** – Nonattainment Areas.

7.5 Step 5: Modeling for Toxic Air Pollutants

Skip this step if there are no toxics to model at this facility. See section 2, "New Mexico State Air Toxics Modeling", to determine if modeling of toxics is required and for other details about toxics regulatory requirements.

I. Model the toxic air pollutants similar to the way the other pollutants were modeled, as described above in steps 1 and 2. Use an 8-hour averaging period, complex terrain, and building downwash.
II. No surrounding source inventory exists for the toxics, so model only your source.
III. Make sure a fine grid is used in the area of maximum concentration.
IV. If more than one toxic pollutant is being modeled and they use the same stacks at the same ratio of emission rates, it is allowable to scale the results of the first pollutants by the emission rate ratio to determine the concentration of the other toxics.

If modeling shows that the maximum eight-hour average concentration of all toxics is less than one percent of the Occupational Exposure Level (OEL) for that toxic, then the analysis of that toxic pollutant is finished. Report details about the maximum concentrations in the modeling report. Otherwise, perform BACT analysis or health assessments, as required. Contact the Bureau on how to proceed if the $1/100^{th}$ of the OEL is exceeded.

7.6 Step 6: PSD Permit Application Modeling

Skip this step if the facility is not a PSD major source.

PSD sources and requirements are defined in NMAC 20.2.74.303 to 305. New PSD major sources and major modifications to PSD major sources must submit the following modeling requirements in addition to the NSR minor source modeling requirements. Minor modifications to PSD major sources

are only subject to NSR minor source modeling requirements listed above, as required under NMAC 20.2.72.

Due to a court ruling, the use of the $PM_{2.5}$ significant monitoring concentration for PSD major modifications or new PSD major sources is not allowed. This significant ambient concentration level may still be used for minor source and nonattainment permitting.

Sources subject to PSD requirements should consult with the Bureau to determine how to proceed in the application process. For PSD applications, a modeling protocol is required for review. Please refer to EPA's *New Source Review Workshop Manual.* The following items are required for PSD permit applications and supersede other modeling requirements in this document.

7.6.1 Meteorological Data

Applicants may need to collect one year of on-site meteorological and ambient data to satisfy PSD requirements. In some cases, it may be advantageous to begin collecting on-site meteorological and ambient data to ensure that it is available at a site that may become PSD in the future. A company considering a monitoring program is advised to consult with the Bureau as early as possible so that an acceptable data collection process, including instrument parameters, can be started. Generally, the following meteorological parameters will be measured: wind direction, wind speed, ambient air temperature, solar insolation, ΔT, and σ_θ. For further information on meteorological monitoring Refer to EPA's *Guideline on Air Quality Models* and *On-Site Meteorological Program Guidance for Regulatory Modeling Applications*. Refer to *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)* for ambient monitoring guidance. In addition, a monitoring protocol and QA plan **must** be submitted and approved prior to beginning collection of data for a PSD application if these data are to be used for the analysis.

In the absence of actual on-site data, the Bureau may approve the use of off-site data that the Bureau believes mimics on-site data for that location or the Bureau may approve the use of data produced by the model MM5.

7.6.2 Ambient Air Quality Analysis

The ambient air quality analysis is the same as described above, with the exception of the following points.

- The PSD project is defined as the future potential emission rate minus the past actual emission rate.
- If the maximum ambient impact is less than EPA's significant concentration levels (see Table 6), then a full analysis is not required.
- Nearby sources must be considered. Discarding sources is discussed in the section on "neighboring sources data".
- A total air quality analysis must also be performed for each appropriate Class I area if the facility produces concentrations greater than the Class I significance levels in Table 6. All sources near the Class I area must be considered. The inventories for the analysis near the facility and the inventory for the analysis near Class I areas may be quite different because they are centered on different locations.
- If subject to 20.2.74.403 NMAC (Sources impacting Federal Class I Areas), an analysis of Air Quality Related Values must be included in the PSD application. If the facility will have no impact on the AQRV, then that must be stated in the application (NSR Workshop Manual, Chapter D).
- There may be additional analyses required by the Federal Land Managers (FLM) for Air Quality Related Values (AQRVs). See **F**ederal **L**and **M**anagers' **A**ir Quality Related Values Work

Group (FLAG) for more information at: http://www2.nature.nps.gov/air/Permits/flag/index.cfm

7.6.3 Additional Impact Analysis (NMAC 20.2.74.304)

The owner or operator of the proposed major stationary source or major modification shall provide an analysis of the impact that would occur as a result of the source or modification and general commercial, residential, industrial, and other growth associated with the source or modification. This analysis is in addition to the Class I analysis, but may use some of the same techniques that were used in the Class I analysis. The analysis required for a National Environmental Policy Act (NEPA) review may work to satisfy some requirements of this section.

- Visibility Analysis: A Class II Visibility Analysis is required to determine impact the facility will have upon Class II areas. Analyze the change in visibility of a nearby peak or mountain for this analysis. In the absence of nearby mountains, analyze the visibility of clear sky from nearby state or local parks.
- Soils analysis: What changes will occur to soil pH, toxicity, susceptibility to erosion, or other soil characteristics as a result of the project and indirect growth related to the project?
- Vegetation analysis: What changes will occur to type, abundance, vulnerability to parasites, or other vegetation characteristics as a result of the project and indirect growth related to the project? The owner or operator need not provide an analysis of the impact on vegetation having no significant commercial or recreational value.
- Growth analysis: The owner or operator shall also provide an analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial, and other growth associated with the source or modification.

7.6.4 Increment Analysis

- If the facility produces ambient concentrations greater than the significance levels in Table 6, then the Class II PSD increment analysis for the facility must use the inventory of all increment consuming sources near the facility. Sources in other states should be obtained from the agency in the surrounding state.
- If there is a Class I area within 100 km of the facility (or any distance, if requested by the FLM), then receptors must be located at the Class I area.
- If the facility produces ambient concentrations greater than the Class I significance levels in Table 6 in a Class I area, then the increment analysis for the Class I areas should use the inventory of all increment consuming sources near the Class I area, including those sources in other states. Sources in other states should be obtained from the agency in the surrounding state.

7.6.5 Emission Inventories

- The most current inventory of sources must be used. It should contain all sources currently under review by the Bureau that would be located within the appropriate inventory area. The applicant should check with the modeling staff to ensure that the inventory is up to date.

7.6.6 BACT analysis

- The analysis must follow current EPA procedures and guidelines.

7.7 Step 7: Write Modeling Report

A narrative report describing the modeling performed for the facility is required to be submitted with the permit application using Universal Application form 4 (UA4). This report should be written to provide the public and the Bureau with sufficient information to determine that the proposed construction does not cause or contribute to exceedances of air quality standards. The report needs to contain enough information to allow a reviewer to determine that modeling was done in a manner consistent and defensible with respect to available modeling guidance. Do not include raw modeling output in the report, only summaries and descriptions of the output or input.

This outline may be used as a checklist to determine if the analysis is complete.

I. Applicant and consultant information
   a. Name of facility and company.
   b. Permit numbers currently registered for the facility.
   c. Contact name, phone number, and e-mail address for the Bureau to call in case of modeling questions.

II. Facility and operations description
   a. A narrative summary of the purpose of the proposed construction, modification, or revision.
   b. Brief physical description of the location.
   c. Duration of time that the facility will be located at this location.
   d. A map showing UTM coordinates and the location of the proposed facility, on-site buildings, emission points, and property boundaries. Include UTM zone and datum.

III. Modeling requirements description
   a. List of pollutants at this facility requiring NAAQS and/or NMAAQS modeling.
   b. AQCR facility is located in and resulting list of pollutants requiring PSD increment (Class I and II) modeling. Include distances to Class I areas in discussion.
   c. List of State Air Toxic pollutants requiring modeling.
   d. PSD, NSPS, and NESHAP applicability and any additional modeling requirements that result if those regulations are applicable to the facility.
   e. State whether or not the facility is in a federal Nonattainment area, and any special modeling requirements or exemptions due to this status.
   f. Any special modeling requirements, such as streamline permit requirements.

IV. Modeling inputs
   a. General modeling approach
      i. The models used and the justification for using each model.
      ii. Model options used and why they were considered appropriate to the application.
      iii. Ozone limiting model options discussion, if used for NO_2 impacts.
      iv. Background concentrations.
   b. Meteorological data
      i. A discussion of the meteorological data, including identification of the source of the data.
      ii. Discussion of how missing data were handled, how stability class was determined, and how the data were processed, if the Bureau did not provide the data.
   c. Receptor and terrain discussion
      i. Description of the spacing of the receptor grids.
      ii. List fence line coordinates and describe receptor spacing along fence.
      iii. PSD Class I area receptor description.
      iv. Flat and complex terrain discussion, including source of elevation data.
   d. Emission sources
      i. Description of sources at the facility, including:

1. A cross-reference from the model input source numbers/names to the sources listed in the permit application for the proposed facility.
2. Determination of sigma-Y and sigma-Z for fugitive sources.
3. Description and list of PSD increment consuming sources, baseline sources, and retired baseline sources.
4. Describe treatment of operating hours
5. Particle size characteristics, if plume depletion is used.
6. If the modeled stack parameters are different from the stack parameters in the application, an explanation must be provided as to what special cases are being analyzed and why.
7. Partial operating loads analysis description.
8. Flare calculations used to determine effective stack parameters.
9. In-stack NO_2/NO_X ratio determination, if using OLM or PVMRM.

ii. Surrounding sources:

1. The date of the surrounding source retrieval.
2. Details of any changes or corrections that were made to the surrounding sources.
3. Description of adjacent sources eliminated from the inventory.

e. Building downwash

i. Dimensions of buildings

V. Modeling files description

a. A list of all the file names in the accompanying CD and description of these files.
b. Description of the scenarios represented by each file.

VI. Modeling results

a. A discussion of the radius of impact determination.
b. A summary of the modeling results including the maximum concentrations, location where the maximum concentration occurs, and comparison to the ambient standards.
c. Source, cumulative, and increment impacts.
d. Class I increment impact.
e. A table showing concentrations and standards corrected for elevation.
f. If ambient standards are exceeded because of surrounding sources, please include a culpability analysis for the source and show that the contribution from your source is less than the significance levels for the specific pollutant.
g. Toxics modeling results, if needed.

VII. Summary/conclusions

a. A statement that modeling requirements have been satisfied and that the permit can be issued.

Ask the modeling section or check the web page for a sample modeling reports. The modeling report documents details the standard format for the modeling report.

7.8 Step 8: Submit Modeling Analysis

Submit the following materials to the Bureau:

A CD containing the following:

I. An electronic copy (in MS Word format) of the modeling report.
II. Input and output files for all model runs. Include BEEST, ISC-View, or BREEZE files, if available.
III. Building downwash input and output files.

IV. Fence line coordinates.
V. Meteorological data, if not Bureau-supplied.
VI. A list of the surrounding sources at the time the facility was modeled.
VII. An electronic copy of the approved modeling protocol.

Do not include paper copies of modeling input and output files.

8.0 List of Abbreviations

Table 30: List of Abbreviations

ACRONYM	DESCRIPTION
AQB	Air Quality Bureau
AQCR	Air Quality Control Region
AQCR	Air Quality Control Regulation (CURRENTLY NOT USED)
AQRV	Air Quality Related Values
ARM2	Ambient Ratio Method 2
BACT	Best Available Control Technology
CO	Carbon monoxide
DEM	Digitized Elevation Model
EPA	Environmental Protection Agency
FLAG	**F**ederal **L**and **M**anagers' **A**ir Quality Related Values Work **G**roup
FEM	Federal Equivalent Method
FRM	Federal Reference Method
GEP	Good Engineering Practice
H_2S	Hydrogen sulfide
ISCST3	Industrial Source Complex Short Term Model version 3
NAAQS	National Ambient Air Quality Standards
NED	National Elevation Dataset
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
NMAAQS	New Mexico Ambient Air Quality Standards
NMAC	New Mexico Administrative Code
O_3	Ozone
OEL	Occupational Exposure Level
OLM	Ozone limiting method
Pb	Lead
PDF	Probability density function
$PM_{2.5}$	Particulate matter equal to or under 2.5 μm in aerodynamic diameter
PM_{10}	Particulate matter equal to or under 10 μm in aerodynamic diameter
PPM	Parts per million (volume ratio)
PSD	Prevention of Significant Deterioration
PVMRM	Plume Volume Molar Ratio Method
ROI	Radius of Impact
SO_2	Sulfur dioxide
TSP	Total suspended particulates
UTM	Universal Trans Mercator
VOC	Volatile organic compounds

9.0 References

Ensor, D.S. and M.J., Pilat (1971). Calculation of smoke plume opacity from particulate air pollutant properties. J.Air Poll.Cont.Assoc. 21(8): 496-501.

EPA (1995). User's Guide for the Industrial Source Complex (ISC3) Dispersion Model, Volume I - User Instructions. EPA-454/B-95-003a. September 1995.

Joseph A. Tikvart (1993). "MEMORANDUM: Proposal for Calculating Plume Rise for Stacks with Horizontal Releases or Rain Caps for Cookson Pigment, Newark, New Jersey", Joseph A. Tikvart (Model Clearinghouse), July 9, 1993.

SCREEN3 Model User's Guide (1995). SCREEN3 Model User's Guide, EPA-454/B-95-004, September, 1995. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Emissions, Monitoring, and Analysis Division, Research Triangle Park, NC.

NSR Workshop Manual, Chapter D – Air Quality Related Values

Federal **L**and **M**anagers' **A**ir Quality Related Values Work **G**roup (FLAG) Phase I Report: http://www2.nature.nps.gov/air/Permits/flag/index.cfm–
New Mexico Administrative Code (NMAC)

EPA, 1995d*: User's Guide for the Industrial Source Complex (ISC3) Dispersion Models*, EPA-454/B-95-003a, September, 1995. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Emissions, Monitoring, and Analysis Division, Research Triangle Park, NC.

Texas 1999: ***Air Quality Modeling Guidelines***, TNRCC-New Source Review Permits Division, RG-25 (Revised), February 1999

"The Plume Volume Molar Ratio Method [(PVMRM)] for Determining NO_2/NOx Ratios in Modeling", by Pat Hanrahan of the Oregon DEQ. The paper appeared in the November 1999 issue of the AWMA journal.

Links:

Environmental Protection Agency, 40 CFR Part 51, Revision to the Guideline on Air Quality Models Appendix W: http://www.epa.gov/ttn/scram/guidance/guide/appw_05.pdf

NSR Workshop Manual 1990 Draft: http://www.epa.gov/ttn/nsr/gen/wkshpman.pdf

Modeling Procedures for Demonstrating Compliance with PM2.5 NAAQS memo from Stephen Page, March 23, 2010:
http://www.epa.gov/ttn/scram/Official%20Signed%20Modeling%20Proc%20for%20Demo%20Compli%20w%20PM2.5.pdf

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Appendix A: Recent changes to the NM Modeling Guidelines

Note of changes made in 2019:

February 7, 2019: An error in summary Table 6C was corrected to make it match the full text in section 2.6.4.4.

Note of changes since 2016 version:

Source definition was changed to better match EPA definitions.

Original:

> Modeling significance levels are thresholds below which the source is not considered to contribute to any predicted exceedance of air quality standards or PSD increments. The definition of ‘source’ can apply to the whole facility or to the modifications at the facility. In cases where a particular averaging period has not been modeled for a pollutant, or was modeled, but predicted concentrations were above 95% of air quality standards or PSD increments, then NMED considers the entire facility to be the ‘source’ for those pollutants and periods. For other cases, ‘source’ includes only the modification described in the current application plus all contemporaneous emissions increases in the past 5 years since the entire facility was last modeled.

New:

> Modeling significance levels are thresholds below which the source is not considered to contribute to any predicted exceedance of air quality standards or PSD increments. The definition of ‘source’ can apply to the whole facility or to the modifications at the facility. For a new facility or an unpermitted facility, NMED considers the entire facility to be the ‘source’. For other cases, ‘source’ includes only the new equipment or new emissions increases described in the current application. Equipment that replaces other equipment is part of the new equipment.

Meteorological data recommendations have changed to reflect recent data. AQB has processed new meteorological data and has retired some old data that may be out of date. The processed data is available on the meteorological data webpage (https://www.env.nm.gov/air-quality/meteorological-data/). At the time of this writing, Substation has replaced Bloomfield data for permitting sources to be located in unknown locations (portable source relocation modeling). This change was based on a comparison of modeling results for existing sets of meteorological data.

NO_2 conversion using Ambient Ratio Method (ARM) has been replaced with Ambient Ratio Method 2 (ARM2). EPA no longer mentions the use of ARM in Appendix W. Instead, that appendix described details about what ratios can be used for the ARM2 method, which is now built into AERMOD as a default option.

Title V sources that have not demonstrated compliance with NAAQS or PSD increments are required to model for these standards and increments or produce a compliance plan to come into compliance.

SO_2 background concentrations were added for the annual averaging period.

PM2.5 Class I significance levels were updated.

TSP standards were repealed November 30, 2018.

Background concentrations were updated to 2015-2017.

Areas Where Streamlined Permits Are Restricted were updated.

Secondary formation of ozone and PM2.5 were updated to reflect current Appendix W and MERP guidance.

Note of changes that were made in 2016:

1-hour NO_2 and SO_2 modeling is now required for all sizes of facilities with NO_2 or SO_2 emissions.

ARM2 method of NO_2 modeling has been added to the approved options.

AERMOD output is considered to be expressed at Standard Temperature and Pressure (STP), eliminating most of the need for concentration conversion.

Emission rates for the very small emission rate modeling waivers have changed.

The modeling report form, Universal Application 4 (UA4), is available.

Background concentrations have been updated to 2013-2015 monitoring results.

(Hobbs PM2.5 background concentration was corrected from the July 8, 2016 version).
(September 1, 2016: PM2.5 annual standard was corrected in Table 5F)

Errors in summary Tables 6A and 6C that did not match the instructions in the pollutant-specific standards sections were corrected.

EXHIBIT 3

Rebuttal Testimony of Lori Marquez and Jeff Bennett

New Mexico EIB No. 20-21(A)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

AUG 0 4 2017

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Use of Photochemical Grid Models for Single-Source Ozone and secondary $PM_{2.5}$ impacts for Permit Program Related Assessments and for NAAQS Attainment Demonstrations for Ozone, $PM_{2.5}$ and Regional Haze

FROM: Tyler Fox, Group Leader
Air Quality Modeling Group, C439-01

TO: EPA Regional Modeling Contacts

The EPA recently revised the *Guideline on Air Quality Modeling*, also referred to as Appendix W or the *Guideline*, to recommend a two tiered screening approach for permit related program demonstrations rather than establishing a single preferred model (U.S. Environmental Protection Agency, 2017). As detailed in Section 5 of the *Guideline*, both of these tiers involves the use of chemical transport models (*e.g.*, photochemical grid models). The recommended approach for Tier 1 demonstrations would utilize such models to provide sensitivity estimates (either through existing modeling work or new projects) of responsiveness to precursor emissions in developing screening tools or methods (U.S. Environmental Protection Agency, 2016a). The recommended approach for Tier 2 demonstrations would directly utilize such models to estimate the impacts of the new or modifying sources (U.S. Environmental Protection Agency, 2016b). As stated in the preamble to the 2017 revisions (U.S. Environmental Protection Agency, 2017),the EPA believes that use of photochemical models for such purposes is scientifically appropriate and practical to implement. The purpose of this memorandum is to provide an alternative model demonstration for specific photochemical transports models establishing their fit for purpose in PSD compliance demonstrations for ozone and $PM_{2.5}$ and in NAAQS attainment demonstrations for ozone, $PM_{2.5}$ and Regional Haze.[1] This document provides for their general applicability; however, it does not replace the need for such demonstrations to provide model protocols describing model application choices or the evaluation of model inputs and baseline predictions

[1] These specific photochemical models are the Comprehensive Air Quality Model with Extensions (CAMx) and the Community Multiscale Air Quality (CMAQ).

against measurements relevant for their specific use by permit applicants and state, local, tribal air agencies.

Photochemical grid models have been used extensively for decades to support both scientific and regulatory air quality assessments for primary and secondarily formed pollutants. These models have been traditionally applied to support urban to continental scale multi-source assessments but have increasingly been used to understand air quality impacts from specific sectors and sources. The United States Environmental Protection Agency (US EPA) has used photochemical grid models to support interstate transport rules including Clean Air Interstate Rule (U.S. Environmental Protection Agency, 2005b), Cross-State Air Pollution Rule (U.S. Environmental Protection Agency, 2011a); criteria pollutant impacts of the Mercury and Air Toxics Standard (U.S. Environmental Protection Agency, 2011c); reviews of National Ambient Air Quality Standard (U.S. Environmental Protection Agency, 2014c); and federal rulemakings related to the mobile sources (U.S. Environmental Protection Agency, 2011b, 2014a). US EPA has used photochemical grid models to provide generalized relationships about precursor emissions from specific emissions sectors (*e.g.* pulp & paper, residential wood combustion, coke ovens, electric arc furnaces, etc.) to model estimated ozone and $PM_{2.5}$ and subsequent health benefit analysis (Fann et al., 2012). State and local agencies have used photochemical grid models to support NAAQS attainment demonstrations for non-attainment areas, Regional Haze rule reasonable progress demonstrations, county-specific contribution analysis to support nonattainment area proposals (U.S. Environmental Protection Agency, 2012), source impacts for exceptional events demonstrations (Kansas Department of Health and Environment, 2012), and single-source related demonstrations (ENVIRON, 2005).

The *Guideline on Air Quality Modeling* outlines multiple criteria that need to be satisfied to provide a satisfactory alternative model demonstration that the modeling system is fit for the purpose of supporting permit related program technical demonstrations or NAAQS attainment demonstration plans (U.S. Environmental Protection Agency, 2005a, 2015). For situations where there is no EPA preferred model, Section 3.2.2(e) includes specific elements which are listed below.

1) The model or technique has received a scientific peer review;
2) The model or technique can be demonstrated to be applicable to the problem on a theoretical basis;
3) The databases which are necessary to perform the analysis are available and adequate;
4) Appropriate performance evaluations of the model or technique have shown that the model or technique is not inappropriately biased for regulatory application; and
5) A protocol on methods and procedures to be followed has been established.

The remainder of this memorandum provides information about the Comprehensive Air Quality Model with Extensions (CAMx) (ENVIRON, 2016) and the Community Multiscale Air Quality

(CMAQ) (Byun and Schere, 2006) model systems relevant for each of these elements. This document is not intended to provide a demonstration for the appropriateness of other chemical transport models to support single source permit program related assessments nor NAAQS attainment demonstrations.

Element 1: Peer Review

Publicly available and documented Eulerian photochemical grid models such as the Comprehensive Air Quality Model with Extensions (CAMx) (ENVIRON, 2016) and the Community Multiscale Air Quality (CMAQ) (Byun and Schere, 2006) model treat emissions, chemical transformation, transport, and deposition using time and space variant meteorology. These modeling systems include primarily emitted species and secondarily formed pollutants such as ozone, $PM_{2.5}$, and regional haze (Chen et al., 2014; Civerolo et al., 2010; Russell, 2008; Tesche et al., 2006).

Both modeling systems are open source and freely available on the internet, have full documentation, and have been peer-reviewed. Information about the location of the freely available code and documentation is provided in the table below.

Acronym	Name	Internet location for source code and documentation
CAMx	Comprehensive Air Quality Model with eXtensions	http://www.camx.com
CMAQ	Community Multiscale Air Quality Model	http://www.epa.gov/cmaq

The Comprehensive Air Quality Model with extensions (CAMx) has been extensively peer-reviewed for estimating O_3 and $PM_{2.5}$ (Boylan and Russell, 2006; Morris et al., 2006; Nopmongcol et al., 2012; Tesche et al., 2006). Further, the modeling system has been peer reviewed specifically toward estimating the impacts of single sources on secondary pollutants (Baker and Foley, 2011; Baker et al., 2014; Baker et al., 2015).

The Community Multiscale Air Quality (CMAQ) model has also been extensively peer-reviewed for estimating O_3 and $PM_{2.5}$ (Appel et al., 2012; Appel et al., 2017; Foley et al., 2010). The CMAQ modeling system has also been peer-reviewed for application of estimating single source impacts on secondary pollutants (Baker and Kelly, 2014; Baker and Woody, 2017; Bergin et al., 2008; Zhou et al., 2012).

Element 2: Theoretically Applicable

Chemical transport models treat atmospheric chemical and physical processes such as gas and particle chemistry, deposition, and transport. There are two types of chemical transport models which are differentiated based on a fixed frame of reference (Eulerian grid based) or a frame of reference that moves with parcels of air between the source and receptor point (Lagrangian) (McMurry et al., 2004). Photochemical grid models are three-dimensional grid-based models that treat chemical and physical processes in each grid cell and use Eulerian diffusion and transport processes to move chemical species to other grid cells (McMurry et al., 2004). Photochemical models have been used to support single source assessments for O_3 and secondary $PM_{2.5}$ and also to support NAAQS attainment demonstrations for O_3 and $PM_{2.5}$ and reasonable progress demonstrations for the Regional Haze Rule.

Single Source Permit Related Assessments

Photochemical models are appropriate for assessment of near-field and regional scale reactive pollutant impacts from specific sources (Baker and Foley, 2011; Baker and Kelly, 2014; Bergin et al., 2008; Zhou et al., 2012). Since $PM_{2.5}$ and O_3 impacts may be estimated for single sources as part of a permit review process, it is important that a modeling system be able to capture single source primary (*e.g.* precursors) and secondary impacts. Photochemical grid models including CAMx and CMAQ appropriately treat single source impacts on O_3 and secondarily formed $PM_{2.5}$ because these modeling systems include emissions from all source sectors and treat the subsequent chemical and physical fate of pollutants using gas, aerosol, and aqueous phase chemistry and wet and dry deposition processes. The approaches used to model these chemical and physical processes are based on state of the science (Seinfeld and Pandis, 2012). In addition to characterizing the physical and chemical evolution of plumes from specific sources, these models provide a realistic 3D chemical and physical environment for these plumes so that when these plumes interact with the surrounding environment secondary formation of pollutants such as O_3 and $PM_{2.5}$ can take place (Baker and Kelly, 2014; Baker and Woody, 2017; Kelly et al., 2015).

Near-source in-plume measurements are useful to develop confidence that a modeling system captures secondarily formed pollutants from specific sources. These types of assessments are typically only done occasionally when a modeling system has notably changed from previous testing or has never been evaluated for this purpose. Even though single source emissions are injected into a grid volume, photochemical transport models have been shown to capture single source impacts when compared with downwind in-plume measurements (Baker and Kelly, 2014; Baker and Woody, 2017; Zhou et al., 2012). Specific to single-source applications for PSD, near-source in-plume aircraft based measurement field studies provide an approach for evaluating model estimates of (near-source) downwind transport and chemical impacts from single stationary point sources (ENVIRON, 2012). Photochemical grid model source apportionment and source sensitivity simulation of a single source downwind impacts compare well against field study primary and secondary ambient measurements (*e.g.* O_3) made in Tennessee and Texas

(ENVIRON, 2012). This work indicates photochemical grid models and source apportionment and source sensitivity approaches provide meaningful estimates of single source impacts. Assessments comparing photochemical grid model estimates of single source impacts with ambient measurements do not show a systematic tendency toward over-estimation (Baker et al., 2014; Baker and Kelly, 2014; Baker and Woody, 2017; ENVIRON, 2012; Zhou et al., 2012).

Where set up appropriately for the purposes of assessing the contribution of multiple or single sources to primary and secondarily formed pollutants, photochemical grid models could be used with a variety of approaches to estimate these impacts. These approaches generally fall into the category of source sensitivity (how air quality changes due to changes in emissions) and source apportionment (how emissions contribute to air quality levels under modeled atmospheric conditions). The simplest source sensitivity approach (brute-force change to emissions) would be to simulate 2 sets of conditions, one with all emissions and one with the source of interest removed from the simulation (Cohan and Napelenok, 2011). The difference between these simulations provides an estimate of the air quality change related to the change in emissions from the project source. Another source sensitivity approach to identify the impacts of single sources on changes in model predicted air quality is the decoupled direct method (DDM), which tracks the sensitivity of an emissions source through all chemical and physical processes in the modeling system (Dunker et al., 2002). Sensitivity coefficients relating source emissions to air quality are estimated during the model simulation and output at the resolution of the host model.

Some photochemical models have been instrumented with source apportionment, which tracks emissions from specific sources through chemical transformation, transport, and deposition processes to estimate a contribution to predicted air quality at downwind receptors (Kwok et al., 2015; Kwok et al., 2013). Source apportionment has been used to differentiate the contribution from single sources on model predicted ozone and $PM_{2.5}$ (Baker and Foley, 2011; Baker and Kelly, 2014; Baker and Woody, 2017). DDM has also been used to estimate O_3 and $PM_{2.5}$ impacts from specific sources (Baker and Kelly, 2014; Bergin et al., 2008; Kelly et al., 2015) as well as the simpler brute-force sensitivity approach (Baker and Kelly, 2014; Baker and Woody, 2017; Bergin et al., 2008; Kelly et al., 2015; Zhou et al., 2012). Limited comparison of single source impacts between models (Baker et al., 2013) and approaches to identify single source impacts (Baker and Kelly, 2014; Baker et al., 2013; Baker and Woody, 2017) show generally similar downwind spatial gradients and impacts.

NAAQS Attainment Demonstration Assessments

Photochemical transport models have been used extensively to support State Implementation Plans (SIPs) and explore relationships between inputs and air quality impacts in the United States and beyond (Cai et al., 2011; Civerolo et al., 2010; Hogrefe et al., 2011). Both CMAQ and CAMx have been used extensively to estimate O_3 and both primary and secondarily formed $PM_{2.5}$ on local to continental scales (Appel et al., 2012; Appel et al., 2017; Byun and Schere, 2006; Cai et al., 2011; Foley et al., 2010; Morris et al., 2006; Pun et al., 2007; Russell, 2008; Simon et al., 2012; Tesche et al., 2006). Both modeling systems contain chemistry and physics designed for the purposes of estimating O_3 and $PM_{2.5}$ based on precursor emissions, transport, chemical evolution, and physical removal processes.

Some examples of the use of photochemical models to support SIPs include:

- The California Air Resources Board used CMAQ to support a $PM_{2.5}$ attainment demonstration for the San Joaquin Valley: http://www.valleyair.org/Air_Quality_Plans/docs/PM25-2015/2015-PM2.5-Plan_Bookmarked.pdf
- Alaska used CMAQ as part of a $PM_{2.5}$ Impracticability Demonstration for Fairbanks: http://dec.alaska.gov/air/anpms/comm/fbks_pm2-5_moderate_SIP.htm
- The South Coast Air District in southern California used the CMAQ model to support a $PM_{2.5}$ attainment demonstration and to project 8-hr O3 design values: http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2012-air-quality-management-plan/final-2012-aqmp-(february-2013)/appendix-v-final-2012.pdf
- LADCO used the CAMx model to support an O_3 attainment demonstration for Chicago: http://www.ladco.org/reports/ozone/post08/LADCO%20Ozone%20TSD%20FINAL%20(Feb%203%202017).pdf
- The state of Georgia applied CMAQ to support a technical demonstration of the Regional Haze Rule: https://epd.georgia.gov/air/sites/epd.georgia.gov.air/files/related_files/document/appendixd.pdf

Element 3: Databases for Application

EPA works to continually develop photochemical grid model platforms that generally support both CMAQ and CAMx systems. These platforms are regularly updated and tend to follow the cycle of updates to the National Emission Inventory and include gridded hourly meteorology inputs for a baseline meteorology year, gridded hourly emissions from all source types matching the meteorological year, and projected future year emissions to support potential rulemakings, and sets of initial and boundary conditions. These platforms are regularly distributed to multi-jurisdictional organizations and also to specific interested groups or organizations interested in using the EPA model platform as a starting point for scientific assessments and regulatory demonstrations. EPA also makes scripts and inputs for processing emissions publically available so that other groups can reprocess emissions for different grid projections, subsets of the modeling domain, or with updated spatial, temporal, or speciation allocations appropriate for their specific application. Further, the meteorological and photochemical model simulations done to support these periodic modeling platforms are compared with ambient data and broad model performance evaluations are available. An example platform evaluation is the technical support document for the 2011 EPA modeling platform used for the Cross State Air Pollution Rule update (U.S. Environmental Protection Agency, 2016d).

In addition to data being available from EPA, other organizations have made photochemical model inputs and outputs (i.e, model platform) freely available to interested users. For instance, model-ready inputs for both CAMx and CMAQ for the entire year of 2011 are available at http://views.cira.colostate.edu/tsdw/. Further, multi-jurisdictional organizations typically either have existing photochemical grid model inputs or can direct those interested to other groups/organizations in the same region that may have suitable data. A brief list of multi-jurisdictional organizations with experience in the application of photochemical grid models such as CMAQ and CAMx is provided in the table below with an internet location for more information about that organization including contacts. The appropriateness of any data for a specific regulatory demonstration necessitate the development of a modeling protocol and agreement by the regulating authority.

Organization	**Region of the country**	**Internet site**
CENSARA	Central U.S.	http://www.censara.org
LADCO	Upper Midwest	http://www.ladco.org
MARAMA	Mid-Atlantic	http://www.marama.org
NESCAUM	Northeast U.S.	http://www.nescaum.org
NW-AIRQUEST	Northwestern U.S.	http://lar.wsu.edu/airpact
SESARM	Southeast U.S.	http://www.metro4-sesarm.org/content/metro-4sesarm-partnership
WESTAR/WRAP	Western U.S.	https://www.wrapair2.org

Element 4: Model Evaluation

The results of a model performance evaluation should be considered prior to using modeling to support a regulatory assessment. The objective of a model performance evaluation is to demonstrate that the baseline model scenario specific to the application can simulate observed pollution concentrations during historical episodes of elevated pollution. Both CAMx and CMAQ models have been shown to display generally similar performance features with respect to matching historical periods of primary and secondarily formed pollutants. A recent literature review (Simon et al., 2012) summarized photochemical model performance for applications published in the peer-reviewed literature between 2006 and 2012. This review may serve as a useful resource for identifying typical model performance for state of the science modeling applications. The remainder of this section provides more information relevant for evaluating photochemical models used for single source permit related assessments and NAAQS attainment demonstrations. Information about meteorological model performance evaluation for both purposes is also provided.

Models used for single source permit related demonstrations need routine evaluation of model estimates compared to routine surface measurements to provide general confidence that the modeling system is appropriately replicating historical pollution episodes. This is a more systematic evaluation as compared to the fit for purpose evaluation done to show whether the modeling system can replication single source plumes compared to in-plume or near-source field measurements that are infrequently available. This second type of evaluation fulfills the need to determine whether inputs to the modeling system for a particular scenario are adequate for the specific conditions of the project impact assessment (Appendix W Section 3.2.2.e). This type of evaluation usually consists of comparing model predictions with observation data that coincides with the episode being modeled for a permit review assessment. It is important to emphasize that a broad evaluation of a model platform's skill in estimating meteorology or chemical measurements may not sufficiently illustrate the appropriateness of that platform for specific projects that will be focused on a narrow subset of the larger set of model inputs and outputs. Therefore, broad model platform evaluations should be supplemented with focused evaluation and discussion of the appropriateness of model inputs for specific project assessments focused on the specific locations and time periods of interest.

Model evaluation is used to assess how accurately the model predicts observed concentrations and can provide a benchmark for model performance and identify model limitations that require diagnostic evaluation for further model development and improvement. The evaluation should be done for $PM_{2.5}$ and ozone. Some additional considerations for a $PM_{2.5}$ evaluation are that $PM_{2.5}$ consists of many components and is typically measured with a 24-hour averaging time. The individual components of $PM_{2.5}$ should be evaluated individually. In fact, it is more important to evaluate the components of $PM_{2.5}$ than to evaluate total $PM_{2.5}$ itself. Apparent "good performance" for total $PM_{2.5}$ does not indicate whether modeled $PM_{2.5}$ is predicted for "the right reasons" (the proper mix of components). If performance of the major components is good, then performance for total $PM_{2.5}$ should also be good.

Model estimates should be compared to observation data to generate confidence that the modeling system is representative of the local and regional air quality. For ozone related projects, model estimates of hourly average ozone and daily maximum 8-hour ozone should be compared with observations in both time and space. For $PM_{2.5}$, model estimates of speciated 24-hour average $PM_{2.5}$ components (such as sulfate ion, nitrate ion, etc.) should be matched in time and space with observation data in the model domain. Modeled concentrations should not be averaged in space or averaged over multiple days/weeks/months before being compared to measurements as this averaging may mask errors that occur on shorter time-scales or at specific locations. Model performance metrics comparing observations and predictions are often used to summarize model performance. These metrics include mean bias, mean error, fractional bias, fractional error, and correlation coefficient (Simon et al., 2012). There are no specific levels of any model performance metric that indicate "acceptable" model performance. Model performance metrics should be compared with similar contemporary applications to assess how well the model performs (Simon et al., 2012). Evaluation of the photochemical transport models used to support NAAQS attainment demonstrations should conform to recommendations outlined in EPA guidance (U.S. Environmental Protection Agency, 2014b).

Meteorological Model Evaluation

One of the most important questions in an evaluation concerns whether the prognostic or diagnostic meteorological fields are adequate for their intended use in supporting the project model application demonstration. It is important to determine whether and to what extent confidence may be placed in a prognostic meteorological model's output fields (*e.g.*, wind, temperature, mixing ratio, diffusivity, clouds/precipitation, and radiation) that will be used as input to models. Currently there is no bright line for meteorological model performance and acceptability. A significant amount of information (*e.g.* model performance metrics) can be developed by following typical evaluation procedures that will enable quantitative comparison of the meteorological modeling to other contemporary applications and to judge its suitability for use in modeling studies. Evaluation of the requisite meteorological databases necessary for use of photochemical transport models should conform to recommendations outlined in EPA guidance (U.S. Environmental Protection Agency, 2014b).

Element 5: Model Protocol

Per section 9.2.1 of the *Guideline*, the development of a modeling protocol is critical to a successful modeling assessment and that "Every effort should be made by the appropriate reviewing authority (paragraph 3.0(b)) to meet with all parties involved in either a SIP submission or revision or a PSD permit application prior to the start of any work on such a project." A modeling protocol is intended to communicate the scope of the analysis and generally includes (1) the types of analysis performed, (2) the specific steps taken in each type of analysis, (3) the rationale for the choice of modeling system, (4) names of organizations participating in preparing and implementing the protocol, and (5) a complete list of model configuration options. This protocol should detail and formalize the procedures for conducting all phases of the modeling study, such as describing the background and objectives for the study, creating a schedule and organizational structure for the study, developing the input data, conducting model performance evaluations, interpreting modeling results, describing procedures for using the model to demonstrate whether regulatory levels are met, and producing documentation to be submitted for review and approval.

Protocols should include the following elements at a minimum.

1. Overview of Modeling/Analysis Project
    - Participating organizations
    - Schedule for completion of the project
    - Description of the conceptual model for the project source/receptor area
    - Identification of how modeling and other analyses will be archived and documented
    - Identification of specific deliverables to the review authority

2. Model and Modeling Inputs
    - Rationale for the selection of air quality, meteorological, and emissions models
    - Modeling domain specifications
    - Horizontal resolution, vertical resolution and vertical structure
    - Episode selection and rationale for episode selection
    - Description of meteorological model setup
    - Description of emissions inputs
    - Specification of initial and boundary conditions
    - Methods used to quality assure emissions, meteorological, and other model inputs

3. Model Performance Evaluation
    - Identification of relevant ambient data near the project source and key receptors; provide relevant performance near the project source and key receptor locations
    - List evaluation procedures
    - Identification of possible diagnostic testing that could be used to improve model performance

4. Model Outputs
    - Description of the process for extracting project source impacts including temporal aggregation and in the case of $PM_{2.5}$ chemical species aggregation

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EXHIBIT 4

Rebuttal Testimony of Lori Marquez and Jeff Bennett

New Mexico EIB No. 20-21(A)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

APR 3 0 2019

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program

FROM: Richard A. Wayland, Director Richard A. Wayland
Air Quality Assessment Division

TO: Regional Air Division Directors

The Environmental Protection Agency (EPA) is providing the attached *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program* in final form. This guidance reflects the EPA's recommendations for how air agencies conduct air quality modeling and related technical analyses to satisfy compliance demonstration requirements for ozone and secondary $PM_{2.5}$ under the Prevention of Significant Deterioration (PSD) permitting program.

This document is not binding and does not change or substitute for provisions of the Clean Air Act (CAA) or CAA regulations, nor is it a regulation or final agency action itself. As the term "guidance" indicates, it provides recommendations on compliance demonstration tools that may be used together with other relevant information in satisfying air quality modeling requirements for PSD permitting. Thus, it does not impose enforceable requirements on any party. In addition, the guidance may not apply to a particular situation based upon the circumstances. Permitting decisions by the EPA or an air agency regarding a PSD permit application are made based on the applicable statutory and regulatory provisions and the relevant permitting record.

A detailed framework is provided in this document that permit applicants may choose to use, subject to review by the appropriate permitting authority, to estimate single source impacts on secondary pollutants under the first tier (Tier 1) approach put forth in EPA's *Guideline on Air Quality Models* (Appendix W to 40 CFR part 51). For Tier 1 assessments, it is generally expected that applicants would use existing empirical relationships between precursors and secondary impacts based on modeling systems appropriate for this purpose as detailed in relevant EPA guidance. We are providing this guidance document for consideration and use by permitting authorities and permit applicants on a case-by-case basis under the PSD program in assessing the effects of precursors of $PM_{2.5}$ and ozone.

This document also presents the EPA's modeling of hypothetical single source impacts on ozone and secondary $PM_{2.5}$ to illustrate how this framework can be implemented by stakeholders. The modeling relationships and illustrative MERPs presented here, in some cases, may provide relevant technical information to assist or inform an applicant in providing a Tier 1 demonstration and also as a template for permit applicants and/or state or local agencies to develop information relevant to a specific area or source type.

If there are any questions regarding this guidance, please contact George Bridgers of EPA's Air Quality Modeling Group at (919) 541-5563 or *bridgers.george@epa.gov*.

cc: Peter Tsirigotis, OAQPS
Mike Koerber, OAQPS
Air Program Managers, EPA Regions 1 – 10
Scott Mathias, OAQPS, AQPD
Raj Rao, OAQPS, AQPD
Tyler Fox, AQAD
Brian Doster, OGC
Mark Kataoka, OGC

Attachment

Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program

EPA-454/R-19-003
April 2019

Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Air Quality Assessment Division
Air Quality Modeling Group
Research Triangle Park, NC

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EXECUTIVE SUMMARY

EPA finalized revisions to the *Guideline on Air Quality Models* (the "*Guideline,*" published as Appendix W to 40 CFR part 51) that recommend a two-tiered approach for addressing single-source impacts on ozone (O_3) and secondary particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) (U.S. Environmental Protection Agency, 2017a). The first tier (or Tier 1) involves use of appropriate and technically credible relationships between emissions and ambient impacts developed from existing modeling studies deemed sufficient for evaluating a project source's impacts. The second tier (or Tier 2) involves more sophisticated case-specific application of chemical transport modeling (e.g., with an Eulerian grid or Lagrangian model).

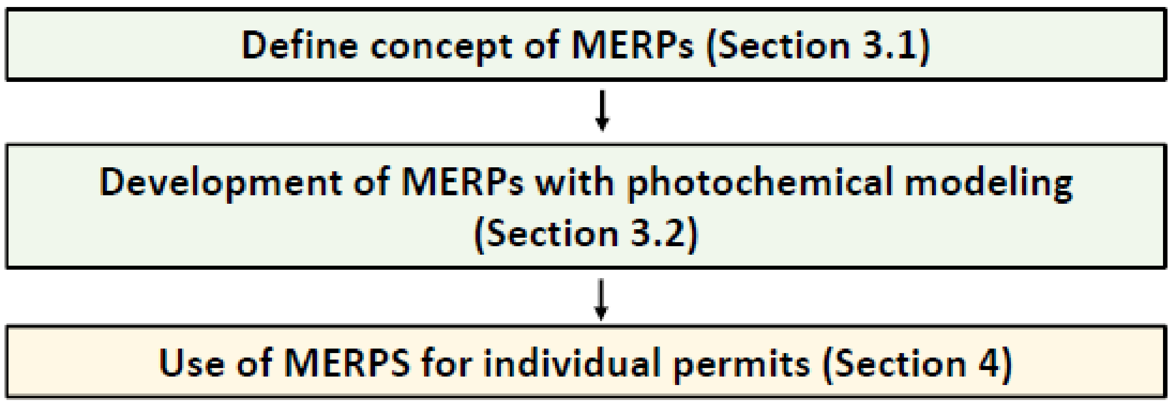
As EPA introduced in the preamble to the 2015 proposed revisions to the *Guideline*, Modeled Emission Rates for Precursors (MERPs) can be viewed as a type of Tier 1 demonstration tool under the Prevention of Significant Deterioration (PSD) permitting program that provides a simple way to relate maximum downwind impacts with a critical air quality threshold (e.g., a significant impact level or SIL) (U.S. Environmental Protection Agency, 2018). The purpose of this document is to provide a framework for permitting authorities and permit applicants on how air quality modeling can be used to develop relationships between precursors and maximum downwind impacts for the purposes of developing a technically credible Tier 1 demonstration tool.

A conceptual understanding of an area's emission sources and which precursor emissions limit the formation of secondary pollutants such as O_3 and $PM_{2.5}$ is useful for interpreting modeled and monitored impacts due to changes in emissions to that area. O_3 formation is a complicated, nonlinear process that depends on meteorological conditions in addition to volatile organic compounds (VOC) and nitrogen oxides (NO_x) concentrations (Seinfeld and Pandis, 2012). Warm temperatures, clear skies (abundant levels of solar radiation), and stagnant air masses (low wind speeds) increase O_3 formation potential (Seinfeld and Pandis, 2012). In the case of $PM_{2.5}$, or fine PM, total mass is often categorized into two groups: primary (i.e., emitted directly as $PM_{2.5}$ from sources) and secondary (i.e., $PM_{2.5}$ formed in the atmosphere by precursor emissions from sources). $PM_{2.5}$ organic carbon is directly emitted from primary sources and also formed secondarily in the atmosphere by reactions involving VOCs. $PM_{2.5}$ sulfate, nitrate, and ammonium are predominantly the result of chemical reactions of the oxidized products of sulfur dioxide (SO_2) and NO_X emissions and direct ammonia (NH_3) emissions (Seinfeld and Pandis, 2012).

A Tier 1 demonstration tool, as described in the *Guideline,* consists of technically credible air quality modeling that relates precursor emissions and secondary pollutant impacts from specific or hypothetical sources (U.S. Environmental Protection Agency, 2017a). Existing credible air quality modeling generally may include single source modeling based on an approved State Implementation Plan (SIP) demonstration, a more recent submitted but not yet approved SIP demonstration, or modeling not used to support a SIP demonstration but considered representative of the current air quality in the area and of sufficient quality that is comparable to a model platform supporting a SIP demonstration.

Figure ES-1 illustrates the framework for MERPs as a Tier 1 demonstration tool. This framework is the organizing flow of this guidance and sequences from the concept of a MERP, how MERPs can be developed from either existing EPA modeling or other credible sources, and then how that information can be credibly used for a source impact analysis and, if necessary, a cumulative impact analysis.

Figure ES-1. Framework for MERPs as a Tier 1 demonstration tool.



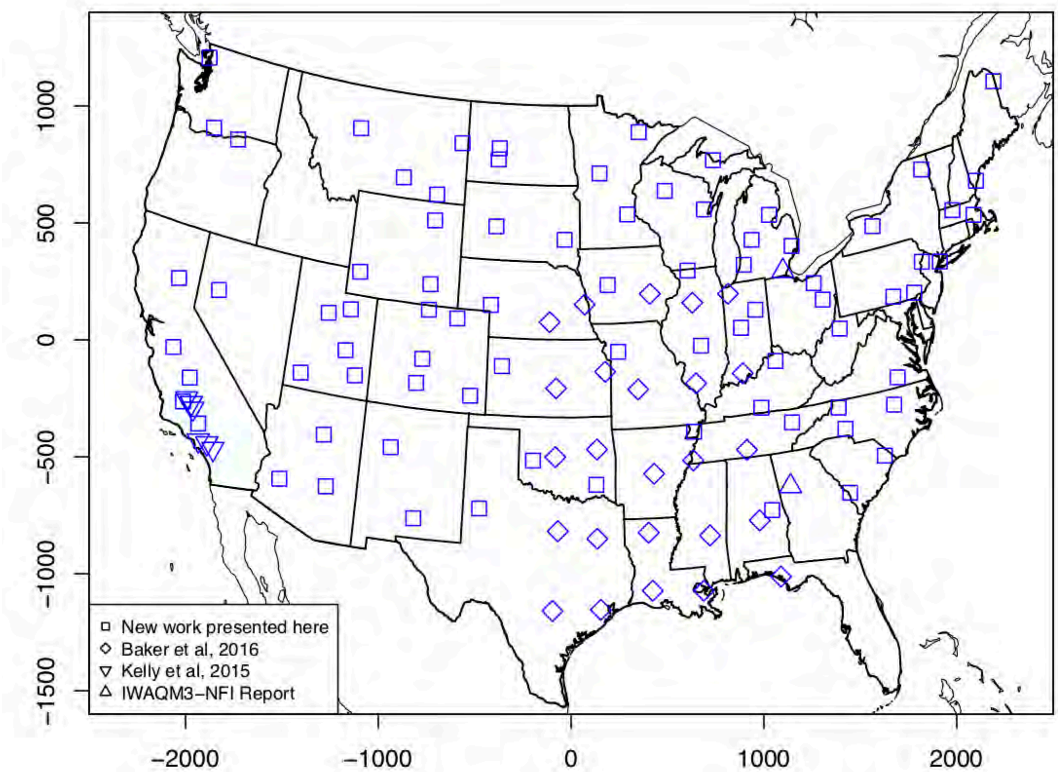
Properly supported MERPs provide a straightforward way to relate modeled downwind impacts with an air quality threshold that is used to determine if such an impact causes or contributes to a violation of the appropriate National Ambient Air Quality Standard (NAAQS). To derive a MERP value for the purposes of a PSD compliance demonstration, the model predicted relationship between precursor emissions from hypothetical sources and their modeled downwind impacts can be combined with the appropriate SIL value using the following equation:

Eq 1. $$\text{MERP} = \text{appropriate SIL value} \times \frac{\text{Modeled emission rate from hypothetical source}}{\text{Modeled air quality impact from hypothetical source}}$$

MERPs can be derived using any air quality threshold of concern (“critical air quality threshold”) and are not necessarily dependent on SILs. In practice, MERPs are intended to be used with SILs as analytical tools for PSD air quality analyses. For $PM_{2.5}$, the modeled air quality impact of an increase in precursor emissions from the hypothetical source is expressed in units of $\mu g/m^3$. For O_3, the modeled air quality impact is expressed in ppb.

As stated in the preamble to the 2017 final revisions to the *Guideline* (U.S. Environmental Protection Agency, 2017a), the EPA believes that use of photochemical models for the purpose of developing MERPs is scientifically appropriate and practical to implement. In this guidance document, EPA presents existing and new photochemical modeling of hypothetical single source impacts on downwind O_3 and secondary $PM_{2.5}$. This modeling was configured, applied, and post-processed consistent with EPA single source modeling guidance (U.S. Environmental Protection Agency, 2016a). The locations of hypothetical sources included here are shown in Figure ES-2. The single source impacts detailed in this section are collected from various past and more recent photochemical grid model-based assessments. More than 100 locations were modeled with hypothetical source emissions and are presented here.

Figure ES-2. Hypothetical sources modeled for downwind secondary air quality impacts included in this assessment.



The relationships shown here for these hypothetical sources are not intended to provide an exhaustive representation of all combinations of source type, chemical, and physical source environments but rather to provide insightful information about secondary pollutant impacts from hypothetical single sources in different parts of the U.S. Based on these annual photochemical model simulations, the maximum impacts for daily $PM_{2.5}$, annual $PM_{2.5}$ and daily maximum 8-hr average O_3 are provided for each modeled source described in Appendix Table A-1 in an Excel spreadsheet on EPA's Support Center for Regulatory Atmospheric Modeling (SCRAM) website. It is expected that the information in the Excel spreadsheet will be updated over time as newer modeling is done consistent with EPA's single source modeling guidance (U.S. Environmental Protection Agency, 2016a).

Based on these photochemical modeling data, EPA recommends that the permit applicant in consultation with the appropriate reviewing authority follow a three-step process:

1) Identify a representative hypothetical source (or group of sources for an area) from EPA's modeling results (as described in Section 3.2.1).

    - ✓ If a representative hypothetical source is not available, then consider whether any of these derived MERP values available for the geographic location of the project source may be appropriate to use. Alternatively, one can consider conducting photochemical modeling (as described in Section 3.2.2) to derive a source- or area-specific value.

2) Acquire the source characteristics and associated modeling results for the hypothetical source(s).

3) Apply the source characteristics and photochemical modeling results from Step 2 above with the appropriate SIL to the MERP equation for comparison with the project emission rate.

Section 4 provides details on the use of MERPs for PSD compliance demonstrations for: 1) source impact analysis, 2) $PM_{2.5}$ increment analysis, and 3) cumulative impact analysis. It also provides illustrative examples that show how existing EPA hypothetical source modeling can be used to support a Tier 1 demonstration.

For $PM_{2.5}$, based on EPA modeling presented here and recommended $PM_{2.5}$ SILs, the illustrative MERPs for NO_X as a precursor to daily $PM_{2.5}$ range from 1,073 tons per year (tpy) to over 100,000 tpy, while the illustrative MERPs for sulfur dioxide (SO_2) as a precursor to daily $PM_{2.5}$ range from 188 tpy to over 27,000 tpy. The illustrative MERPs for NO_X as a precursor to annual $PM_{2.5}$ range from 3,182 tpy to over 700,000 tpy, while the illustrative MERPs for SO_2 to annual $PM_{2.5}$ range from 859 tpy to over 100,000 tpy. For this assessment, the illustrative MERPs are generally lower for SO_2 than NO_X reflecting that SO_2 tends to form $PM_{2.5}$ more efficiently than NO_X.

For O_3, based on EPA modeling presented here and recommended O_3 SIL, the illustrative MERPs for NO_X as a precursor to daily maximum 8-hr O_3 range from 125 tpy to over 5,000 tpy, while the illustrative MERPs for VOC as a precursor to daily maximum 8-hr O_3 range from 1,049 tpy to over 140,000 tpy. For this assessment, illustrative MERPs for NO_X tend to be lower than VOC which suggests most areas included in this assessment are more often NO_X limited rather than VOC limited in terms of O_3 formation.

1. Background

EPA finalized revisions to the *Guideline on Air Quality Models* (the "*Guideline,*" published as Appendix W to 40 CFR part 51) that recommend a two-tiered approach for addressing single-source impacts on ozone (O_3) and secondary particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) (U.S. Environmental Protection Agency, 2017a). The first tier (or Tier 1) involves use of appropriate and technically credible relationships between emissions and ambient impacts developed from existing modeling studies deemed sufficient for evaluating a project source's impacts. The second tier (or Tier 2) involves more sophisticated case-specific application of chemical transport modeling (e.g., with an Eulerian grid or Lagrangian model). This guidance document is intended to provide a detailed framework that applicants may choose to apply, in consultation with the appropriate permitting authority, to estimate single-source impacts on secondary pollutants under the first-tier approach put forth in the *Guideline* (i.e., Sections 5.3.2.b and 5.4.2.b).

For Tier 1 assessments, EPA generally expects that applicants would use existing empirical relationships between precursors and secondary impacts based on modeling systems (e.g., chemical transport models) appropriate for this purpose. The use of existing credible technical information that appropriately characterizes the emissions to air quality relationships will need to be determined on a case-by-case basis. Existing credible air quality modeling would generally include single source modeling based on an approved State Implementation Plan (SIP) demonstration, a more recent submitted but not yet approved SIP demonstration, or modeling not used to support a SIP demonstration but considered representative of the current air quality in the area and of sufficient quality that is comparable to a model platform supporting a SIP demonstration. The applicant should describe how the existing modeling reflects the formation of O_3 or $PM_{2.5}$ in that geographic area. Information that could be used to describe the comparability of two different geographic areas include average and peak temperatures, humidity, terrain, rural or urban nature of the area, nearby local and regional sources of pollutants and their emissions (e.g., other industry, mobile, biogenic), and ambient concentrations of relevant pollutants where available.

As EPA introduced in the preamble to the 2015 proposed revisions to the *Guideline*, Modeled Emission Rates for Precursors (MERPs) can be viewed as a type of Tier 1 demonstration tool under the Prevention of Significant Deterioration (PSD) permitting program that provides a simple way to relate maximum downwind impacts with a critical air quality threshold (e.g., a significant impact level or SIL) (U.S. Environmental Protection Agency, 2018). EPA had initially planned to establish generally applicable MERPs through a future rulemaking. However, after further consideration, EPA believes it is preferable for permit applicants and permitting authorities to consider site-specific conditions when deriving MERPs and to allow for the development and application of locally and regionally appropriate values in the permitting process. Thus, instead of deriving generally-applicable MERP values, the EPA is providing this guidance document for consideration and use by permitting authorities and permit applicants on a permit specific basis.

This guidance is relevant for the PSD program and focuses on assessing the ambient impacts of precursors of $PM_{2.5}$ and O_3 for purposes of that program. The MERP framework may be used to describe an emission rate of an individual precursor that is expected to result in a change in the level of ambient O_3 or $PM_{2.5}$, as applicable, that would be less than a specific air quality threshold for O_3 or $PM_{2.5}$ that a permitting authority adopts and chooses to use in determining whether a projected impact causes or contributes to a violation of the NAAQS for O_3 or $PM_{2.5}$, such as the SILs recommended by EPA. In the context of the PSD program, precursors to O_3 include volatile organic compounds (VOC) and nitrogen oxides (NO_X) and precursors to $PM_{2.5}$ generally include sulfur dioxide (SO_2) and NO_X. MERPs relate emissions of a specific precursor of O_3 or $PM_{2.5}$ to ambient impacts of O_3 or $PM_{2.5}$ and do not provide a single demonstration for all NAAQS pollutants.

If approved by the permitting authority as a $PM_{2.5}$ Tier 1 demonstration tool for a PSD source in a $PM_{2.5}$ attainment or unclassifiable area, a finding that projected increases in the $PM_{2.5}$ precursor emissions of NO_X and/or SO_2 from a project are below the respective MERPs may be part of a sufficient demonstration that the project will not cause or contribute to violation of the applicable NAAQS (hereafter “demonstration of compliance” or “compliance demonstration”). Similarly, for the O_3 NAAQS, an appropriate Tier 1 demonstration may include a finding that the projected increases in O_3 precursor emissions of NO_X and/or VOC are below the respective MERPs.

For situations where project sources are required to assess multiple precursors of $PM_{2.5}$ or of O_3, EPA recommends that the impacts of multiple precursors should be estimated in a combined manner for comparison to the appropriate SIL such that the sum of precursor impacts would be lower than the SIL in a demonstration of compliance. Examples of combining precursor impacts are provided in Section 4 of this document. Further, where project sources are required to assess both primary $PM_{2.5}$ and precursors of secondary $PM_{2.5}$, EPA recommends that applicants combine the primary and secondary impacts to determine total $PM_{2.5}$ impacts as part of the PSD compliance demonstration. An example of combining primary and secondary impacts is provided in Section 4 of this document.

The purpose of this document is to provide a framework for using air quality modeling to develop relationships between precursors and maximum downwind impacts for the purposes of developing and using MERPs as a Tier 1 demonstration tool. We provide hypothetical single source impacts on O_3 and secondary $PM_{2.5}$ to illustrate how this framework can be implemented by permit applicants. The relationships presented here in some cases may provide relevant technical information to assist or inform an applicant in providing a first-tier demonstration for their specific permit situation and as a template for stakeholders and/or state or local agencies to develop information relevant to a specific area or source type. Based on the EPA modeling conducted to inform these illustrative MERPs provided here, such values will vary across the nation reflecting different sensitivities of an area’s air quality level to changes in levels of precursor emissions thereby providing an appropriate technical basis for evaluating the impacts of these precursors to $PM_{2.5}$ and O_3 formation because they reflect the regional or local atmospheric conditions for particular situations.

This document is not a final agency action and does not reflect a final determination by the EPA that any particular proposed source with emissions below an illustrative MERP value developed by EPA (or a MERP developed by another party using methods recommended by EPA) will not cause or contribute to a violation of an O_3 or $PM_{2.5}$ NAAQS or $PM_{2.5}$ PSD increments. A determination that a proposed source does not cause or contribute to a violation can only be made by a permitting authority on a permit-specific basis after consideration of the permit record. The illustrative MERP values identified by the EPA have no practical effect unless and until permitting authorities decide to use those values in particular permitting actions. This guidance document does not require the use, nor does it require acceptance of the use, of this framework or any result using this framework by a permit applicant or a permitting authority. Permit applicants and permitting authorities retain the discretion to use other methods to complete a first-tier assessment under Sections 5.3.2.b and 5.4.2.b of the Guideline and to require additional information from a permit applicant to make the required air quality impact demonstration. This guidance document does not create any binding requirements on EPA, permitting authorities, permit applicants, or the public.

Subsequent sections of this document include information about O_3 and secondary $PM_{2.5}$ formation in the atmosphere, a conceptual description of MERPs, information about developing MERPs using photochemical modeling, using MERPs for individual permit demonstrations, and several illustrative examples of using MERPs to support hypothetical permit applications.

2. O_3 and Secondary $PM_{2.5}$ Formation in the Atmosphere

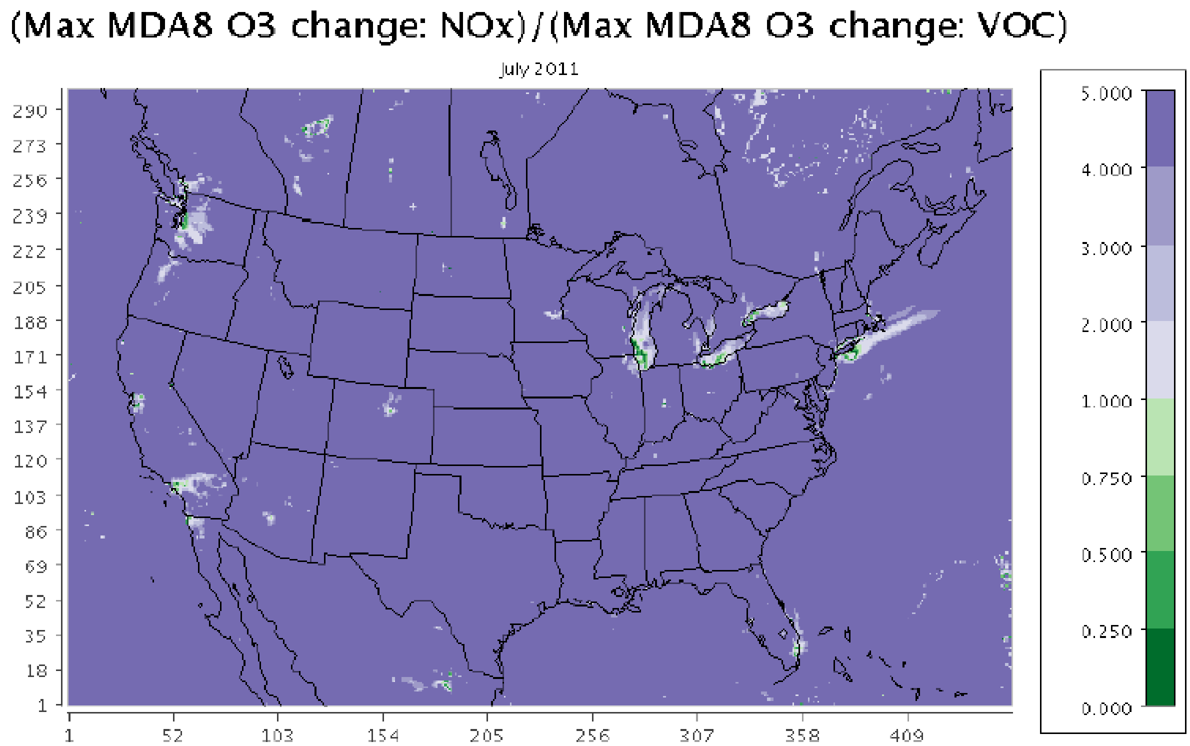
A conceptual understanding of an area's emissions sources and which precursor emissions limit the formation of secondary pollutants such as O_3 and $PM_{2.5}$ is useful for interpreting modeled and ambient impacts due to changes in emissions in that area. The formation regime favoring a particular precursor may vary seasonally, day to day, and by hour of the day. It is important to understand how the atmosphere will respond to changes in emissions to make informed decisions about how changes in emissions from a source might impact ambient pollutant levels. Typically, reductions in emissions of primary pollutants or precursors of secondary pollutants result in some level of reduction in ambient pollutant concentrations.

Secondary $PM_{2.5}$ and O_3 are closely related to each other in that they share common sources of emissions and are formed in the atmosphere from chemical reactions with similar precursors (U.S. Environmental Protection Agency, 2017a). Air pollutants formed through chemical reactions in the atmosphere are referred to as secondary pollutants. For example, ground-level O_3 is predominantly a secondary pollutant formed through photochemical reactions driven by emissions of NO_x and VOCs in the presence of sunlight. O_3 formation is a complicated nonlinear process that depends on meteorological conditions in addition to VOC and NO_x concentrations (Seinfeld and Pandis, 2012). Warm temperatures, clear skies (abundant levels of solar radiation), and stagnant air masses (low wind speeds) increase O_3 formation potential (Seinfeld and Pandis, 2012).

<u>O_3 Formation</u>

O_3 formation may be limited by either NO_X or VOC emissions depending on the meteorological conditions and the relative mix of these pollutants. When O_3 concentrations increase (decrease) because of increases (decreases) in NO_X emissions, the O_3 formation regime is termed "NO_X limited." Alternatively, the O_3 formation regime is termed "VOC limited" when ambient ozone concentrations are very sensitive to changes in ambient VOC. The VOC-limited regime is sometimes referred to as "radical-limited" or "oxidant-limited" because reactions involving VOCs produce peroxy radicals that can lead to O_3 formation by converting nitric oxide (NO) to nitrogen dioxide (NO_2) in the presence of sunlight. In a NO_X-limited regime, ozone decreases with decreasing NO_X and has very little response to changes in VOC. The NOx-limited formation regime is more common in rural areas of the U.S. where high levels of biogenic VOC exist and relatively few man-made, or anthropogenic, NOx emissions occur. O_3 decreases with decreasing VOC in a VOC-limited formation regime. The O_3 formation regime for some urban areas in the U.S. is locally VOC-limited during daytime hours due to large NO_X emissions from mobile and industrial sources and relatively smaller amount of biogenic and anthropogenic VOC emissions. Additional information on O_3 formation regimes based on modeling (U.S. Environmental Protection Agency, 2017b) and satellites (Chang et al., 2016; Duncan et al., 2010; Jin et al., 2017) are available elsewhere. An example is shown in Figure 2-1.

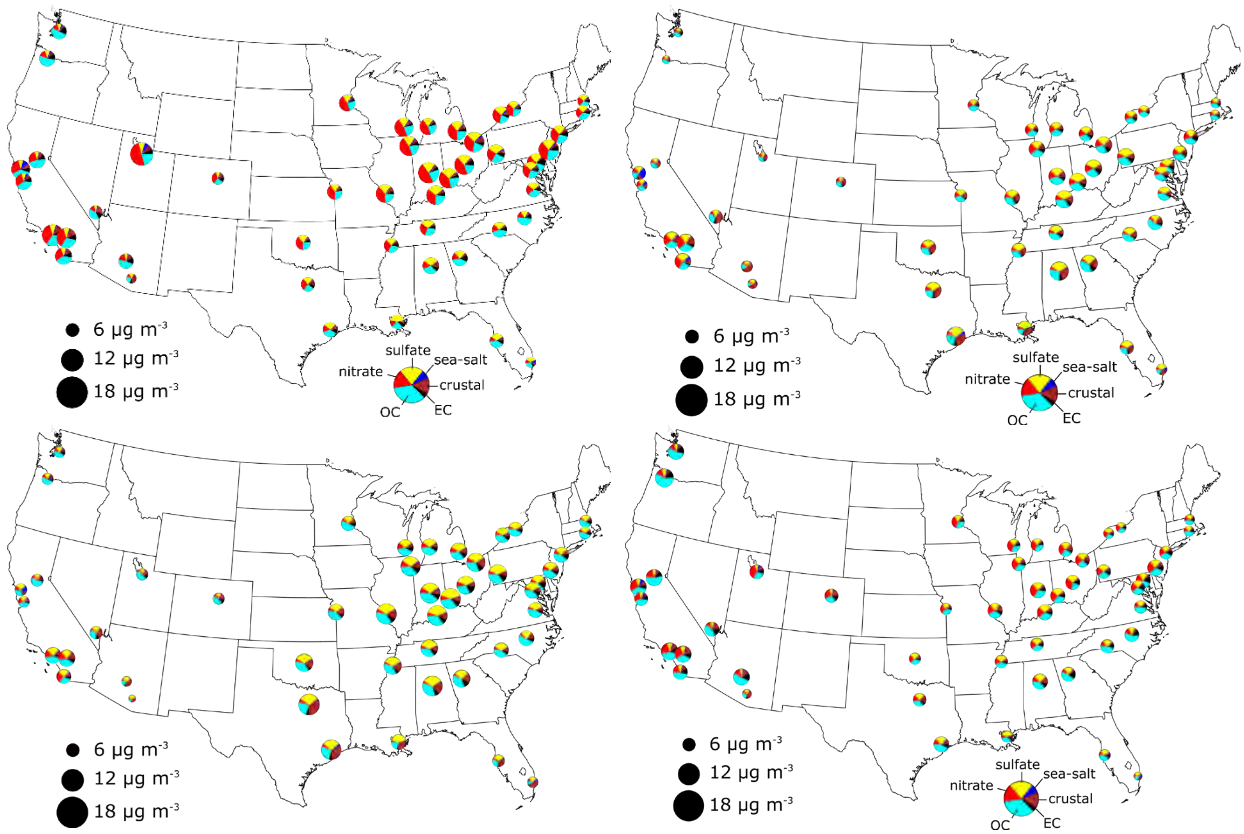
Figure 2-1. The ratio of the change in monthly peak daily maximum 8-hr (MDA8) O_3 from the 50% reduction in NO_X to the change in monthly peak MDA8 O_3 from a 50% reduction in VOC.
Note: Ratios greater than one (shown in purple) indicate that ozone was reduced more effectively by similar percentage reductions in NO_X emissions than reductions in VOC emissions. Ratios less than one (shown in green) indicate that ozone was reduced more effectively by similar percentage reductions in VOC emissions than reductions in NO_X emissions.
Source: https://www.epa.gov/sites/production/files/2017-05/documents/national_modeling.advance.may_2017.pdf



<u>$PM_{2.5}$ Formation</u>

In the case of $PM_{2.5}$, or fine PM, total mass is often categorized into two groups: primary (i.e., emitted directly as $PM_{2.5}$ from sources) and secondary (i.e., $PM_{2.5}$ formed in the atmosphere by precursor emissions from sources). The ratio of primary to secondary $PM_{2.5}$ varies by location and season. In the U.S., $PM_{2.5}$ is dominated by a variety of chemical components: sulfate, nitrate, ammonium, organic carbon (OC), elemental carbon (EC), crustal elements, sea-spray constituents, and oxidized metals. $PM_{2.5}$ EC, crustal elements, and sea spray are directly emitted into the atmosphere from primary sources. $PM_{2.5}$ OC is directly emitted from primary sources but is also formed secondarily in the atmosphere by reactions involving VOCs. $PM_{2.5}$ sulfate, nitrate, and ammonium are predominantly the result of chemical reactions of the oxidized products of SO_2 and NO_X emissions and direct NH_3 emissions (Seinfeld and Pandis, 2012). Figure 2-2 shows the average composition by season (spring, summer, fall and winter) for $PM_{2.5}$ data collected during 2013-15. In the eastern United States, sulfate is high in the spring (March-May) and summer (July-September). Nitrate is most evident in the Midwest and western cities and highest during the winter. Organic mass (OM) is a large component throughout the year.

Figure 2-2. Average composition by season for $PM_{2.5}$ data collected during 2013-15.
Note: Quarter 1 (top left), quarter 2 (top right), quarter 3 (bottom left), and quarter 4 (bottom right).



Sulfur dioxide emissions are oxidized in the atmosphere and form sulfuric acid, which has a very low vapor pressure and tends to exist in the particulate phase. Particulate sulfuric acid reacts with NH_3 to form ammonium bisulfate and ammonium sulfate. Aqueous phase reactions are also an important pathway for particulate sulfate formation. SO_2 dissolves into cloud and fog droplets and is oxidized to sulfate via reaction pathways involving hydrogen peroxide, O_3, and other oxidants. Since sulfate is essentially non-volatile under atmospheric conditions, sulfate formed in clouds persists as particulate sulfate after the cloud evaporates. Sulfur dioxide emission reductions lead to reductions in particulate sulfate. The process is not completely linear, especially when aqueous phase production is significant, and so changes in SO_2 emissions may not result in the same proportion of change in $PM_{2.5}$ sulfate concentration.

Emissions of NO_X are chemically transformed to nitric acid (HNO_3) through gas-phase and heterogeneous reactions. Nitric acid may condense onto particles to form particulate nitrate depending on the conditions. Condensation of HNO_3 onto particles is favored by low temperature, high relative humidity, and relatively less acidic conditions associated with high levels of NH_3 and particulate cations. HNO_3 formation may be oxidant or NOx-limited, and $PM_{2.5}$ ammonium nitrate formation may be limited by the availability of either nitric acid or NH_3 or by meteorological conditions. When $PM_{2.5}$ ammonium nitrate is limited by the availability of NH_3, the formation regime is termed "ammonia-limited," and the formation regime is termed "nitric acid-limited" when the opposite situation exists (Stockwell et al., 2000). In general, a decrease in NO_X emissions will result in a decrease in $PM_{2.5}$ nitrate concentration (Pun et al., 2007). Since $PM_{2.5}$ ammonium nitrate formation is preferred under low temperature and high relative humidity conditions and in the presence of NH_3, ammonium nitrate concentrations tend to be greater during colder months and in areas with significant NH_3 emissions. NO_X emission changes during warm temperatures may result in less change in ambient $PM_{2.5}$ compared to cold months due to HNO_3 staying in the gas rather than particle phase due to higher temperatures. Additionally, NO_X emission changes in places with very little or no ambient ammonia may result in little change in ambient $PM_{2.5}$ ammonium nitrate.

3. Framework for Developing MERPs as a Tier 1 Demonstration Tool

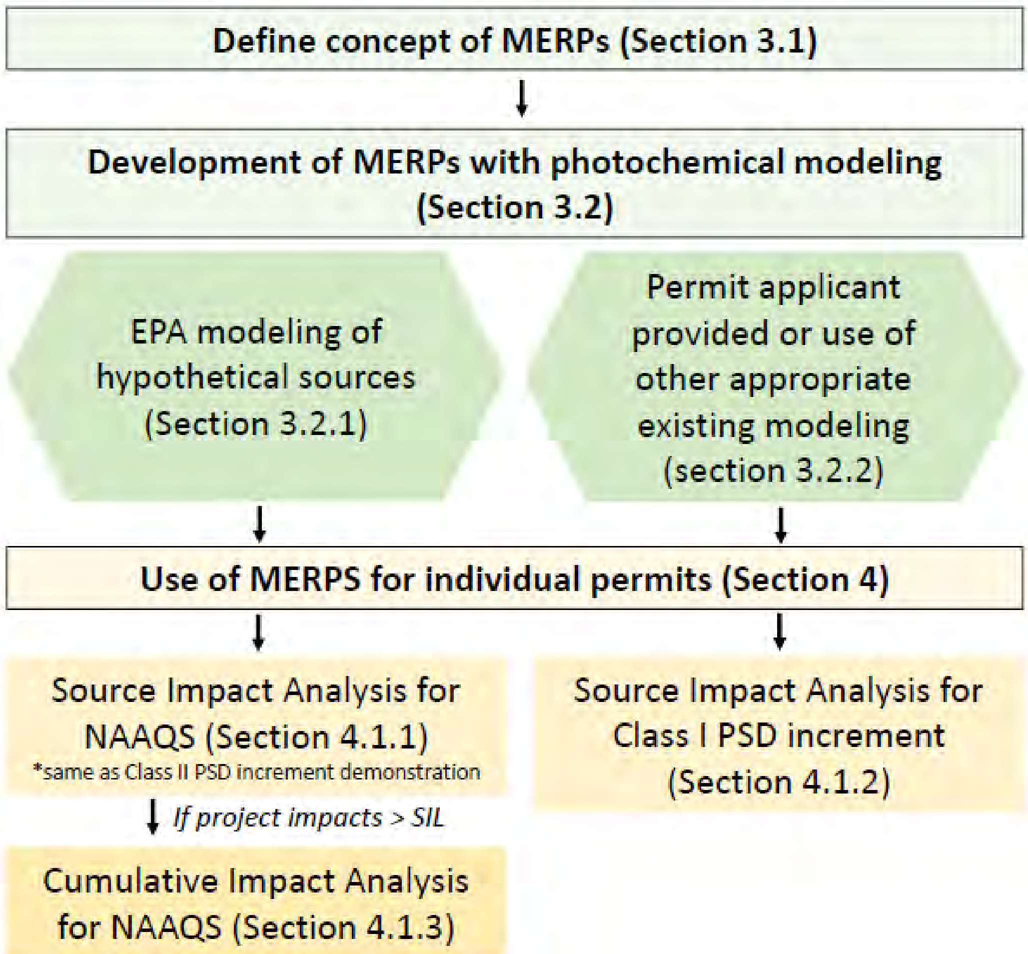
A Tier 1 demonstration tool as described in the *Guideline* consists of technically credible air quality modeling done to relate precursor emissions and peak secondary pollutant impacts from specific or hypothetical sources (U.S. Environmental Protection Agency, 2017a). With appropriate supporting information, permit applicants may use existing appropriate air quality modeling as part of an assessment of air quality impacts from a proposed new or modified source under the PSD permitting program. Permit applicants should provide a narrative explanation describing how project source emissions relate to the information provided as part of their Tier 1 demonstration. It should be made clear how the chemical and physical environments modeled as part of an existing set of information included in their Tier 1 demonstration are relevant to the geographic area of the project and key receptors.

As detailed below, this framework for developing MERPs focuses on use of photochemical modeling to relate the modeled air quality impacts and a critical air quality threshold (e.g., appropriate SIL value) to estimate a MERP for comparison with the project source emissions. However, a similar screening approach would be to adjust the modeled air quality impacts based on the relationship between the modeled and project source emissions to then compare the resulting air quality impact with the appropriate SIL.

Existing credible air quality modeling generally may include single source modeling based on an approved SIP demonstration, a more recent submitted but not approved SIP demonstration, or modeling not used to support a SIP demonstration but considered representative of the current air quality in the area and of sufficient quality that is comparable to a model platform supporting a SIP demonstration. The specifications for single source demonstration model platforms (e.g., horizontal grid spacing, vertical resolution, non-project source emission treatment, etc.) are detailed in the 2016 EPA guidance document "Guidance on the use of models for assessing the impacts of emissions from single sources on the secondarily formed pollutants O_3 and $PM_{2.5}$" (U.S. Environmental Protection Agency, 2016a).

Figure 3-1 illustrates the EPA's framework for MERPs as a Tier 1 demonstration tool. This framework is intended to show how the elements and concepts described in this document relate to each other and where more information is provided in this document about each step of the process. This flow diagram shows how MERPs can be developed from either existing EPA modeling or another source of data and how that information can be credibly used for a source impact analysis and, if necessary, a cumulative impact analysis. In this framework, the source impact analysis for the $PM_{2.5}$ NAAQS may also satisfy Class II PSD increment since the recommended EPA SILs are the same.

Figure 3-1. EPA's framework for MERPs as a Tier 1 Demonstration Tool.



3.1. Definition of MERPs as a Tier 1 Demonstration Tool

Properly-supported MERPs provide a simple way to relate modeled downwind impacts with an air quality threshold that is used to determine if such an impact causes or contributes to a violation of the appropriate NAAQS. In the discussion that follows and in reported results in computing MERP values, we use the EPA's recommended SIL values for O_3 and $PM_{2.5}$ as the relevant air quality threshold (U.S. Environmental Protection Agency, 2018). Consistent with EPA's SILs guidance, to the extent a permitting authority elects to use a SIL to help quantify a level of impact that does not cause or contribute to a violation of the O_3 and/or $PM_{2.5}$ NAAQS or $PM_{2.5}$ PSD increment(s), such values will need to be justified on a case-by-case basis. To derive a MERP value for the purposes of a PSD compliance demonstration, the model predicted relationship between precursor emissions from hypothetical sources and their downwind modeled impacts can be combined with the appropriate SIL value using the following equation:

$$\textbf{Eq. 1} \quad \text{MERP} = \text{appropriate SIL value} \times \frac{\text{Modeled emission rate (tpy) from hypothetical source}}{\text{Modeled air quality impact from hypothetical source}}$$

For $PM_{2.5}$, the modeled air quality impact of an increase in precursor emissions from the hypothetical source is expressed in units of μg/m^3. For O_3, the modeled air quality impact is expressed in ppb. As discussed in Section 4, these modeled impacts would reflect the maximum downwind impacts for $PM_{2.5}$ and O_3. The SIL value is expressed as a concentration for $PM_{2.5}$ (in μg/m^3) and mixing ratio for O_3 (in ppb). Consistent with the air quality model application used here to predict a change in pollutant concentration, MERPs are expressed as an annual emissions rate (in this case as tons per year).

3.2. Development of MERPs through Photochemical Modeling

As stated in the preamble to the 2017 revisions to the Guideline (U.S. Environmental Protection Agency, 2017a), the EPA believes that use of photochemical models for estimating single source secondary pollutant impacts is scientifically appropriate and practical to implement. Publicly available and fully documented Eulerian photochemical grid models such as the Comprehensive Air Quality Model with Extensions (CAMx) (Ramboll ENVIRON, 2016) and the Community Multiscale Air Quality (CMAQ) (Byun and Schere, 2006) model treat emissions, chemical transformation, transport, and deposition using time and space variant meteorology. These modeling systems simulate primarily emitted species and secondarily formed pollutants such as O_3 and $PM_{2.5}$ (Chen et al., 2014; Civerolo et al., 2010; Russell, 2008; Tesche et al., 2006). Even though single source emissions are injected into a grid volume, photochemical transport models have been shown to adequately capture single source impacts when compared with downwind in-plume measurements (Baker and Kelly, 2014; Baker and Woody, 2017; Zhou et al., 2012). Where set up appropriately for the purposes of assessing the air quality impact of single sources to ambient levels of primary and secondarily formed pollutants, photochemical grid models could be used with a variety of approaches to estimate these impacts. These approaches generally fall into the categories of source sensitivity (how air quality changes due to changes in emissions) and source apportionment (what air quality impacts are related to certain emissions).

The simplest source sensitivity approach, commonly referred to as a brute-force change to emissions, would be to simulate two sets of conditions, one with all emission sources and a subsequent simulation with all emission sources and the post-construction characteristics of the new source or modification being the only difference from the original baseline simulation (Cohan and Napelenok, 2011). The difference between these model simulations provides an estimate of the air quality change related to the change in emissions from the project source. In addition to the brute force approach, some photochemical models have been “instrumented” with techniques that allow tracking of air quality impacts from the emissions of a particular sector or source. One sensitivity approach is the decoupled direct method (DDM), which tracks the sensitivity of an emission source through all chemical and physical processes in the modeling system (Dunker et al., 2002). Sensitivity coefficients relating source emissions to air quality are estimated during the model simulation and output at the resolution of the host model. Unlike the brute force approach, a second simulation is not necessary when using DDM, although additional resources are required as part of the initial baseline simulation when DDM is applied.

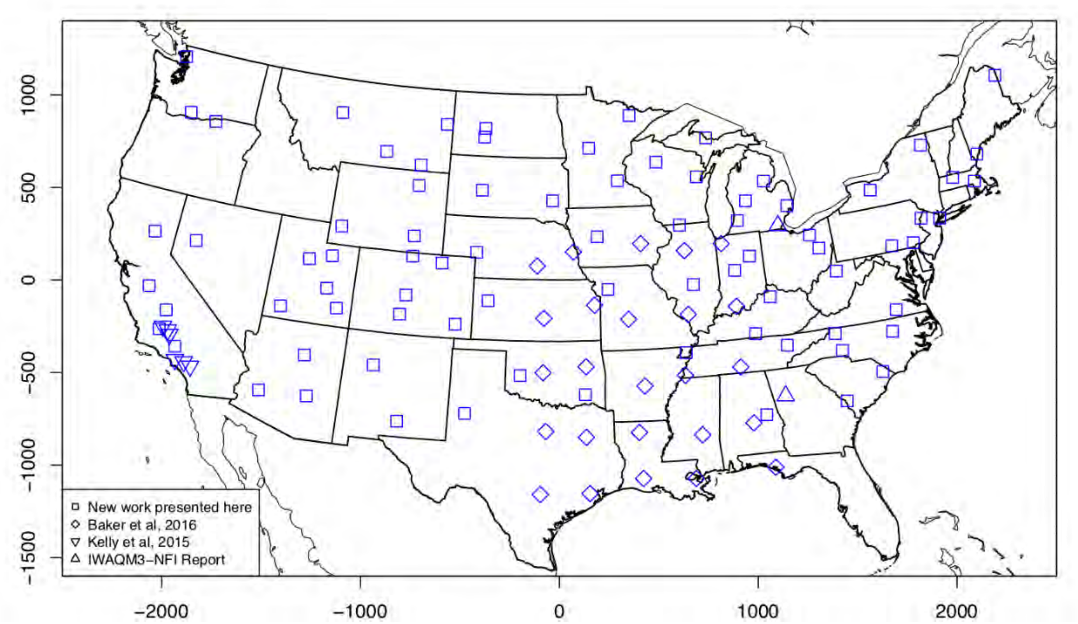
Some photochemical models have been instrumented with source apportionment capabilities which tracks emissions from specific sources through chemical transformation, transport, and deposition processes to estimate source-specific impacts to predicted air quality at downwind receptors (Kwok et al., 2015; Kwok et al., 2013). Source apportionment has been used to differentiate the air quality impact from single sources on model predicted O_3 and $PM_{2.5}$ (Baker and Foley, 2011; Baker and Kelly, 2014; Baker and Woody, 2017). DDM has also been used to estimate O_3 and $PM_{2.5}$ impacts from specific sources (Baker and Kelly, 2014; Bergin et al., 2008; Kelly et al., 2015) as well as the simpler brute-force sensitivity approach (Baker and Kelly, 2014; Bergin et al., 2008; Kelly et al., 2015; Zhou et al., 2012). Limited comparison of single source impacts between models (Baker et al., 2013) and approaches to differentiate single source impacts (Baker and Kelly, 2014; Kelly et al., 2015) show generally similar downwind spatial gradients and impacts.

Near-source in-plume aircraft based measurement field studies provide an opportunity to evaluate model estimates of (near-source) downwind transport and chemical impacts from single stationary point sources (ENVIRON, 2012b). Photochemical grid model source apportionment and source sensitivity simulation of single-source downwind impacts compare well against field study primary and secondary ambient in-plume measurements (Baker and Kelly, 2014; Baker and Woody, 2017; ENVIRON, 2012b). This work indicates photochemical grid models using source apportionment or source sensitivity approaches provide meaningful estimates of single source impacts.

3.2.1. EPA Single Source Photochemical Modeling for O_3 and Secondary $PM_{2.5}$

This section presents a summary of EPA photochemical modeling of hypothetical single source impacts on downwind O_3 and secondary $PM_{2.5}$. The locations of hypothetical sources modeled are shown in Figure 3-2. A total of 113 locations were modeled. The single source impacts detailed in this section were collected from various past and recent photochemical grid model-based assessments. The resulting relationships were based on photochemical modeling studies that estimated single source impacts in California (Kelly et al., 2015), the Detroit and Atlanta urban areas (U.S. Environmental Protection Agency, 2016b), and at rural and suburban locations in the central and eastern United States (Baker et al., 2016). Additional photochemical modeling was conducted by EPA consistent with the approach described in Baker et al., 2016 for hypothetical sources in the western, central, and eastern U.S. to provide broader geographic coverage across the nation.

Figure 3-2. Location of hypothetical sources modeled for downwind secondary air quality impacts included in EPA's assessment.



Atlanta and Detroit both include a single hypothetical source modeled at 4 km horizontal grid resolution for an entire year. The California sources were also modeled at 4 km but only include a sub-set of an entire year meaning the maximum impact from those hypothetical sources may not be realized as part of that study design. The western, central, and eastern U.S. sources were modeled at 12 km horizontal grid resolution for the entire year of 2011. It is possible that the maximum impacts from each of these hypothetical sources may not have been realized using a single year of meteorology and that another year with more conducive meteorology for secondary formation of O_3 and/or $PM_{2.5}$ might be more appropriate and result in greater downwind impact. As shown, we define the following source types throughout the continental U.S. that reflect different release heights and multiple emissions rates:

- Source release type "L" refers to sources modeled with surface level emissions releases: stack height of 10 m, stack diameter of 5 m, exit temperature of 311 K, exit velocity of 27 m/s, and flow rate of 537 m^3/s.
- Source release type "H" refers to sources modeled with tall stack emissions releases: stack height of 90 m, stack diameter of 5 m, exit temperature of 311 K, exit velocity of 27 m/s, and flow rate of 537 m^3/s.

Hypothetical sources for this assessment include impacts based on multiple emission rates and emitted with a near-surface release or tall stack. Information about each hypothetical source modeled is provided in Appendix A.

The relationships shown here for these hypothetical sources are not intended to provide an exhaustive representation of all combinations of source type, chemical, and physical source environments but rather to provide insightful information about secondary pollutant impacts from single sources in different parts of the U.S. The maximum impacts for daily $PM_{2.5}$, annual $PM_{2.5}$ and daily maximum 8-hr average O_3 are shown in the following sub-sections for the hypothetical sources modeled for an entire year and do not include sources modeled for an episode.

Tables showing the maximum impacts for sources modeled with annual simulations are provided in an Excel spreadsheet on EPA's SCRAM website. Impacts for each source include the maximum daily $PM_{2.5}$ impacts, maximum annual $PM_{2.5}$ impacts, and maximum daily 8-hr O_3 impacts over annual simulations. Emissions are shown in tpy and release height in meters. VOC speciation used for these assessments is shown in Table 3-1. More information about these hypothetical sources and how the model output was processed to generate maximum impacts are described in more detail in (Baker et al., 2016).

Table 3-1. Assumed VOC speciation for hypothetical sources presented here.

Carbon bond specie	Fraction	Carbon bond specie	Fraction
ALD2	0.0152	MEOH	0.0054
ALDX	0.0155	NVOL	0.0008
ETH	0.0324	OLE	0.1143
ETHA	0.0094	PAR	0.4057
ETOH	0.0090	TERP	0.0170
FORM	0.0757	TOL	0.1148
IOLE	0.0088	UNR	0.1080
ISOP	0.0007	XYL	0.0674

Additional information has been provided for each source to facilitate qualitative comparison between hypothetical sources with project sources. The additional information includes the terrain within 50 km of the source and maximum grid cell percent urban landcover within 50 km of the source to provide some additional information about nearby orography and whether the source is in proximity to population centers. This additional information is illustrated in Figure 3-3.

The spreadsheet also includes the climate zone where the source is located as shown in Figure 3-4. These regional classifications are used to aggregate impacts in summarizing modeling results in subsequent sections.

Figure 3-3. Maximum terrain height (top) and fractional urban coverage (bottom) within 50 km of each of the hypothetical sources modeled.

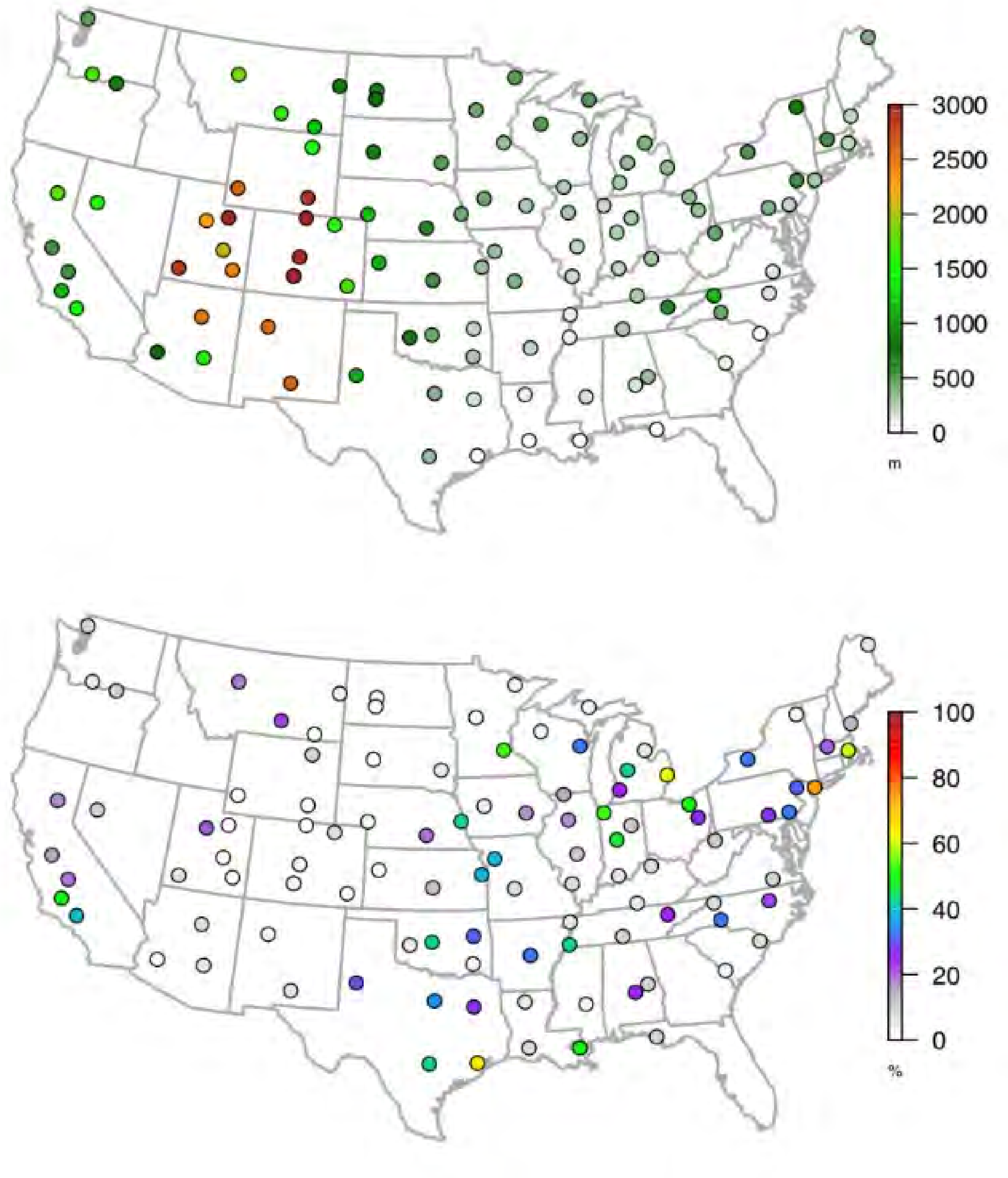
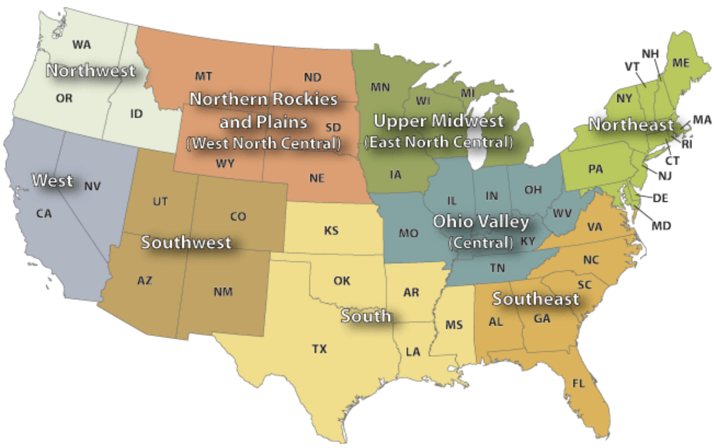


Figure 3-4. NOAA climate zone map with number of hypothetical source locations modeled in each climate zone.
Source: https://www.ncdc.noaa.gov/monitoring-references/maps/us-climate-regions.php

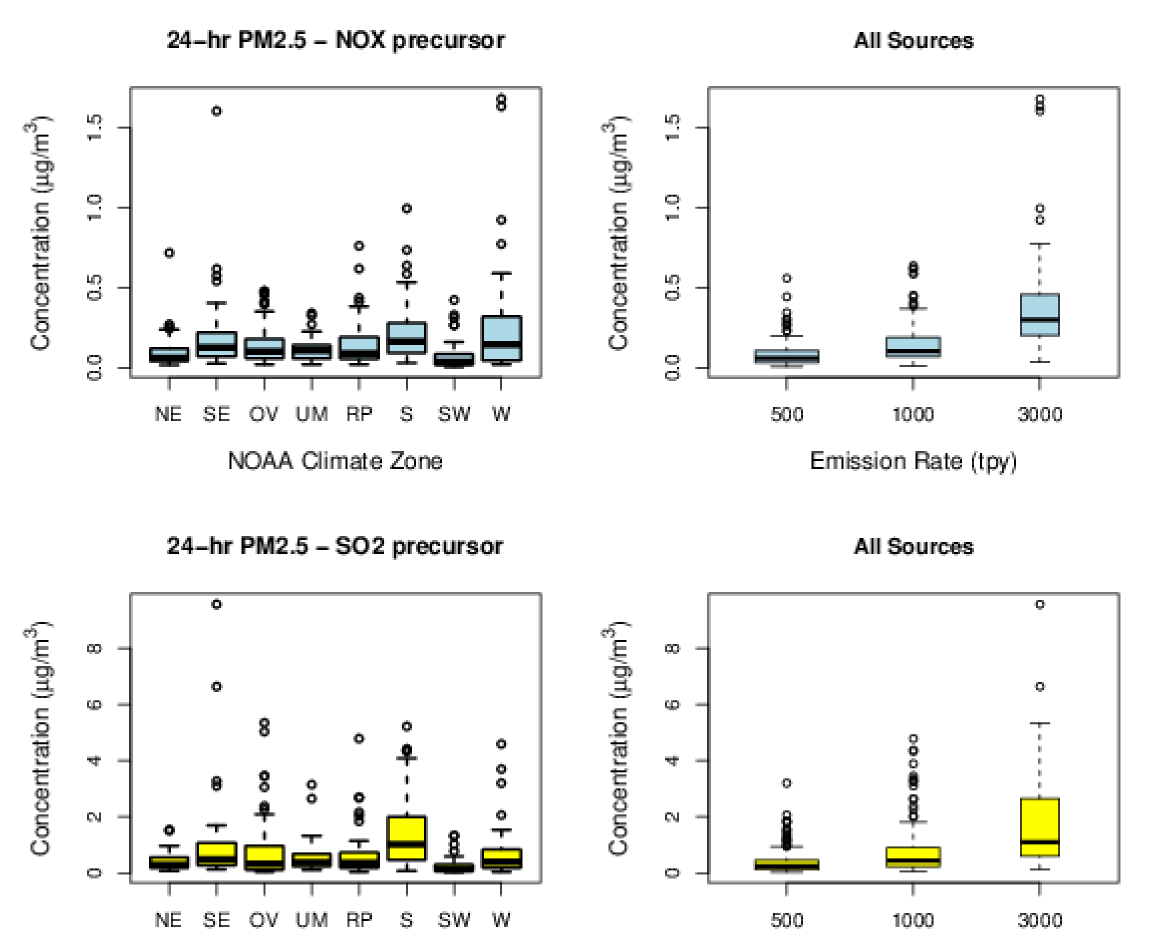


Climate Zone	Sources
Northeast	10
Southeast	9
Ohio Vally	19
Upper Midwest	12
Rockies/Plains	14
South	17
Southwest	15
West	6
Northwest	3

3.2.1.1. EPA Modeled Impacts: Annual and Daily PM2.5

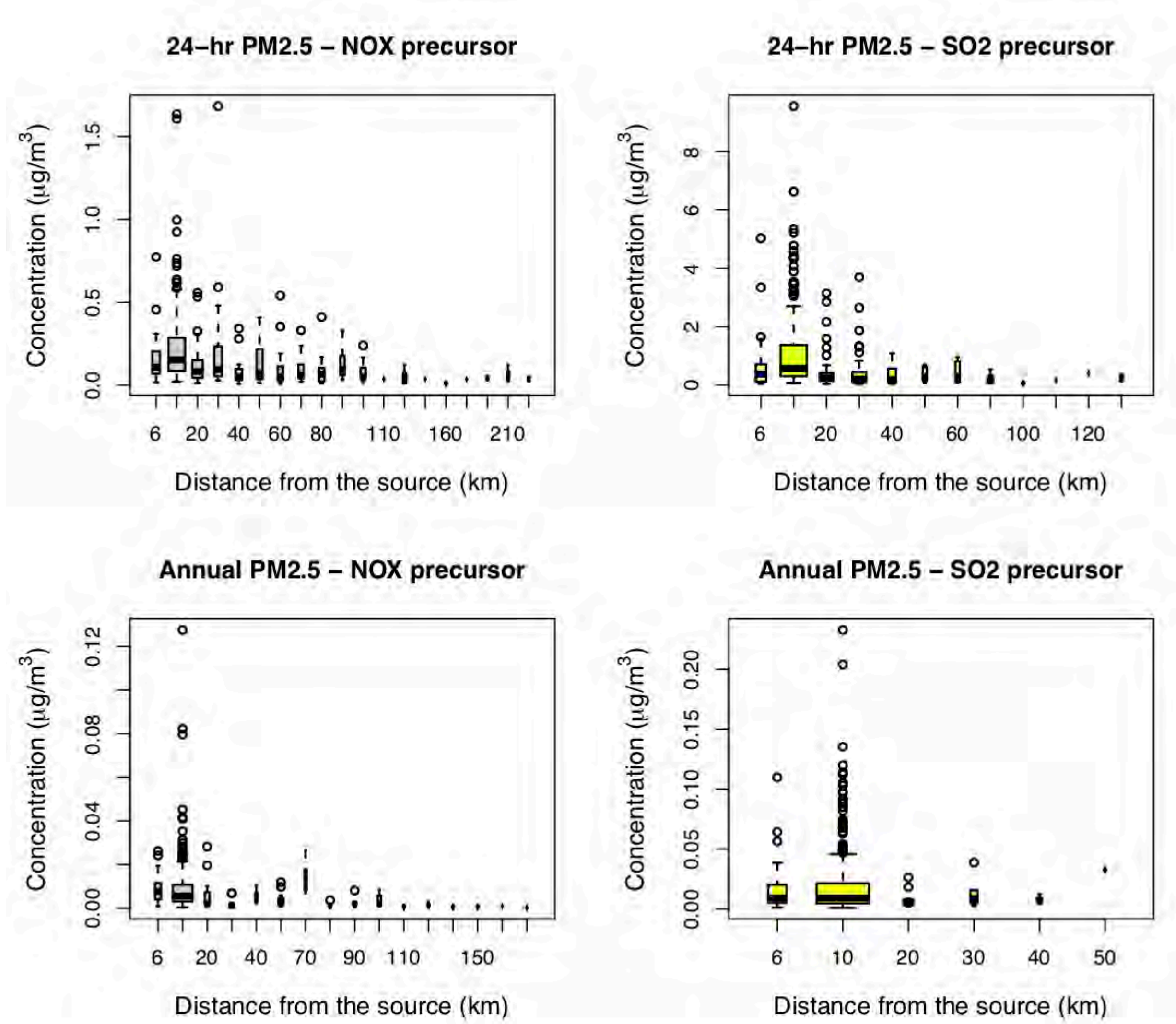
The maximum daily average $PM_{2.5}$ sulfate ion from SO_2 emissions and maximum daily average $PM_{2.5}$ nitrate ion from NO_X emissions are shown in Figure 3-5 by emission rate and area. Downwind maximum $PM_{2.5}$ impacts generally increase as rates of precursor emissions increase. However, differences in chemical (e.g. NO_X/VOC ratio, NH_3 concentrations) and physical (e.g., terrain and meteorology) regimes among these hypothetical sources result in differences in downwind impacts even for similar types of sources. Differences in maximum impacts can also be seen between the different areas and studies. One such example is described in Section 3.2.1.3 of this document.

Figure 3-5. Maximum daily average $PM_{2.5}$ nitrate ion impacts from NO_X emissions and $PM_{2.5}$ sulfate ion impacts from SO_2 emissions.
Note: These impacts are from multiple modeling studies estimating downwind impact from hypothetical sources. The distribution shown for each climate zone represents multiple emission rates.



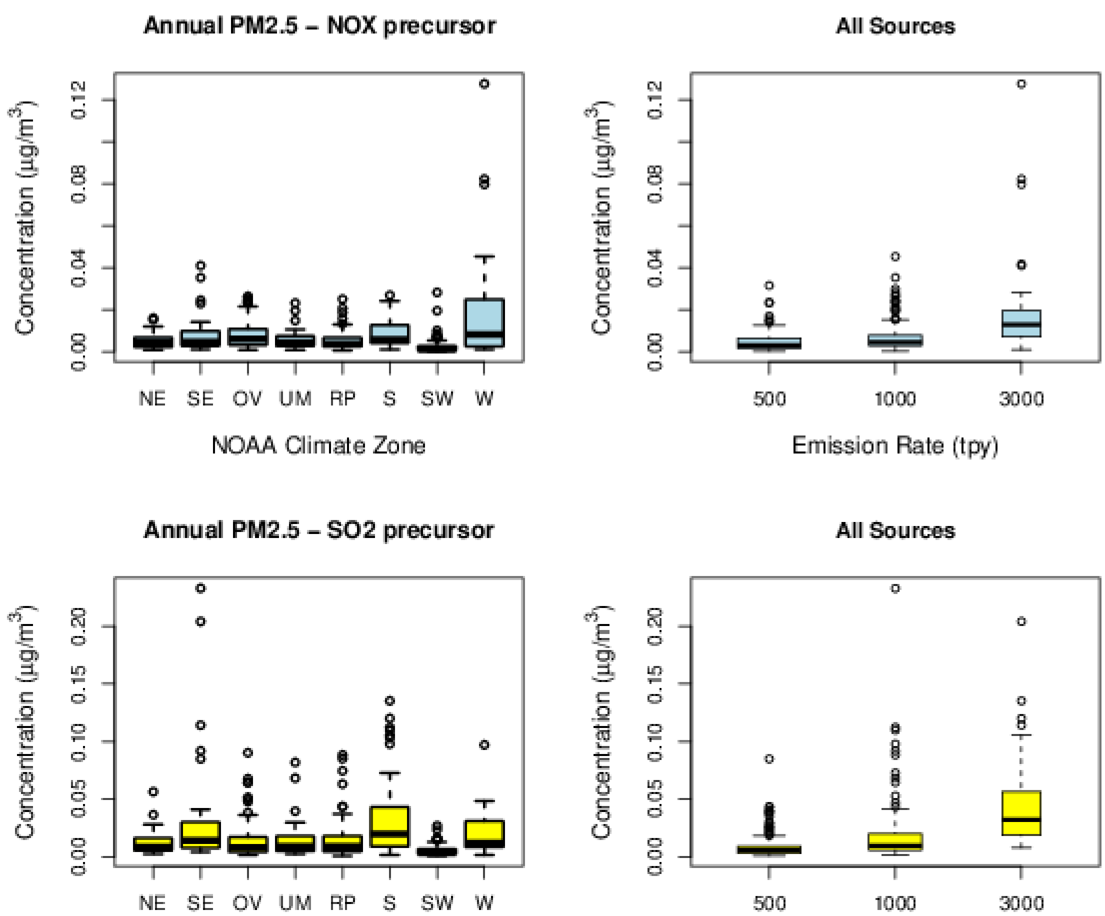
The distance from the source of maximum daily and annual average secondary $PM_{2.5}$ impact is shown in Figure 3-6. Peak impacts tend to be in close proximity to the source. For NO_X precursor, the peak 24-hour $PM_{2.5}$ impacts are typically within 20 to 50 kilometers, while peak annual average $PM_{2.5}$ impacts are typically within 20 kilometers of the source. For SO_2 precursor, the peak 24-hour $PM_{2.5}$ impacts are shown to be mostly within 10 to 40 kilometers, while peak annual average $PM_{2.5}$ impacts are largely within 20 kilometers. These peak impacts become less common as distance from the source increases. Figure 3-7 shows maximum annual average impacts from SO_2 emissions on modeled $PM_{2.5}$ sulfate ion and NO_X emissions on modeled $PM_{2.5}$ nitrate ion. Downwind impacts tend to increase as emissions of precursors increase. Also, impacts vary from area to area.

Figure 3-6. Maximum daily and annual average secondary $PM_{2.5}$ nitrate ion impacts from NO_X emissions and $PM_{2.5}$ sulfate ion impacts from SO_2 emissions shown by distance from the source.



The tendency for secondary $PM_{2.5}$ to be larger near the source is important when considering how to use impact estimates to inform different types of permit demonstrations. For NAAQS demonstrations, peak impacts tend to be near the source. Class I impacts are likely to be further downwind of the project source, so a near-source impact estimate would typically not be as relevant.

Figure 3-7. Maximum annual average secondary $PM_{2.5}$ nitrate ion impacts from NO_X emissions and $PM_{2.5}$ sulfate ion impacts from SO_2 emissions.
Note: These impacts are from multiple modeling studies estimating downwind impact from hypothetical sources. The distribution shown for each climate zone represents multiple emission rates.

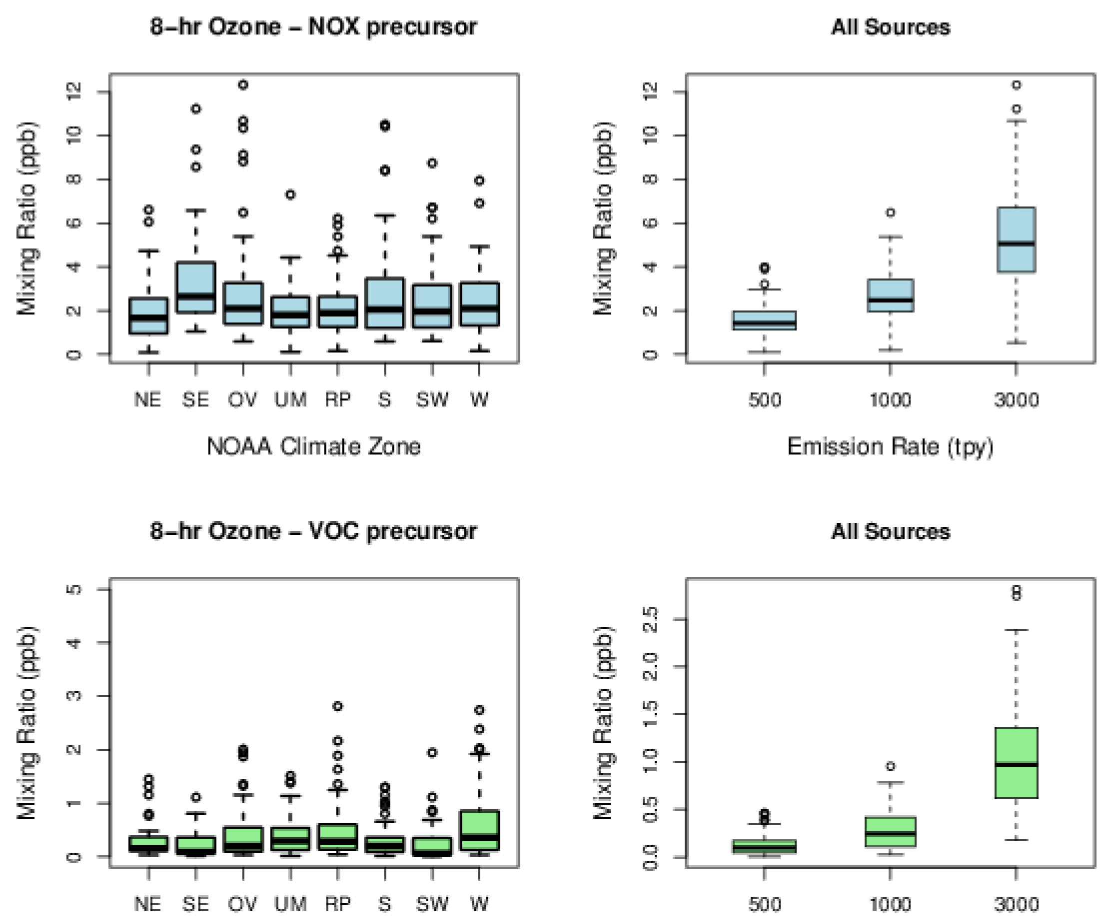


3.2.1.2. EPA Modeled Impacts: 8-hour Ozone

Maximum 8-hr O_3 impacts are shown in Figure 3-8 compared to single source precursor emission rates. These relationships are based on photochemical modeling studies that estimated single source impacts in California (Kelly et al., 2015), the Detroit and Atlanta urban areas (U.S. Environmental Protection Agency, 2016b), and at rural and suburban locations in the central and eastern United States (Baker et al., 2016). Additional modeling was conducted consistent with the approach described in Baker et al., 2016 for hypothetical sources in the western and eastern U.S. to provide broader geographic coverage of the U.S.

Downwind maximum 8-hr O_3 impacts generally increase as rates of precursor emissions increase. However, differences in chemical (e.g., NO_X/VOC ratio, radical concentrations) and physical (e.g., terrain and meteorology) regimes among these hypothetical sources result in differences in downwind impacts even for similar types of sources.

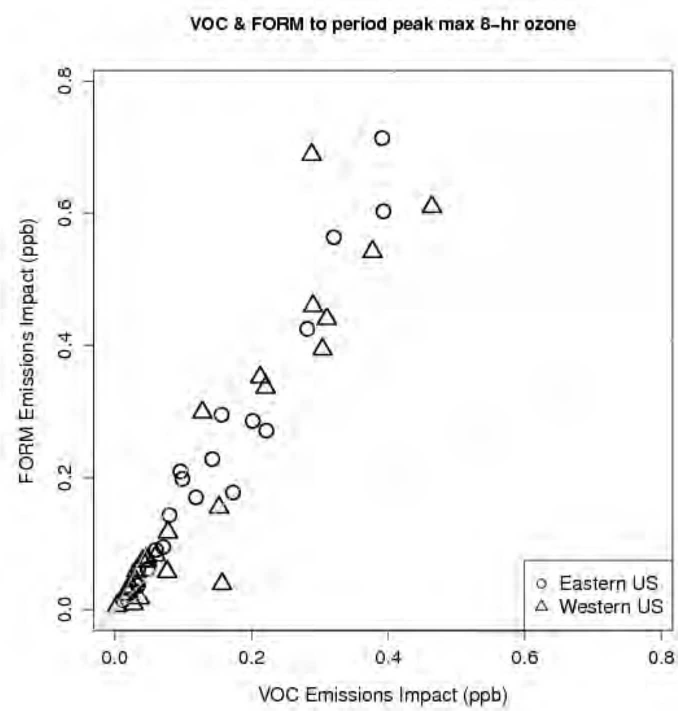
Figure 3-8. Maximum 8-hr ozone impacts from NO_X emissions and from VOC emissions.
Note: These impacts are from multiple modeling studies estimating downwind impact from hypothetical sources. The distribution shown for each climate zone represents multiple emission rates.



Each of the hypothetical source impacts modeled as part of EPA's assessment used a typical industrial assumption for speciation of VOC emissions (see Table 3-1 for VOC speciation profile). To better understand the influence of VOC speciation, as a sensitivity analysis, EPA modeled a set of hypothetical sources with near-surface releases in the western and eastern U.S. with an alternative VOC emissions speciation that assumed 100% of the VOC emissions were emitted as formaldehyde to provide a more reactive profile than typically used. Figure 3-9 shows a comparison of the downwind maximum daily 8-hr average O_3 impacts using the typical VOC profile compared with impacts where these same sources are modeled with formaldehyde-only VOC emissions. For both sets of emissions scenarios, a total of 500 tpy of VOC was emitted, the only difference being the VOC speciation. The formaldehyde only simulations for these sources generally resulted in higher downwind O_3 impacts than the simulations of hypothetical sources with VOC speciation shown in Table 3-1. The increases in impacts are typically between 1.5 and 2 times higher (Figure 3-9).

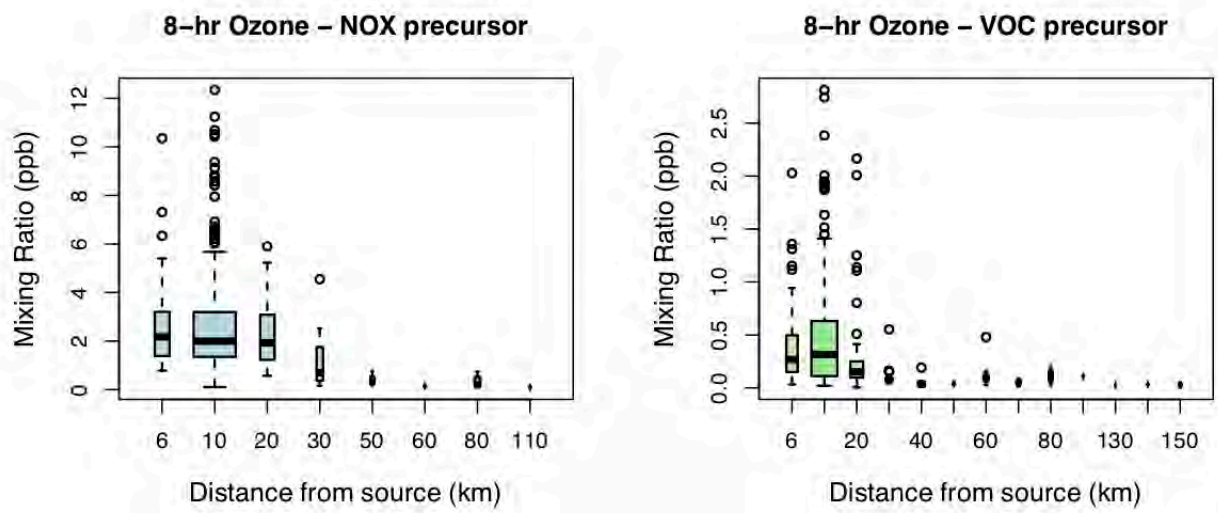
Since VOC reactivity can be important, some areas may want to develop separate VOC to O_3 relationships using typical VOC profiles and VOC profiles that may be more reflective of certain types of sources that exist in that area or are anticipated to operate in that area in the future.

Figure 3-9. Maximum 8-hr ozone impacts from 500 tpy of near-surface VOC emissions using a typical industrial VOC speciation profile and assuming all VOC emissions are formaldehyde.
Note: these impacts are for the eastern and western U.S. hypothetical sources presented here and do not include information from any other studies.



The distance from the source of the maximum daily 8-hr average O_3 impacts are shown in Figure 3-10. Like maximum daily $PM_{2.5}$ impacts, maximum daily 8-hr average O_3 impacts tend to be in close proximity to the source and are less frequent as distance from the source increases. This is particularly notable where distance from the source exceeds 50 km.

Figure 3-10. Maximum 8-hr ozone impacts from NO_X emissions and from VOC emissions by distance from the source.
Note: These impacts are from multiple modeling studies estimating downwind impact from hypothetical sources.



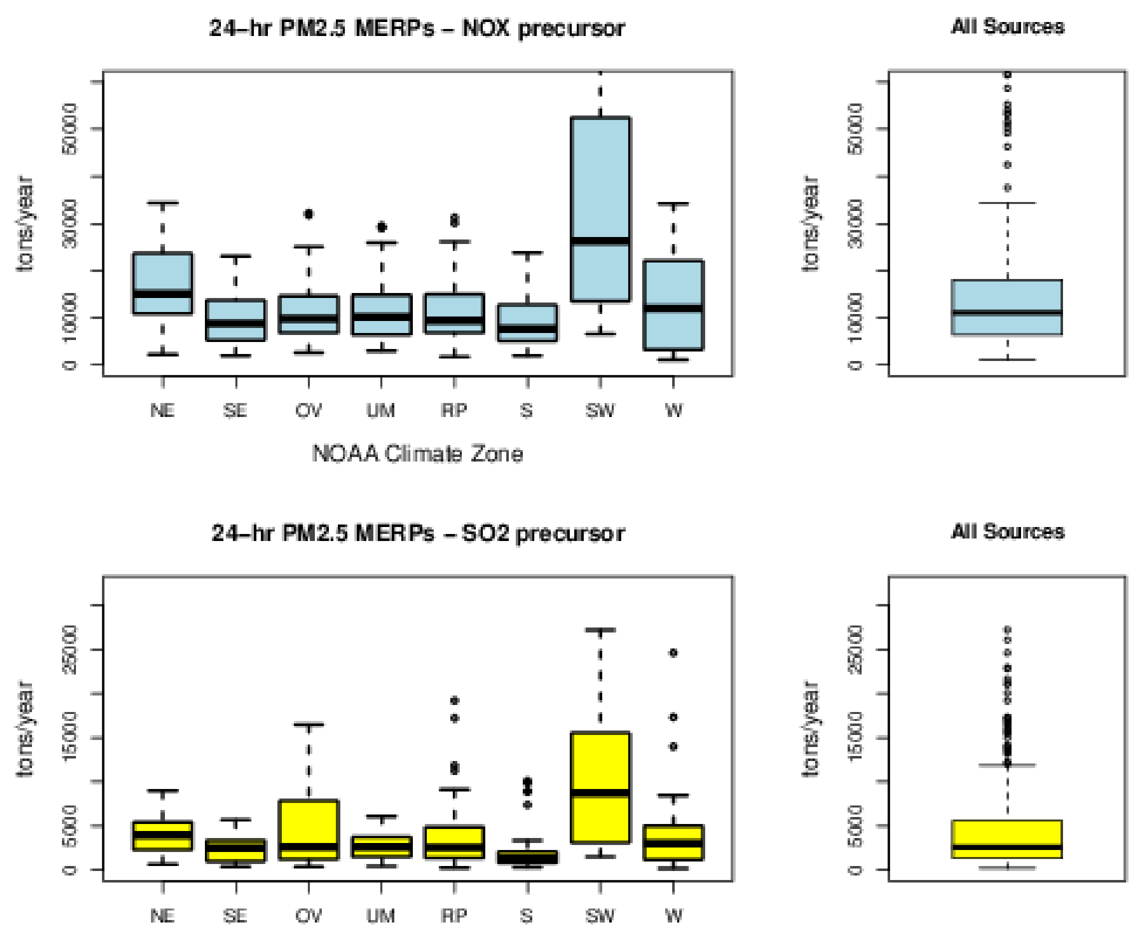
3.2.1.3. EPA Illustrative MERPs: Annual and Daily PM2.5

The hypothetical single source modeling presented here was used to develop illustrative MERPs based on equation 1 and the EPA recommended SIL. Based on the EPA's photochemical modeling results across all hypothetical sources presented above and detailed in Appendix A of this document, Figure 3-11 shows NO_X to annual maximum daily average $PM_{2.5}$ nitrate ion and SO_2 to annual maximum daily average $PM_{2.5}$ sulfate ion MERPs that illustrate the range of potential values for these sources and time period. Neither $PM_{2.5}$ sulfate nor $PM_{2.5}$ nitrate was assumed to be neutralized by ammonium. For this illustrative example, consistent with EPA's SILs guidance (U.S. Environmental Protection Agency, 2018), the EPA recommended 24-hour $PM_{2.5}$ NAAQS SILs value of 1.2 μg/m^3 was used to estimate daily average $PM_{2.5}$ MERPs.

The illustrative MERPs for NO_X to daily $PM_{2.5}$ range from 1,073 tpy to over 100,000 tpy, while the illustrative MERPs for SO_2 to daily $PM_{2.5}$ range from 188 tpy to over 27,000 tpy for the hypothetical sources modeled and presented here based on the selected air quality threshold. The variation from source to source is related to different chemical and meteorological environments around the source that range in terms of conduciveness toward secondary $PM_{2.5}$ formation.

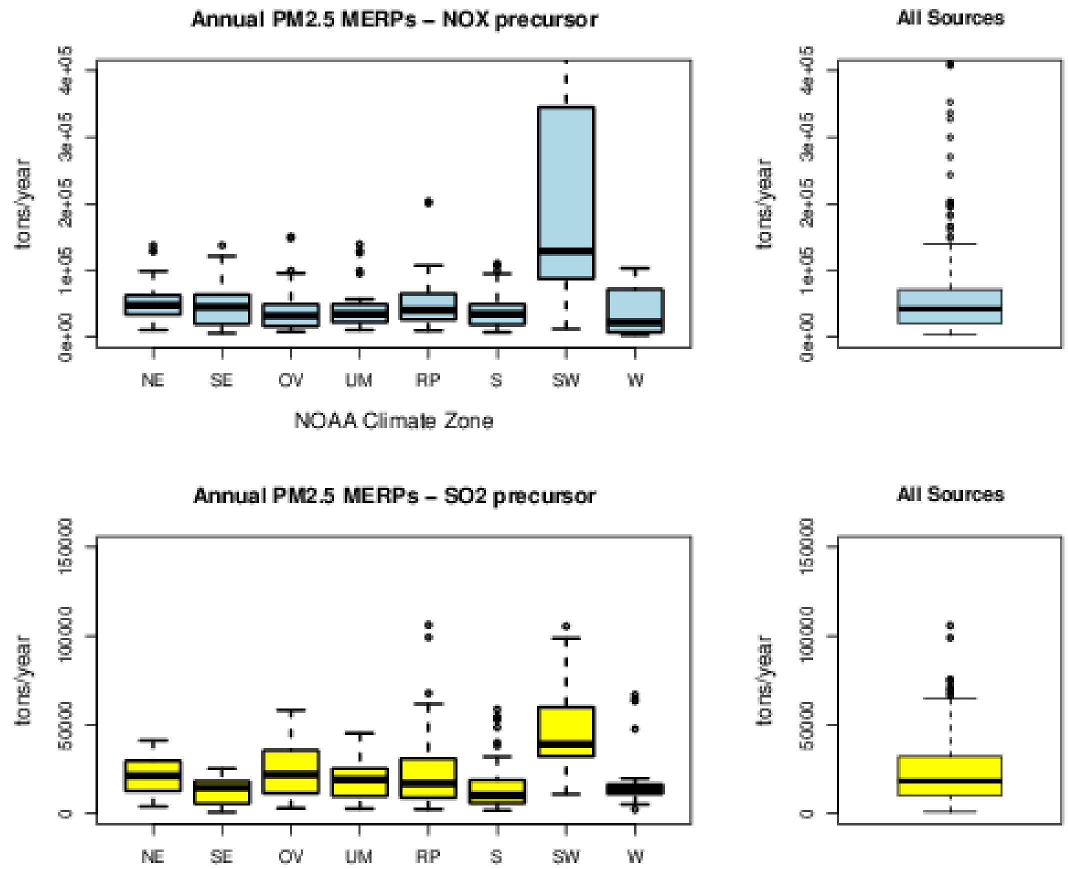
Similarly, based on EPA's photochemical modeling results of hypothetical sources, Figure 3-12 shows NO_X to maximum annual average $PM_{2.5}$ nitrate ion and SO_2 to maximum annual average $PM_{2.5}$ sulfate ion MERPs to illustrate the range of potential values for these sources and this time period. Neither $PM_{2.5}$ sulfate nor $PM_{2.5}$ nitrate were assumed to be neutralized by ammonium.

Figure 3-11. NO_X and SO_2 daily average $PM_{2.5}$ MERPs estimated from single source hypothetical emissions impacts on $PM_{2.5}$ nitrate ion and $PM_{2.5}$ sulfate ion respectively.
Note: Daily $PM_{2.5}$ MERPs derived here based on EPA recommended 24-hour $PM_{2.5}$ NAAQS SIL value of 1.2 µg/m^3 and neither $PM_{2.5}$ sulfate nor nitrate is assumed to be neutralized by ammonia.



For this illustrative example, consistent with EPA's SILs guidance, the EPA recommended annual $PM_{2.5}$ NAAQS SILs value of 0.2 µg/m^3 was used to estimate annual average $PM_{2.5}$ MERPs. The illustrative MERPs for NO_X to annual $PM_{2.5}$ range from 3,182 tpy to over 700,000 tpy, while the illustrative MERPs for SO_2 to annual $PM_{2.5}$ range from 859 tpy to over 100,000 tpy for the hypothetical sources presented here based on the selected air quality threshold. The variation from source to source is related to different chemical and meteorological environments around the source that range in terms of conduciveness toward secondary $PM_{2.5}$ formation.

Figure 3-12. NO_X and SO_2 annual average $PM_{2.5}$ MERPS shown by geographic region.
Note: Annual $PM_{2.5}$ MERPs derived here based on EPA recommended annual $PM_{2.5}$ NAAQS SIL value of 0.2 μg/m^3 and neither $PM_{2.5}$ sulfate nor nitrate is assumed to be neutralized by ammonia.



As shown, the illustrative MERPs are generally lower for SO_2 than NO_X meaning that SO_2 tends to form $PM_{2.5}$ more efficiently than NO_X. This is consistent with the conceptual model of secondary $PM_{2.5}$ formation in many parts of the United States reflecting that the $PM_{2.5}$ sulfate ion has a lower vapor pressure than $PM_{2.5}$ nitrate ion and tends to stay in the particulate phase in a greater range of meteorological conditions.

The distribution of illustrative MERPs for both SO_2 and NO_X to daily $PM_{2.5}$ are shown to vary between regions of the United States. This is expected since the chemical (e.g., oxidants, neutralizing agents) and physical (e.g., terrain) environments vary regionally in the United States. Figure 3-13 shows the lowest MERP at each hypothetical source location for daily (left panels) and annual (right panels) $PM_{2.5}$ from SO_2 (top panels) and NO_X (bottom panels) emissions. These plots show broad regional patterns in $PM_{2.5}$ formation potential which are generally related to regions with conducive meteorology, available neutralizing agents, and other emission sources competing for these neutralizing agents.

Figure 3-13. Lowest MERP value at each hypothetical source location for daily (left panels) and annual (right panels) $PM_{2.5}$ from SO_2 (top panels) and NO_X (bottom panels) emissions.

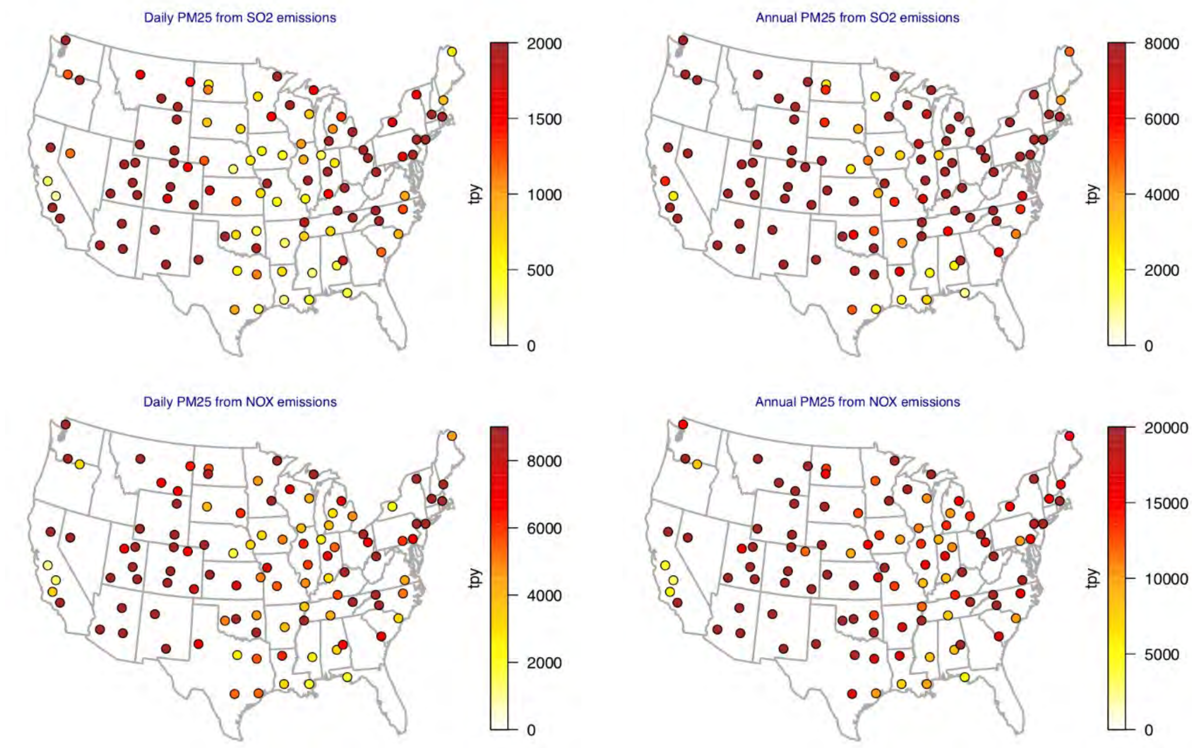


Figure 3-13 also shows that sometimes there are notable differences in $PM_{2.5}$ formation potential for sources in close proximity. Again, these differences are related to differences in local to regional mix of pollution, terrain, and meteorology. This also shows that spatial interpolation between these hypothetical sources would not always provide a realistic representation of model response to the introduction of new precursor emissions.

One interesting example of sources in close proximity with different $PM_{2.5}$ formation potential for sulfate and nitrate are the two hypothetical sources in western North Dakota. These sources are in fairly close proximity but are situated by very different types of emissions sources (e.g., large complex of industrial sources, animal operations). Figure 3-14 shows the location of these sources relative to modeled monthly average ammonia concentration and annual NO_2 emissions from the oil and gas sector.

Figure 3-14. Monthly average ammonia concentrations estimated by CAMx for July 2011 and annual total NO_2 emissions from the oil and gas sector based on the 2011 National Emission Inventory.

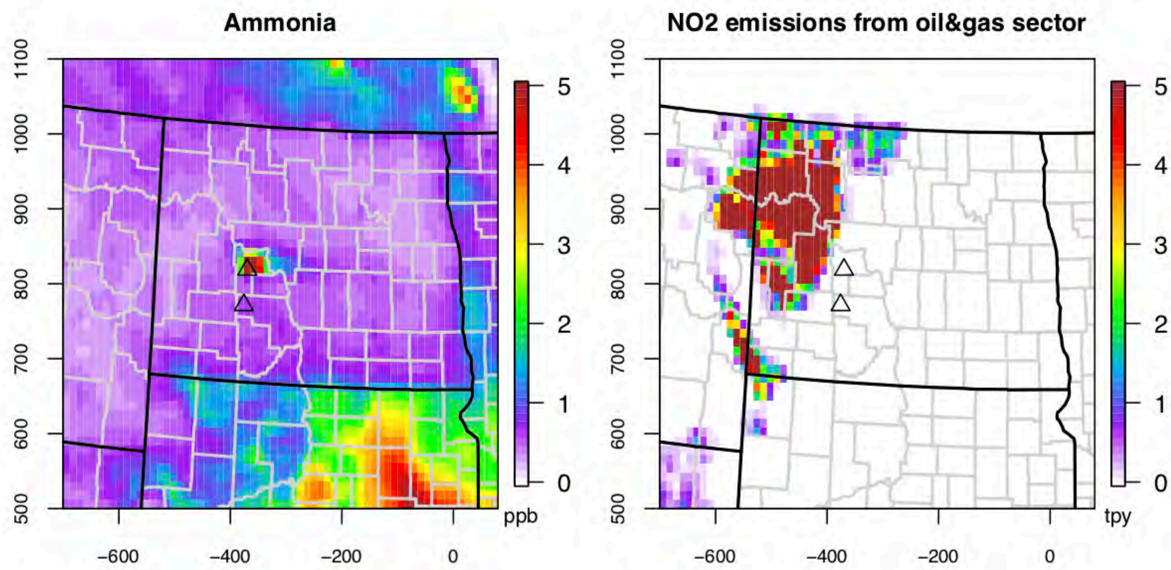
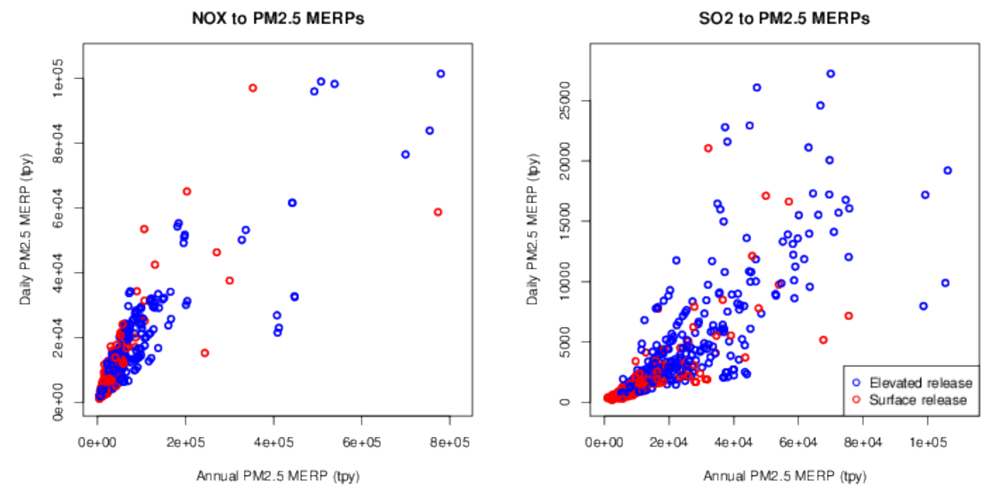


Figure 3-14 shows that the northern source is in very close proximity to a very large ammonia source which provides a readily available neutralizing agent for $PM_{2.5}$ formation when weather conditions are favorable. However, when winds are out of the north the southern source is in closer proximity to ammonia emissions located to the south in South Dakota. Further, the northern source is closer to the Bakken shale which is an area of high emissions that can provide oxidants for secondary chemical production and compete for neutralizing agents like ammonia.

Therefore, depending on meteorology, these sources will often have different potential for $PM_{2.5}$ production given their proximity to other industrial emissions sources and ammonia emissions sources. Figure 3-15 shows illustrative MERPs estimated for modeled sources for the daily and annual average forms of the $PM_{2.5}$ NAAQS.

Figure 3-15. Illustrative $PM_{2.5}$ MERPs for NO_X (left panel) and SO_2 (right panel) estimated from single source hypothetical emissions impacts on $PM_{2.5}$ nitrate ion and $PM_{2.5}$ sulfate ion respectively. Note: Daily average $PM_{2.5}$ MERPs are directly compared with annual average $PM_{2.5}$ MERPs.



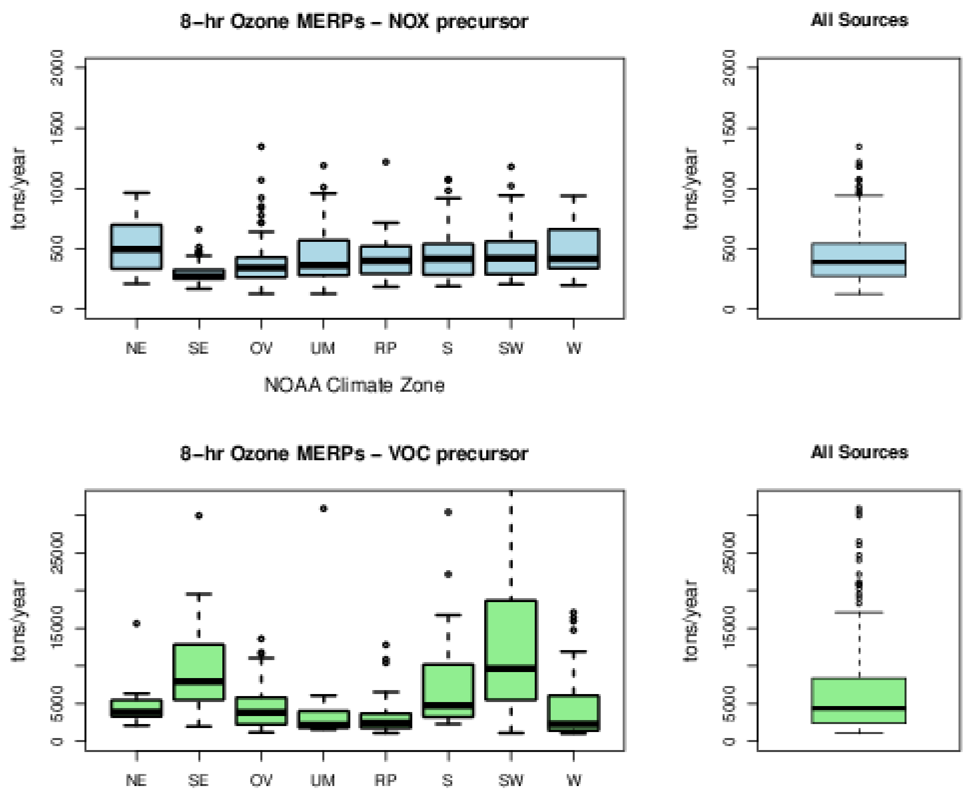
3.2.1.4. EPA Illustrative MERPs: 8-hour Ozone

The hypothetical single source modeling presented here was used to develop illustrative MERPs based on equation 1 and the EPA recommended SIL. Figure 3-16 shows illustrative MERPs for NO_X and VOC to daily maximum 8-hr average O_3 to illustrate the variability between regions/studies for the hypothetical sources included in this assessment. The modeled impacts reflect the highest annual 8-hr O_3 impacts from various hypothetical sources presented in this assessment (Baker et al., 2016; Kelly et al., 2015; U.S. Environmental Protection Agency, 2016b). The hypothetical source impacts presented here were not intended to capture O_3 formation associated with winter time cold pool events and are not appropriate for situations where peak impacts would be expected during these meteorological conditions.

Based on EPA's SILs guidance (U.S. Environmental Protection Agency, 2018), the recommended 8-hour O_3 NAAQS SIL of 1.0 ppb was used for this illustrative example. The illustrative VOC MERPs are based on single source VOC impacts on downwind daily maximum 8-hr O_3, while the illustrative NO_X MERPs are based on single source NO_X impacts on downwind daily maximum 8-hr O_3. The illustrative MERPs for NO_X to daily maximum 8-hr O_3 range from 125 tpy to over 5,000 tpy, while the illustrative MERPs for VOC to daily maximum 8-hr O_3 range from 1,049 tpy to over 140,000 tpy for the hypothetical sources presented here.

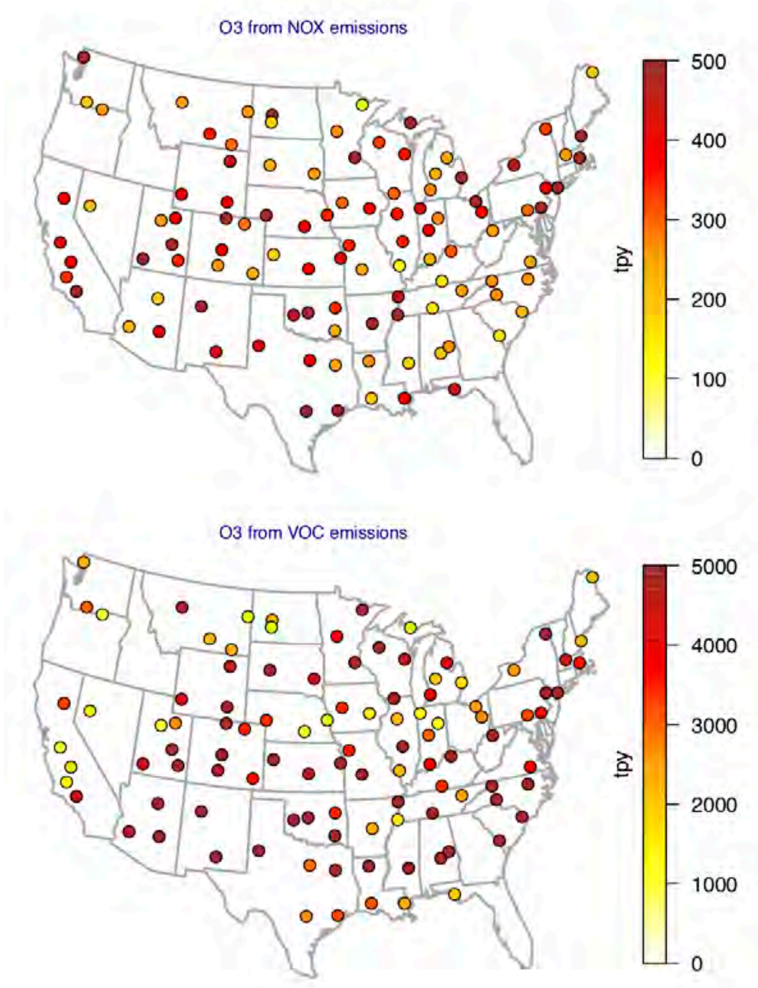
For this assessment, illustrative MERPs for NO_X tend to be lower than VOC which suggests most areas included in this assessment are often more NO_X limited rather than VOC limited in terms of O_3 formation regime. This finding is consistent with the information provided in Section 2. The distribution of illustrative MERPs for both NO_X and VOC are shown to vary between areas modeled as part of this assessment. Similar to $PM_{2.5}$, this is expected since the chemical (e.g., oxidants) and physical (e.g., terrain) environments vary regionally in the United States. The area-to-area availability of oxidants will determine whether O_3 production is NO_X or VOC limited which will be an important factor in how much an emissions source of NO_X or VOC will impact O_3 production.

Figure 3-16. NO_X (top panels) and VOC (bottom panels) MERPs estimated from single source hypothetical emissions impacts on daily maximum 8-hr O_3.
Note: 8-hr O_3 MERPs derived here based on EPA recommended 8-hour O_3 NAAQS SIL value of 1.0 ppb



The lowest MERP value for each of the hypothetical source locations is shown for NO_X (top) and VOC (bottom) in Figure 3-17. This shows that even within geographic areas there are sometimes notable differences in O_3 production potential for these precursors. Some broader patterns do emerge such as VOC emissions having less potential for O_3 formation in areas rich in regional VOC such as the southeast and intermountain west. Differences are also sometimes seen for sources located in fairly close proximity, which is related to local scale differences in emissions and meteorology. Figure 3-3 provides additional information about each of the hypothetical sources to help interpret conceptual differences in O_3 formation that may be related to terrain or proximity to urban areas.

Figure 3-17. Lowest MERP value for each hypothetical source location for O_3 from NO_X (top panel) and VOC (bottom panel) emissions.



3.2.2. Use of Other Photochemical Modeling to Develop MERPs for O_3 and Secondary $PM_{2.5}$

Given the spatial variability in illustrative MERPs for each precursor for $PM_{2.5}$ and O_3, stakeholders choosing to develop their own Tier 1 demonstration tool will need to conduct air quality modeling. Therefore, the air quality modeling should be consistent with the type of modeling system, model inputs, model application and estimation approach for O_3 and secondary $PM_{2.5}$ recommended in the *Guideline* and the "Guidance on the use of models for assessing the impacts from single sources on secondarily formed pollutants ozone and $PM_{2.5}$" (U.S. Environmental Protection Agency, 2016a). The chosen modeling system should be applied with a design scope similar to that shown in this document where multiple hypothetical single sources with varying emission rates and stack release parameters are simulated for a period that includes meteorology conducive to the formation of O_3 and/or secondary $PM_{2.5}$. A modeling protocol should be developed and shared with the EPA Regional office that details the planned approach for developing MERPs based on photochemical modeling to ensure a sound technical basis for development of a suitable Tier 1 demonstration tool.

There is no minimum number of hypothetical sources to include in developing a MERPs Tier 1 demonstration tool, but the benefit of including more hypothetical sources is that more information is available for future sources to use in predicting secondary pollutant impacts from their post-construction emissions. Permitting authorities or permit applicants should examine existing recent (e.g., last 5 to 10 years) permit applications in that area to determine what types of emission rates and stack characteristics (e.g., surface and elevated release) should be reflected in the hypothetical project sources included in the model simulations. These model simulations should include a credible representation of current or post-construction conditions around the project source and key receptors.

Existing regulatory modeling platforms can be used to minimize resource burden. The most recently submitted regulatory demonstration (e.g., O_3 or $PM_{2.5}$ attainment demonstration, Regional Haze SIP demonstration) modeling platform considered appropriate for the purposes of permit related single source secondary impact demonstrations by the reviewing authority could provide a platform for development of a MERPs Tier 1 demonstration tool. This could include the last approved SIP demonstration, a more recent submitted but not yet approved SIP demonstration, or modeling not used to support a SIP demonstration but considered representative of the current air quality in the area and of sufficient quality that is comparable to a model platform supporting a SIP demonstration.

Where multiple appropriate modeling platforms are available for a particular area, the platform that is considered to be the most reflective of the current atmosphere in a particular area should be used for the demonstration to account for growth in an area and the changing mix of sources. For instance, if an area has a SIP modeling platform with a baseline year of 2011 and projected future year of 2018 and the current year is 2018, then the projected future year may better represent air quality in that area.

For areas that do not have an existing regulatory demonstration modeling platform, a new modeling platform that represents the current air quality and conforms to the specifications outlined for attainment demonstration modeling could be acceptable. The specifications for permit related demonstration model platforms (e.g., horizontal grid spacing, vertical resolution, non-project source emission treatment) are detailed in the "Guidance on the use of models for assessing the impacts from single sources on secondarily formed pollutants ozone and PM2.5" (U.S. Environmental Protection Agency, 2016a).

These platforms should be assessed for reasonableness with respect to predictive capability compared to ambient data to ensure that single sources are modeled in a realistic chemical and physical environment.

3.2.2.1. Developing Area Specific MERPs

Photochemical modeling conducted for an area by a source, a governmental agency, or some other entity that is deemed sufficient may be adequate for air agencies to conduct permit related demonstrations and also or alternatively leading to the development of area-specific MERPs.

8-hr Ozone: The general framework for such developmental efforts for O_3 should include the following steps:

1) Define the geographic area(s)
2) Conduct a series of source sensitivity simulations with appropriate air quality models to develop a collection of modeled O_3 impacts associated with emissions of O_3 precursors (i.e., VOC and NO_X) from typical industrial point sources within the area of interest.
3) Extract the highest daily 8-hr average modeled impact related to each hypothetical source anywhere in the domain from each model simulation (U.S. Environmental Protection Agency, 2016a).
4) Calculate the MERP estimate(s) using Equation 1.
5) Conduct quality assurance of the resulting MERP estimate(s) and evaluate the interpretation and appropriateness given the nature of O_3 precursor emissions sources and chemical formation in the area of interest. This evaluation will likely require emissions inventory data, observed ambient data for O_3 and precursors, a comparison of baseline total model predictions against ambient data, and qualitative comparison to MERPs estimated here and elsewhere.

Daily $PM_{2.5}$: The general framework for such developmental efforts for daily $PM_{2.5}$ should include the following steps:

1) Define the geographic area(s)
2) Conduct a series of source sensitivity simulations with appropriate air quality models to develop a collection of modeled $PM_{2.5}$ impacts associated with emissions of $PM_{2.5}$ precursors (i.e., SO_2 and NO_X) from typical industrial point sources within the area of interest.
3) Extract the highest daily 24-hr average modeled impact related to each hypothetical source anywhere in the domain from each model simulation (U.S. Environmental Protection Agency, 2016a).
4) Calculate the MERP estimate(s) using Equation 1.
6) Conduct quality assurance of the resulting MERP estimate(s) and evaluate the interpretation and appropriateness given the nature of $PM_{2.5}$ precursor emissions sources and chemical formation in the area of interest. This evaluation will likely require emissions inventory data, observed ambient data for $PM_{2.5}$ and precursors, a comparison of baseline total model predictions against ambient data, and qualitative comparison to MERPs estimated here and elsewhere.

Annual PM$_{2.5}$: The general framework for such developmental efforts for annual PM$_{2.5}$ should include the following steps:

1) Define the geographic area(s)
2) Conduct a series of source sensitivity simulations with appropriate air quality models to develop a collection of modeled PM$_{2.5}$ impacts associated with emissions of PM$_{2.5}$ precursors (i.e., SO_2 and NO_X) from typical industrial point sources within the area of interest.
3) Extract the highest annual average modeled impact related to each hypothetical source anywhere in the domain from each model simulation (U.S. Environmental Protection Agency, 2016a).
4) Calculate the MERP estimate(s) using the Equation 1.
7) Conduct quality assurance of the resulting MERP estimate(s) and evaluate the interpretation and appropriateness given the nature of PM$_{2.5}$ precursor emissions sources and chemical formation in the area of interest. This evaluation will likely require emissions inventory data, observed ambient data for PM$_{2.5}$ and precursors, a comparison of baseline total model predictions against ambient data, and qualitative comparison to MERPs estimated here and elsewhere.

If there are questions about what steps are appropriate in each instance or how to apply the steps described above, air agencies should contact their Regional office modeling contact for further technical consultation.

4. Application of the MERPs to Individual Permit Applications

The *Guideline* recommends a two-tiered approach for addressing single-source impacts on O_3 or secondary $PM_{2.5}$ (U.S. Environmental Protection Agency, 2017a) with the first tier involving use of appropriate and technically credible relationships between emissions and ambient impacts developed from existing modeling studies deemed sufficient for evaluating a project source's impacts. Consistent with the recommendations in EPA's *Guideline*, the appropriate tier for a given application should be selected in consultation with the appropriate reviewing authority (paragraph 3.0(b)) and after reviewing EPA guidance. This section describes how applicants might choose, in consultation with the appropriate permitting authority, to use MERPs in estimating single-source impacts on secondary pollutants under the first-tier approach (i.e., sections 5.3.2.b and 5.4.2.b of the *Guideline*).

The use of MERPs as a Tier 1 demonstration tool can be based on either (1) EPA photochemical modeling with the source-specific value for a representative hypothetical source (as described in Section 3.2.1) or (2) the source- or area-specific value derived from a more similar hypothetical source modeled by a permit applicant or permitting authority (as described in Section 3.2.2). In some situations, the most conservative (lowest) MERP value across a region/area could be considered representative. The relevant geographic area could range from a county or airshed to a state or multi-state region. The selection of this geographic area may be determined in consultation with the appropriate reviewing authority and technical justification should be provided in the modeling protocol and/or permit-related documentation.

EPA recommends that the permit applicant follow a three-step process as shown in Figure 4-1.

1) Identify a representative hypothetical source (or group of sources for an area) from EPA's modeling as detailed in Appendix Table A-1 or the Excel spreadsheet available on SCRAM. If a representative hypothetical source is not available, then consider whether an EPA derived MERP value available for the broader geographic area of the project source may be adequately representative and thus appropriate to use (see Table 4-1). Alternatively, one can consider conducting photochemical modeling (as described in Section 3.2.2) to derive appropriate information to derive a source- or area-specific value.

   The permit applicant should provide the appropriate permitting authority with a technically credible justification that the source characteristics (e.g., stack height, emissions rate) of the specific project source described in a permit application and the chemical and physical environment (e.g., meteorology, background pollutant concentrations, and regional/local emissions) near that project source are adequately represented by the selected hypothetical source(s).

2) Acquire the source characteristics and associated modeling results for the hypothetical source(s). If using EPA modeling, then access these data from the on-line spreadsheet on

EPA's SCRAM website. If using other modeling, then access these data from the relevant input and output files.

3) Apply the source characteristics and photochemical modeling results from Step 2 to the MERP equation with the appropriate SIL value to assess the project source impacts.

   Section 4.1 provides several example PSD permit application scenarios that illustrate how to use source characteristics and photochemical modeling results to derive a MERP Tier 1 demonstration tool. In general, for situations where the project source emits only one precursor for O_3 or secondary $PM_{2.5}$ (and no primary $PM_{2.5}$ emissions), the project source emissions for that precursor can be compared directly to the appropriate MERP value for that precursor to determine if the applicable SIL is exceeded or not. For situations where project sources are required to assess multiple precursors, EPA recommends that the project source impacts on O_3 or secondary $PM_{2.5}$ reflect the sum of air quality changes resulting from each of those precursors for comparison to the EPA recommended SIL. Further, where project sources are required to assess both primary $PM_{2.5}$ and precursors of secondary $PM_{2.5}$, EPA recommends that applicants combine the primary and secondary impacts to determine total $PM_{2.5}$ impacts as part of the PSD compliance demonstration. In such cases, the project source impacts associated with their direct $PM_{2.5}$ emissions should be assessed through dispersion modeling.

At the start of this process, EPA recommends that the permit applicant consult with the appropriate reviewing authority in developing a modeling protocol (per Section 9 of the *Guideline*) and that both parties confirm, at that time, the appropriateness of using these modeling results for the permitting situation. As part of the protocol, the permit applicant should include a narrative that provides a technical justification that the existing information or planned photochemical modeling is appropriate for the project source(s).

Derived from EPA modeling results, Table 4-1 summarizes the distribution of illustrative MERPs values across climate zones showing the lowest, highest and median values. Consistent with Step 1 outlined above, the most conservative (lowest) illustrative MERP value may, in some cases, be considered adequately representative to characterize the responsiveness of ozone or secondary $PM_{2.5}$ to precursors emitted in a region or area and then be considered for the Tier 1 demonstration in an individual permit application. Climate zones are only used here to summarize the MERPs values for the reader. EPA recommends that the permit applicant consult with the appropriate reviewing authority to determine the relevant geographic area and/or hypothetical source from which to select a representative MERP value.

Figure 4-1. EPA recommended multi-step process for use of MERPs in PSD compliance demonstrations.

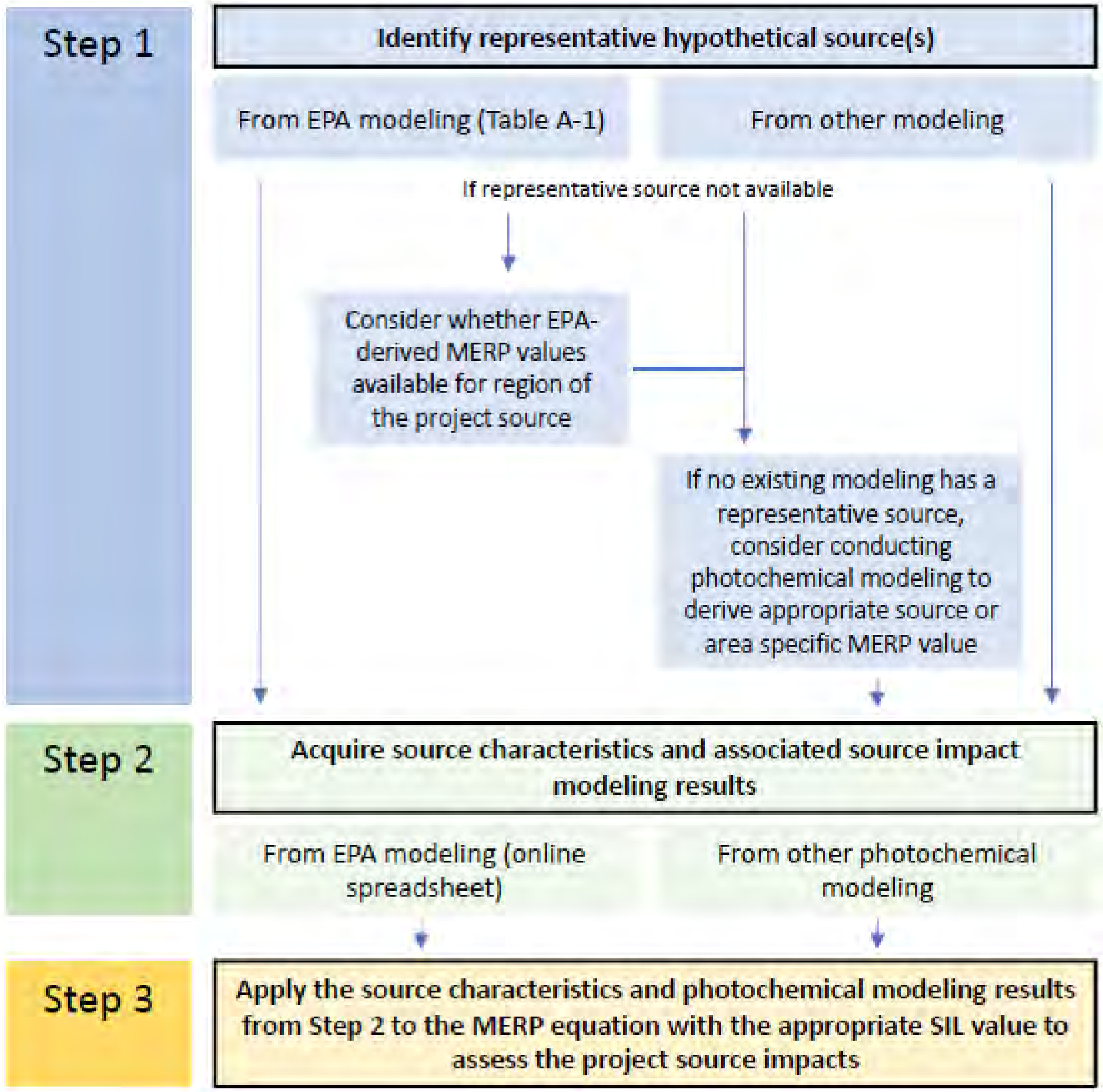


Table 4-1. Lowest, median, and highest illustrative MERP values (tons per year) by precursor, pollutant and climate zone.

Note: illustrative MERP values are derived based on EPA modeling and EPA recommended SILs from EPA's final SILs guidance (U.S. Environmental Protection Agency, 2018).

	8-hr O_3 from NO_X			8-hr O_3 from VOC		
Climate Zone	Lowest	Median	Highest	Lowest	Median	Highest
Northeast	209	495	5,773	2,068	3,887	15,616
Southeast	170	272	659	1,936	7,896	42,964
Ohio Valley	126	340	1,346	1,159	3,802	13,595
Upper Midwest	125	362	4,775	1,560	2,153	30,857
Rockies/Plains	184	400	3,860	1,067	2,425	12,788
South	190	417	1,075	2,307	4,759	30,381
Southwest	204	422	1,179	1,097	10,030	144,744
West	218	429	936	1,094	1,681	17,086
Northwest	199	373	4,031	1,049	2,399	15,929

	Daily PM2.5 from NO_X			Daily PM2.5 from SO_2		
Climate Zone	Lowest	Median	Highest	Lowest	Median	Highest
Northeast	2,218	15,080	34,307	623	3,955	8,994
Southeast	1,943	8,233	23,043	367	2,475	5,685
Ohio Valley	2,570	10,119	32,257	348	3,070	16,463
Upper Midwest	2,963	10,043	29,547	454	2,482	6,096
Rockies/Plains	1,740	9,389	31,263	251	2,587	19,208
South	1,881	8,079	24,521	274	1,511	10,112
Southwest	6,514	26,322	101,456	1,508	8,730	27,219
West	1,073	8,570	34,279	188	2,236	24,596
Northwest	3,003	11,943	20,716	1,203	3,319	8,418

	Annual PM2.5 from NO_X			Annual PM2.5 from SO_2		
Climate Zone	Lowest	Median	Highest	Lowest	Median	Highest
Northeast	10,142	47,396	137,596	4,014	21,353	41,231
Southeast	5,679	45,076	137,516	859	14,447	25,433
Ohio Valley	7,625	31,931	150,868	3,098	23,420	58,355
Upper Midwest	10,011	33,497	139,184	2,522	17,997	45,113
Rockies/Plains	9,220	39,819	203,546	2,263	16,939	106,147
South	7,453	41,577	110,478	1,781	11,890	58,612
Southwest	11,960	128,564	779,117	10,884	38,937	105,417
West	3,182	29,779	103,000	2,331	11,977	66,773
Northwest	7,942	21,928	71,569	11,276	15,507	18,263

4.1. Illustrative MERP Tier 1 Demonstrations for Example PSD Permit Scenarios

In this section, several example PSD permit application scenarios are presented to illustrate how modeled emissions and secondary pollutant impacts from EPA's modeling of hypothetical sources (described in Section 3.2.1) could be used to derive a MERP Tier 1 demonstration tool (as described in Section 3.1) for a given location. Some of these examples demonstrate how to account for multiple precursor impacts on secondary $PM_{2.5}$ formation. One scenario (i.e., scenario D) reflects a situation where a project source emits both primary $PM_{2.5}$ and precursors to secondary $PM_{2.5}$. In those situations, applicants should consult the appropriate sections of the *Guideline* (U.S. Environmental Protection Agency, 2017a) and related permit modeling guidance for information about estimating primary PM2.5 impacts**.** As illustrated in these examples, representative MERPs for each precursor may be developed based on either the most conservative (lowest) value across a region/area or the source-specific value derived from a more similar hypothetical source modeled by a permit applicant, permitting authority, or EPA.

For multiple areas, Table 4.1 shows an example of the most conservative (i.e., lowest) illustrative MERP for each precursor and NAAQS across all sources and studies. These illustrative values in Table 4.1 are based on the EPA modeling of hypothetical sources described in Section 3.2.1. For reference at the individual source level, the maximum predicted downwind impacts for each of the hypothetical sources modeled with annual simulations are provided in the Excel spreadsheet available on EPA's SCRAM website.

4.1.1. Source Impact Analysis: O_3 and $PM_{2.5}$ NAAQS

The following section provides examples of developing a suitable Tier 1 demonstration tool for each precursor and secondary pollutant as part of a PSD source impact analysis for the O_3 and $PM_{2.5}$ NAAQS. Where only a single precursor of O_3 or $PM_{2.5}$, and no direct $PM_{2.5}$, is emitted by the project source, then the MERP for that precursor may be directly applied. For situations where project sources are required to assess multiple precursors of $PM_{2.5}$ or of O_3, EPA recommends that the impacts of multiple precursors should be estimated in a combined manner for comparison to the appropriate SIL such that the sum of precursor impacts would be lower than the SIL in a demonstration of compliance. Further, where project sources are required to assess both primary $PM_{2.5}$ and precursors of secondary $PM_{2.5}$, EPA recommends that applicants combine the primary and secondary impacts to determine total $PM_{2.5}$ impacts as part of the PSD compliance demonstration. In such cases, the project source impacts associated with their direct $PM_{2.5}$ emissions should be assessed through dispersion modeling.

In this assessment, the maximum downwind impact from each source is chosen over the length of the model simulation period and matched with the annual emission rate. The maximum impact is selected since a single year of meteorology (or less in some instances) is used to generate these relationships. Additional or alternative meteorological patterns may result in different impacts in some areas. The following illustrative examples are intended to show how MERP values may be used in specific PSD permit air quality demonstrations.

Scenario A: Single precursor assessment for $PM_{2.5}$ and additive O_3 impacts

In this scenario, a PSD permit applicant with a proposed increase in emissions of 0 tpy of primary $PM_{2.5}$, 130 tpy of VOC, 72 tpy of NO_X, and 0 tpy of SO_2 located in the upper midwest region.

<u>O_3 analysis</u>: The project source is not located in an area with unusual circumstances regarding complex terrain, proximity to very large sources of either NO_X or VOC, or meteorology. Thus, the climate zone may be defined as the relevant geographic area such that the lowest MERPs from Table 4-1 for the upper midwest region could be considered representative and chosen for comparison with the project emissions rather than selecting a particular hypothetical source from this same climate zone. In practice, EPA recommends that the permit applicant consult with the appropriate reviewing authority to determine the relevant hypothetical source and geographic area from which to select representative MERP values.

The NO_X emissions of 72 tpy and VOC emissions of 130 tpy from the project source are well below the lowest (most conservative) MERP values for NO_X as an O_3 precursor (i.e., 125 tpy) and VOC as an O_3 precursor (i.e., 1,560 tpy), respectively, of all sources modeled by EPA in the upper midwest region, as shown in Table 4-1. In this case, air quality impacts for each O_3 precursor from this source would be expected to be below the EPA recommended 8-hour O_3 SIL.

However, for this example, EPA recommends that the NO_X and VOC precursor impacts on 8-hr daily maximum O_3 be considered together to determine if the project source's air quality impact would exceed the O_3 SIL. In such a case, the project source's emissions increase can be expressed as a percent of the MERP for each precursor and then the percentages can be summed. A value less than 100% indicates that the EPA recommended 8-hour O_3 SIL will not be exceeded when considering the combined impacts of these precursors on 8-hr daily maximum O_3.

Example calculation for additive precursor impacts on 8-hr daily maximum O_3:

> (72 tpy NO_X from source/125 tpy NO_X 8-hr daily maximum O_3 MERP) + (130 tpy VOC from source/1,560 tpy VOC 8-hr daily maximum O_3 MERP) = .58 + .08 = .66 * 100 = 66%

A value less than 100% indicates that the O_3 SIL would not be exceeded when considering the combined impacts of these precursors. Thus, the project level O_3 impacts associated with both NO_X and VOC precursor emissions from this source would be expected to be below the EPA recommended 8-hour O_3 SIL.

<u>$PM_{2.5}$ analysis</u>: The project source is not located in an area with unusual circumstances

regarding complex terrain, proximity to very large sources of pollutants that impact atmospheric chemistry (i.e., NO_X, SO_2, NH_3) or meteorology. Thus, similar to the O_3 analysis above, the climate zone may be defined as the relevant geographic area such that the lowest MERPs from Table 4-1 for the upper midwest region could be considered adequately representative and chosen for comparison with the project emissions rather than selecting a particular hypothetical source from this same region. EPA recommends that the permit applicant consult with the appropriate reviewing authority to determine the relevant hypothetical source and geographic area from which to select representative MERP values.

The project source emits no direct $PM_{2.5}$ nor SO_2 so the demonstration focuses only on the NO_X emissions increase of 72 tpy, which is well below the lowest (most conservative) MERP value in the upper midwest region for NO_x as a precursor for the daily and annual $PM_{2.5}$ NAAQS shown in Table 4-1, i.e., 2,963 tpy and 10,011 tpy respectively. In this case, air quality impacts of $PM_{2.5}$ from this source are expected to be below the EPA recommended 24-hour and annual $PM_{2.5}$ SILs.

Scenario B: Single precursor assessment for O_3 impacts and additive secondary $PM_{2.5}$ impacts

In this scenario, a facility with a proposed increase in emissions of 0 tpy of primary $PM_{2.5}$, 0 tpy of VOC, 220 tpy of NO_X, and 75 tpy of SO_2 located in the southeast region.

<u>O_3 analysis</u>: The project source is not located in an area with unusual circumstances regarding complex terrain, proximity to very large sources of either NO_X or VOC, or meteorology. The project source does not emit VOC so the demonstration focuses only on the NOx emission increase of 220 tpy, which is greater than the lowest (most conservative) NO_X MERP for 8-hr O_3 in the southeast region (i.e., 170 tpy). Thus, for this example, even though the project source's surrounding environment does not raise an obvious regional feature that would influence downwind O_3 impacts, it is likely more appropriate to use a specific hypothetical source in the same region or other appropriate geographic area for comparison.

A comparable hypothetical source is identified to be representative of this source (e.g., southeast region source located in Tallapoosa County, Alabama with elevated emissions release). Here, equation 1 is used with the modeled emissions rates and air quality impact information from this hypothetical source. Since multiple hypothetical sources were modeled at this location with an elevated release, the source with the lowest MERP was selected for comparison with the project source, i.e.,

> MERP for selected representative hypothetical source (tpy) = 1.0 ppb * (500 tpy /1.528 ppb) = 327 tpy

In this case, based on EPA modeling results for a representative hypothetical source, the project source emissions are less than the calculated NO_X to 8-hr O_3 MERP such that air quality impacts of O_3 from this source would be expected to be less than the EPA recommended 8-hour O_3 SIL.

PM$_{2.5}$ analysis: The project source is not located in an area with unusual circumstances regarding complex terrain, proximity to very large sources of pollutants that impact atmospheric chemistry (i.e., NO_X, SO_2, NH_3) or meteorology. Thus, the climate zone may be defined as the relevant geographic area such that the lowest MERPs from Table 4-1 for the southeast region could be considered adequately representative and chosen for comparison with the project emissions rather than selecting a particular hypothetical source from this same region. In practice, EPA recommends that the permit applicant consult with the appropriate reviewing authority to determine the relevant hypothetical source and geographic area from which to select representative MERP values.

For this example, both the NO_X emissions of 220 tpy and SO_2 emissions of 75 tpy are well below the lowest (most conservative) daily $PM_{2.5}$ MERP values of any source modeled in the southeastern region, i.e., 1,943 tpy for NO_X and 367 tpy for SO_2 respectively. These emission rates are also well below the annual $PM_{2.5}$ MERP values of any source modeled in the southeastern region (see Table 4-1).

However, for this example, EPA recommends that the NO_X and SO_2 precursor impacts to both daily and annual average $PM_{2.5}$ are considered together to determine if the project source's air quality impact on $PM_{2.5}$ would exceed the $PM_{2.5}$ SILs. In this case, the project source's emissions increase can be expressed as a percent of the MERP for each precursor and then the percentages can be summed. A value less than 100% indicates that the EPA recommended daily or annual $PM_{2.5}$ SIL would not be exceeded when considering the combined impacts of these precursors on daily or annual $PM_{2.5}$.

Example calculation for additive secondary impacts on daily $PM_{2.5}$:

> (220 tpy NO_X from source/1,943 tpy NO_X daily $PM_{2.5}$ MERP) + (75 tpy SO_2 from source/367 tpy SO_2 daily $PM_{2.5}$ MERP) = .11 + .20 = .31 * 100 = 31%

Example calculation for additive secondary impacts on annual $PM_{2.5}$:

> (220 tpy NO_X from source/5,679 tpy NO_X annual $PM_{2.5}$ MERP) + (75 tpy SO_2 from source/859 tpy SO_2 annual $PM_{2.5}$ MERP) = .04 + .09 = .13 * 100 = 13%

A value less than 100% indicates that the $PM_{2.5}$ SIL would not be exceeded when considering the combined impacts of these precursors on daily or annual $PM_{2.5}$. Thus, in this case, the air quality impacts of $PM_{2.5}$ from precursor emissions of NO_X and SO_2 from this source would be expected to be less than the EPA recommended daily and annual $PM_{2.5}$ SILs.

Scenario C: Single precursor assessment for O_3 and additive $PM_{2.5}$ impacts

In this scenario, a facility with a proposed increase in emissions of 0 tpy of primary $PM_{2.5}$, 0 tpy of VOC, 920 tpy of NO_X, and 259 tpy of SO_2 located in the Rockies region.

O_3 analysis: The project source is not located in an area with unusual circumstances regarding complex terrain, proximity to very large sources of either NO_X or VOC, or meteorology. The project source does not emit VOC so the demonstration focuses only on the NOx emission increase of 920 tpy, which is greater than the lowest (most conservative) NO_X MERP for 8-hr O_3 in the Rockies region (i.e., 184 tpy). Thus, for this example, even though the project source's surrounding environment does not raise an obvious regional feature that would influence downwind O_3 impacts, it is likely more appropriate to use a hypothetical source for comparison.

A comparable hypothetical source is identified to be representative of this source (e.g., Rockies region in Iron County, Utah with elevated release). Here, equation 1 is used with the modeled emissions rates and air quality impact information from the selected comparable source. Since multiple hypothetical sources were modeled at this location with an elevated release, the source with the most similar emission rate was selected for comparison with the project source, i.e.,

> MERP for selected representative hypothetical source (tpy) = 1.0 ppb * (1000 tpy / 1.314 ppb) = 761 tpy

In this case, based on EPA modeling results for a representative hypothetical source, the project source emissions are greater than the calculated NO_X to 8-hr O_3 MERP such that air quality impacts of O_3 from this source are expected to exceed the EPA recommended 8-hour O_3 SIL. Given that the NO_X emissions from this project source are expected to have air quality impacts that exceed the O_3 SIL, a cumulative impact analysis would be the next step in this scenario. More information for this type of demonstration is provided in Section 4.1.3.

$PM_{2.5}$ analysis: The project source is not located in an area with unusual circumstances regarding complex terrain, proximity to very large sources of pollutants that impact atmospheric chemistry (i.e., NO_X, SO_2, NH_3) or meteorology. The NO_X emissions of 920 are below the lowest (most conservative) daily and annual $PM_{2.5}$ MERP value of any source modeled in the Rockies region (i.e., 1.740 tpy and 9,220 tpy respectively), while the SO_2 emissions of 259 tpy are slightly higher than the lowest daily $PM_{2.5}$ MERP value of any source modeled in the Rockies region (i.e., 251 tpy for daily and 2,263 tpy for annual). Thus, for this example, even though the project source's surrounding environment does not raise an obvious regional feature that would influence downwind secondary $PM_{2.5}$ impacts, it is likely more appropriate to use a hypothetical source for comparison.

A hypothetical representative source is identified to be representative of this source (e.g., Rockies region in Iron County, Utah) and has a 1,000 tpy elevated release NO_X MERP for daily $PM_{2.5}$ of 25,754 tpy and SO_2 MERP for daily $PM_{2.5}$ of 7,515 tpy, which are both much larger than the increase in emissions of the project source such that the source's impact on daily $PM_{2.5}$ would be expected to be less than the EPA recommended daily $PM_{2.5}$ SIL. The same hypothetical source has a NO_X MERP for annual $PM_{2.5}$ of 166,670 tpy and SO_2 MERP for annual $PM_{2.5}$ of 37,997 tpy, which are both much larger than the increase in emissions of the project source such that the source's impact on annual $PM_{2.5}$ would be expected to be less than the

EPA recommended annual $PM_{2.5}$ SIL. However, for this example, EPA recommends that the NO_X and SO_2 precursor contributions to both daily and annual average $PM_{2.5}$ are considered together to determine if the project source's air quality impact of $PM_{2.5}$ would exceed the $PM_{2.5}$ SILs. In this case, the project source's emissions increase can be expressed as a percent of the MERP for each precursor and then the percentages can be summed.

Example calculation for additive secondary impacts on daily $PM_{2.5}$:

> (920 tpy NO_X from source/25,754 tpy NO_X daily $PM_{2.5}$ MERP) + (259 tpy SO_2 from source/7,515 tpy SO_2 daily $PM_{2.5}$ MERP) = .036 + .034 = .07 * 100 = 7%

Example calculation for additive secondary impacts on annual $PM_{2.5}$:

> (920 tpy NO_X from source/166,670 tpy NO_X annual $PM_{2.5}$ MERP) + (259 tpy SO_2 from source/37,997 tpy SO_2 annual $PM_{2.5}$ MERP) = .006 + .007 = .013 * 100 = 1.3%

A value less than 100% indicates that the $PM_{2.5}$ SIL would not be exceeded when considering the combined impacts of these precursors on daily or annual $PM_{2.5}$. Thus, in this case, the air quality impacts of $PM_{2.5}$ from precursor emissions of NO_X and SO_2 from this source would be expected to be less than both the EPA recommended daily and annual $PM_{2.5}$ SILs.

Scenario D: NO_X and SO_2 precursor assessment for additive secondary $PM_{2.5}$ impacts along with direct $PM_{2.5}$

In this scenario, a facility with a proposed increase in emissions of 250 tpy of primary $PM_{2.5}$, 0 tpy of VOC, 220 tpy of NO_X, and 75 tpy of SO_2 located in the southeast region. This scenario is like Scenario B above, except that EPA recommends that in assessing $PM_{2.5}$ the primary $PM_{2.5}$ emissions be accounted for along with the secondary impacts of $PM_{2.5}$ precursor emissions as part of the Tier 1 demonstration.

O_3 analysis: See scenario B above.

$PM_{2.5}$ analysis: Same as Scenario B as to $PM_{2.5}$ precursors. The combined impacts of the proposed increases in $PM_{2.5}$ precursor emissions of NO_X and SO_2 would not exceed the EPA recommended daily or annual $PM_{2.5}$ SILs.

However, for this example, EPA recommends that the primary $PM_{2.5}$ impacts be added to the secondary impacts for a full account of total $PM_{2.5}$ impacts in comparison to the daily and annual $PM_{2.5}$ SILs. The primary $PM_{2.5}$ impacts should be estimated using AERMOD or an approved alternative model as outlined in the *Guideline* (U.S. Environmental Protection Agency, 2017a) and consistent with EPA guidance for combining primary and secondary impacts of $PM_{2.5}$ for permit program assessments.

In this scenario, a representative secondary $PM_{2.5}$ impact for this source is added to the appropriately estimated primary $PM_{2.5}$ impacts. The highest ambient impact at any receptor for primary $PM_{2.5}$ should be divided by the daily or annual $PM_{2.5}$ SIL values to estimate the primary impact calculated as a percentage of the SIL value and then added to the previously calculated secondary impacts.

For the daily $PM_{2.5}$ NAAQS, a peak primary $PM_{2.5}$ impact from AERMOD in this scenario is estimated to be 0.41 μg/m^3. Compared with a 1.2 μg/m^3 SIL for daily $PM_{2.5}$ means that the primary impact is 34% of the SIL. When this primary impact is summed with the secondary impacts of 31% the total is 65% which is below 100% suggesting this source impact is below the EPA recommended daily $PM_{2.5}$ SIL.

For the annual $PM_{2.5}$ NAAQS, annual average primary $PM_{2.5}$ impact from AERMOD is estimated to be 0.11 μg/m^3 for the scenario above. Compared with a 0.2 μg/m^3 SIL for annual $PM_{2.5}$ means that the primary impact is 55% of the SIL. When this primary impact is summed with the secondary impacts of 13% the total is 68% which is below 100% suggesting this source impact is below the EPA recommended annual $PM_{2.5}$ SIL.

Accounting for spatial correlation of primary and secondary impacts: As a variant on this scenario, for the daily $PM_{2.5}$ NAAQS, if the peak primary $PM_{2.5}$ impact from AERMOD is estimated to be 0.90 μg/m^3 for the above scenario, then the percent primary contribution to the SIL would be 75%. When summed with the secondary contribution of 31%, the total source impact exceeds 100% and, therefore, is greater than the EPA recommended daily $PM_{2.5}$ SIL. In this case, the spatial nature of the primary and secondary $PM_{2.5}$ impacts of the project source may be resolved in a more detailed manner to gain a better estimate of the project source impact for comparison to the $PM_{2.5}$ SILs. Primary impacts tend to be higher in closer proximity of the source, whereas secondary impacts can be higher further downwind (beyond the property fence line). For example, the primary and secondary $PM_{2.5}$ impacts could be resolved at varying distances from the source (e.g., within 5-10 km, between 10 and 25 km, and between 25 and 50 km) and then combined at each distance range for a comparison with the EPA recommended $PM_{2.5}$ SILs. If the more spatially resolved assessment still finds combined percentages above 100%, then a cumulative impact analysis would be the next step for this demonstration. More information for this type of demonstration is provided in Section 4.1.3.

4.1.2. Source Impact Analysis: Class 1 PSD Increment for $PM_{2.5}$

This section provides information for single source permit demonstrations for PSD increment of $PM_{2.5}$ at Class I areas. According to 40 CFR 51.166(c)(1) and 52.21(c), an allowable PSD increment based on an annual average may not be exceeded, and the allowable PSD increment for any other time period may be exceeded once per year at any one location. Currently there is no PSD increment for O_3 so no PSD increment demonstration for O_3 is necessary. The $PM_{2.5}$ PSD increment SIL values recommended by EPA for Class II and III areas are the same as the recommended $PM_{2.5}$ NAAQS SIL values so no separate PSD increment demonstration is needed for Class II and III areas.

The hypothetical model results provided in this document represent peak impacts for secondary $PM_{2.5}$, which are typically within 50 km from the source (see section 3.2.1). These impacts may not be applicable for PSD increment demonstrations at Class I area receptors that may be far downwind (beyond 50 km) of the project source. As stated in the *Guideline*, AERMOD is the preferred dispersion model for estimating primary $PM_{2.5}$ impacts from single sources for distances up to 50 km. Currently, there is no preferred modeling system for estimating long range transport impacts (i.e., beyond 50 km). The *Guideline* establishes a screening approach for such assessments (U.S. Environmental Protection Agency, 2017a).

The screening approach for the primary $PM_{2.5}$ component of a PSD Class I area demonstration beyond 50 km could include AERMOD estimates at or about 50 km from the project source (Section 4.2.c.i of the *Guideline*) or a second level assessment based on modeling primary PM2.5 that does not include plume-depleting processes to ensure a conservative estimate (Section 4.2.c.ii of the *Guideline*). The *Guideline* suggests a Lagrangian or comparable modeling system would be appropriate for a second level assessment. Photochemical grid models have been shown to demonstrate similar skill to Lagrangian models for long range pollutant transport when compared to measurements made from multiple mesoscale field experiments (ENVIRON, 2012a; U.S. Environmental Protection Agency, 2016c). EPA modeled a subset of the hypothetical sources shown in Figure 3-2 with tracking of primary $PM_{2.5}$ contribution (N=36) using the CAMx model applied without chemistry. A table of maximum daily average and maximum annual average primary $PM_{2.5}$ impacts by emission rate are shown in Table 4-2. This table is intended to provide illustrative information about peak downwind primary $PM_{2.5}$ impacts at distances beyond 50 km and where agreed to by the appropriate reviewing authority may provide relevant information to support Tier 1 PSD Class I increment demonstrations.

Table 4-2. Maximum daily average and maximum annual average primary $PM_{2.5}$ impacts at 100, 200, and 300 km from modeled hypothetical source.

Emission Rate (tpy)	Distance from source (km)	Highest Daily Average Concentration (μg/m^3) - tall stack	Highest Daily Average Concentration (μg/m^3) - surface release	Highest Annual Average Concentration (μg/m^3) - tall stack	Highest Annual Average Concentration (μg/m^3) - surface release
100	300	0.0117	0.0123	0.0008	0.0009
100	200	0.0223	0.0212	0.0016	0.0015
100	100	0.0537	0.0445	0.0070	0.0049
150	300	0.0180	0.0184	0.0012	0.0013
150	200	0.0328	0.0311	0.0024	0.0022
150	100	0.0807	0.0632	0.0102	0.0073
500	300	0.0610	0.0625	0.0044	0.0045
500	200	0.1167	0.1095	0.0087	0.0078
500	100	0.2717	0.2536	0.0379	0.0238
1000	300	0.1186	0.1217	0.0087	0.0089
1000	200	0.2300	0.2161	0.0175	0.0157
1000	100	0.5445	0.5009	0.0731	0.0477

Single source impacts on secondary $PM_{2.5}$ tend to decrease as distance from the source increases (Baker et al., 2016), which means peak source impacts presented in previous sections to inform a $PM_{2.5}$ NAAQS air quality assessment may not provide relevant information for the spatial scales involved between project sources and Class I areas. Given that project source impacts will be lower at greater distances (see also Figure 3.6), the illustrative MERPs listed in Section 4 would not usually be relevant (unless the source and Class I area were in close proximity), so applicants should follow the screening approach described in this section for a Tier 1 demonstration of compliance with the Class I PSD increment for $PM_{2.5}$.

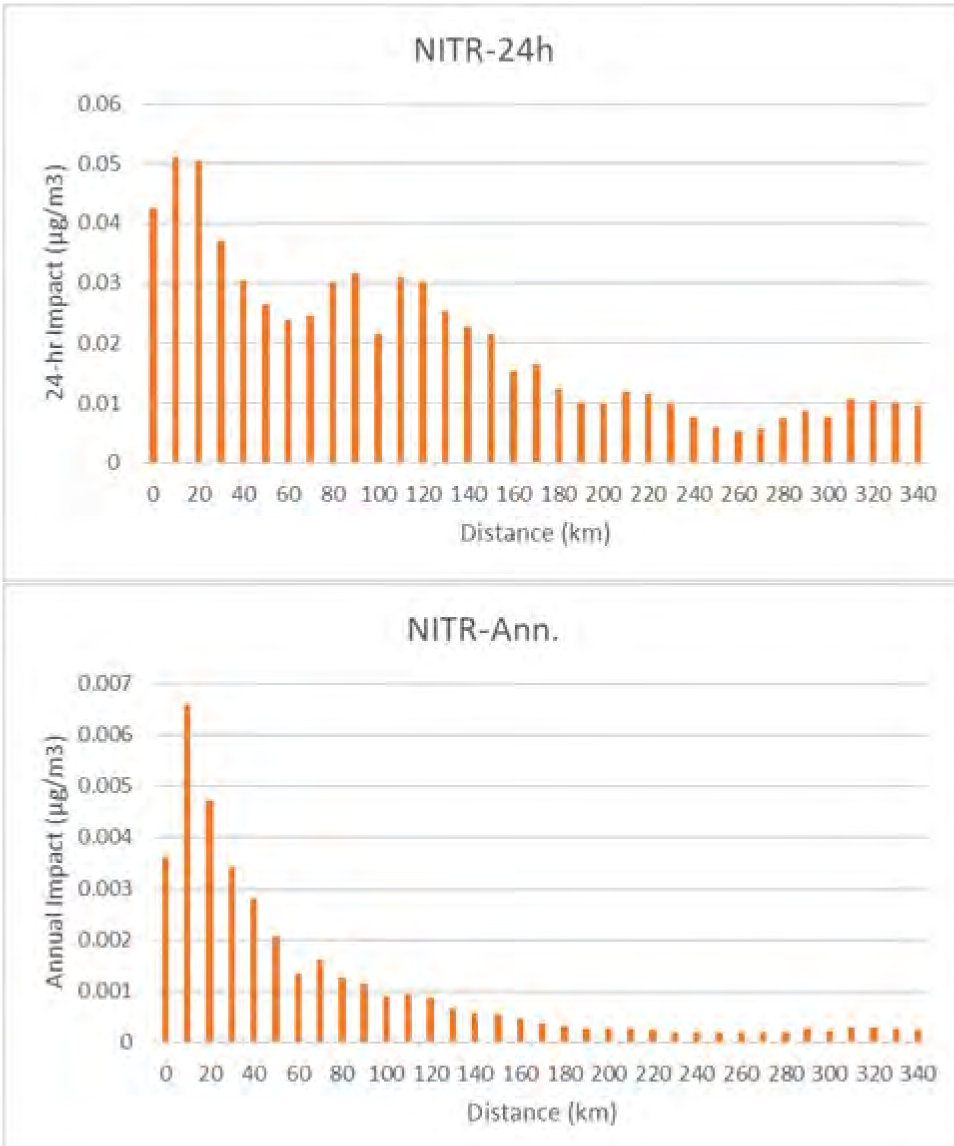
The hypothetical source impact information generated as part of the illustrative examples shown here or other credible existing single source modeling could provide information relevant for Class I SIL screening demonstrations. Rather than using the peak impact, the entirety of modeled information available for a specific project source (if available) or hypothetical source (such as but not limited to the sources modeled as part of this document) could be used to provide an estimate of secondary $PM_{2.5}$ impacts at distances further downwind.

Consistent with the long-range transport (LRT) screening approach in the *Guideline*, the initial screening step would be to select one or more of the hypothetical sources modeled as part of the illustrative assessment provided in this document that are found to be similar to the project source. Then, modeled maximum secondary $PM_{2.5}$ impacts at or greater than 50 km would be used in combination with primary $PM_{2.5}$ impacts estimated with AERMOD at 50 km downwind of the source for comparison to the EPA recommended $PM_{2.5}$ Class I SIL value. Information about using AERMOD to support a LRT demonstration for primary pollutants is provided elsewhere (U.S. Environmental Protection Agency, 2016d).

If the results of the initial screening step show an exceedance of the $PM_{2.5}$ Class I SIL value, a second more refined screening step would involve selecting the highest modeled secondary $PM_{2.5}$ impact at or less than the downwind distance of the Class I area relative to the project source. That value would be combined with primary $PM_{2.5}$ impacts estimated with AERMOD at 50 km downwind and compared with the EPA recommended $PM_{2.5}$ Class I SIL. Another option for this screening step would also involve selecting the highest modeled secondary $PM_{2.5}$ impact at or near the downwind distance of the Class I area relative to the project source but include an estimate of primary $PM_{2.5}$ impacts estimated with a chemical transport model (e.g., Lagrangian or photochemical model) at or less than the downwind distance of the Class I area relative to the project source.

An illustrative example of this type of a screening demonstration for Class I $PM_{2.5}$ increment would be a 3,000 tpy NO_X project source that emits near the surface in the northeast U.S. This project source does not emit SO_2 so secondary formation of $PM_{2.5}$ sulfate ion does not need to be considered in addition to $PM_{2.5}$ nitrate formation from the NO_X emissions. The nearest Class I area is ~300 km downwind of the project source. Multiple hypothetical sources (3 for this particular example) with ground-level emission release characteristics near the project source were examined for annual and 24-hr average $PM_{2.5}$ nitrate impacts at or greater than 50 km and at or near 300 km downwind of the source in any direction. Figure 4-2 shows the peak hypothetical source impacts from 500 tpy of emissions at ~50 km downwind on $PM_{2.5}$ nitrate for daily $PM_{2.5}$ is 0.032 µg/m^3 and annual $PM_{2.5}$ is 0.002 µg/m^3. As shown, at approximately 310 km from the project source, the peak hypothetical source impacts on $PM_{2.5}$ nitrate for daily $PM_{2.5}$ would be 0.01 µg/m^3 and 0.0003 µg/m^3 for annual $PM_{2.5}$ (see Figure 4-2).

Figure 4-2. Modeled peak daily average (top) and annual average (bottom) $PM_{2.5}$ nitrate ion impacts from a hypothetical 500 tpy surface level source of NO_X emissions by distance downwind of the source.



The hypothetical source NO_X emission rate is 500 tpy and the project source emission rate is 3,000 tpy. Impacts from the 500 tpy hypothetical sources are linearly scaled (increased in this example) to be better representative of the project source emission rate. For example, the daily $PM_{2.5}$ nitrate impacts at 50 km downwind would be adjusted to 0.192 µg/m^3: 0.032 µg/m^3 *

3000 tpy/500 tpy = 0.192 μg/m^3. The annual $PM_{2.5}$ nitrate impacts at 300 km downwind would be adjusted to 0.0018 μg/m^3: 0.0003 μg/m^3 * 3000 tpy/500 tpy = 0.0018 μg/m^3.

As part of the initial screening step, the project source impact of 0.192 μg/m^3 for daily $PM_{2.5}$ at 50 km downwind is added to its primary impact estimated with AERMOD at 50 km for comparison with the EPA recommended 24-hr $PM_{2.5}$ Class I area SIL of 0.27 μg/m^3. Assuming the primary impacts are below 0.078 μg/m^3, the project source could include this screening demonstration in its PSD application. Otherwise, the project source would move on to the second step with more refined screening demonstration based on 0.01 μg/m^3 impacts per 500 tpy NO_X at 300 km distance downwind, i.e., 0.01 μg/m^3 * 3000 tpy/500 tpy = 0.06 μg/m^3 of $PM_{2.5}$ nitrate.

This estimate of secondary contribution at the distance of the Class I area from the project source would then be added to the primary impacts modeled with AERMOD at 50 km and be compared with the EPA recommended $PM_{2.5}$ Class I SIL. If the sum of the more refined secondary contribution paired with the primary $PM_{2.5}$ contribution exceeds the SIL, the next step in the screening demonstration would utilize an estimate of primary $PM_{2.5}$ using a chemical transport model (e.g., Lagrangian or photochemical model) that can be paired with the secondary impact at 300 km downwind (as shown above). In situations where the screening demonstration does not show downwind impacts of $PM_{2.5}$ at Class I areas below the SIL, then a more refined approach to estimate the impacts from their project source based on methods suggested for Tier 2 demonstrations may be considered prior to conducting a cumulative impact analysis.

4.1.3. Cumulative Impact Analysis: O_3 and $PM_{2.5}$ NAAQS

As detailed in Section 9 of the *Guideline*, for situations where the project source is not able to demonstrate compliance through the source impact analysis, a cumulative impact analysis can be conducted that accounts for the impacts from the project source, impacts from nearby sources (as appropriate), and monitored background levels. The cumulative impacts are then compared to the NAAQS to determine whether the project source could cause or contribute to a NAAQS exceedance.

The following section provides examples of developing a suitable Tier 1 demonstration tool for each precursor and secondary pollutant for the purposes of a cumulative impact analysis. Where only a single precursor of O_3 or $PM_{2.5}$ necessitates a demonstration, then a direct application of this approach would be appropriate. For situations where project sources are required to assess multiple precursors of $PM_{2.5}$ or of O_3, EPA recommends that the impacts of multiple precursors should be estimated in a combined manner for comparison to the appropriate SIL such that the sum of precursor impacts would be lower than the SIL in a demonstration of compliance. Further, where project sources are required to assess both primary $PM_{2.5}$ and precursors of secondary $PM_{2.5}$, EPA recommends that applicants combine the primary and secondary impacts to determine total $PM_{2.5}$ impacts as part of the PSD compliance demonstration. In such cases, the project source impacts associated with their direct $PM_{2.5}$ emissions should be assessed through dispersion modeling. The examples below include each of these situations.

The Tier 1 demonstration approach detailed in Section 3 of this document can be modified for use in a cumulative impact assessment. Here, existing relevant single source modeled impacts can be estimated and then added to the appropriate background contribution for comparison to the NAAQS. The MERP equation (Eq. 1) can be rearranged such that instead of calculating a modeled emission rate based on a critical air quality threshold such as a SIL value, a project specific impact would be estimated. Equation 2 shows how a project source impact would be the product of the relevant hypothetical source air quality impact relative to emissions scaled either upwards or downwards to the emission rate of the project.

Eq. 2 $\quad \text{Project Impact} = \text{Project emission rate} \times \frac{\text{Modeled air quality impact from hypothetical source}}{\text{Modeled emission rate from hypothetical source}}$

For simplicity in these examples, nearby and background levels are represented by the design value from a representative monitor. In this situation, the cumulative assessment would include the sum of equation 2 and that monitored design value.

Eq. 3 $\quad \text{Projected Design Value with Project} = \text{Project Impact (Eq. 2)} + \text{Monitored Design Value}$

If equation 3 results in an air quality level less that the NAAQS, then there is no NAAQS violation for which the source could cause or contribute to. However, if equation 3 results in an air quality level greater than the NAAQS, then the permit applicant should consult with the reviewing authority to determine the next step in the demonstrating project source impact at the location of the NAAQS violation. This may necessitate more refined modeling to reconcile project source impacts and monitored design values to complete the second phase of the cumulative impact analysis.

The following illustrative examples are intended to show how existing modeling information may be used in specific permit demonstrations.

Scenario A: Single precursor assessment for O_3 and additive secondary $PM_{2.5}$ impacts

In this scenario, a facility with a proposed increase in emissions of 0 tpy of primary $PM_{2.5}$, 0 tpy of VOC, 600 tpy of NO_X, and 3,100 tpy of SO_2 located in the southeast region.

<u>O_3 source impact analysis</u>: The project source is not located in an area with unusual circumstances regarding complex terrain, proximity to very large sources of either NO_X or VOC, or meteorology. However, the NO_X emissions of 600 tpy are larger than the lowest (most conservative) NO_X MERP for 8-hr O_3 in the southeast region (i.e., 170 tpy). Thus, even though the project source's surrounding environment does not raise an obvious regional feature that would influence downwind O_3 impacts, it is likely more appropriate to use a hypothetical source

in the same region or other appropriate geographic area for comparison. In practice, EPA recommends that the permit applicant consult with the appropriate reviewing authority to determine the relevant hypothetical source and geographic area from which to select representative MERP values.

A comparable hypothetical source is identified to be representative of the project (e.g., southeast region source located in Tallapoosa County, Alabama with elevated emissions release). Since multiple hypothetical sources were modeled at this location with an elevated release, the source with the lowest MERP was selected for comparison with the project source. The project source does not emit VOC so a MERP approach addressing only NO_X emission is sufficient in this example. For this example, equation 2 was used to estimate air quality impacts using the hypothetical source information rather than equation 1 because this form of the Tier 1 demonstration approach more clearly fits into the subsequent cumulative assessment.

Project source impact (ppb) = 600 tpy * (1.528 ppb / 500 tpy) = 1.83 ppb

In this case, based on EPA modeling results for a representative hypothetical source, air quality impacts of O_3 from this project source would be expected to exceed the EPA recommended 8-hour O_3 SIL.

<u>O_3 cumulative impact analysis</u>: For the cumulative impact analysis, the impact estimated with equation 2 in the source impact analysis was used with an estimate of nearby source impacts and background O_3, which was a nearby monitor design value. The representative monitor near the project source has a design value of 65 ppb.

Projected Design Value with Project Source (ppb) = 1.83 ppb + 65 ppb = 66.83 ppb

When the source impact is combined with the nearby monitor design value using equation 3, the projected value is below the level of the O_3 NAAQS of 70 ppb.

<u>$PM_{2.5}$ source impact analysis</u>: The project source is not located in an area with unusual circumstances regarding complex terrain, proximity to very large sources of pollutants that impact atmospheric chemistry (i.e., NO_X, SO_2, NH_3) or meteorology. Both the NO_X and SO_2 emissions are below the lowest (most conservative) daily and annual $PM_{2.5}$ MERP values of any source modeled in the southeast region. The SO_2 emissions are not very far below the most conservative MERP relating SO_2 emissions to daily PM2.5 impacts. Thus, for simplicity in this example, even though the project source's surrounding environment does not raise an obvious regional feature that would influence downwind secondary $PM_{2.5}$ impacts, it is likely more appropriate to use a specific hypothetical source in the same region or other appropriate geographic area for comparison. In practice, EPA recommends that the permit applicant consult with the appropriate reviewing authority to determine the relevant hypothetical source and geographic area from which to select representative MERP values.

A comparable hypothetical source is identified to be representative of this project (e.g., southeast region source located in Tallapoosa County, Alabama with elevated emissions release) and has a source derived NO_X MERP for 24-hr $PM_{2.5}$ of 12,686 tpy and SO_2 MERP for 24-hr PM2.5 of 2,593 tpy. This hypothetical source has a derived NO_X MERP for annual $PM_{2.5}$ of 116,399 tpy and SO_2 MERP for annual PM2.5 of 21,106 tpy.

For this example, EPA recommends that the NO_X and SO_2 precursor impacts on both daily and annual average $PM_{2.5}$ are considered together to determine if the project source's air quality impact of $PM_{2.5}$ would exceed the $PM_{2.5}$ SILs. In this case, the project source's emissions increase can be expressed as a percent of the MERP for each precursor and then the percentages can be summed. A value less than 100% indicates that the EPA recommended $PM_{2.5}$ SILs would not be exceeded when considering the combined impacts of these precursors on daily and annual $PM_{2.5}$.

Example calculation based on equation 1 for additive precursor impacts on daily $PM_{2.5}$:

> (600 tpy NO_X from source/12,686 tpy NO_X daily $PM_{2.5}$ MERP) + (3,100 tpy SO_2 from source/2,593 tpy SO_2 daily $PM_{2.5}$ MERP) = .05 + 1.20 = 1.21 * 100 = 121%

Example calculation based on equation 1 for additive precursor impacts on annual $PM_{2.5}$:

> (600 tpy NO_X from source/116,399 tpy NO_X annual $PM_{2.5}$ MERP) + (3,100 tpy SO_2 from source/21,106 tpy SO_2 annual $PM_{2.5}$ MERP) = .005 + .147 = .15 * 100 = 15%

A value less than 100% indicates that the EPA recommended $PM_{2.5}$ SIL would not be exceeded when considering the combined impacts of these precursors on daily or annual $PM_{2.5}$. Thus, in this case, the air quality impacts of $PM_{2.5}$ from precursor emissions of NO_X and SO_2 from this source would be expected to be above the daily $PM_{2.5}$ SIL and less than the annual $PM_{2.5}$ SIL.

<u>$PM_{2.5}$ cumulative impact analysis</u>: For the cumulative impact analysis on daily $PM_{2.5}$ impacts, equation 2 is used with the modeled emissions rates and air quality impact information from this representative hypothetical source with an elevated release. Since multiple hypothetical sources were modeled at this location with an elevated release the source with the lowest MERP was selected for comparison with the project source.

> Source nitrate impact (μg/m^3) = 600 tpy * (0.047 μg/m^3 / 500 tpy) = 0.056 μg/m^3
> Source sulfate impact (μg/m^3) = 3,100 tpy * (0.891 μg/m^3 / 3,000 tpy) = 0.921 μg/m^3

A representative monitor near the project source has a 24-hour $PM_{2.5}$ design value of 14 μg/m^3.

> Projected Design Value with Project Source (μg/m^3) = 0.056 μg/m^3 + 0.921 μg/m^3 + 14 μg/m^3 = 14.98 μg/m^3

When the source impact is combined with the nearby monitor design value using equation 3, the projected value is below the level of the daily $PM_{2.5}$ NAAQS of 35 μg/m^3.

Scenario B: Additive demonstration for O_3 and secondary $PM_{2.5}$ with primary $PM_{2.5}$ impacts

In this scenario, a facility with a proposed increase in emissions of 500 tpy of primary $PM_{2.5}$, 62 tpy of VOC, 920 tpy of NO_X, and 259 tpy of SO_2 located in the western region.

<u>O_3 source impact analysis</u>: The project source is not located in an area with unusual circumstances regarding complex terrain, proximity to very large sources of either NO_X or VOC, or meteorology. However, the NO_X emissions of 920 tpy are larger than the lowest (most conservative) NO_X MERP for 8-hr O_3 in the western region of the U.S. Thus, even though the project source's surrounding environment does not raise an obvious regional feature that would influence downwind O_3 impacts, it is likely more appropriate to use a specific hypothetical source in the same region or other appropriate geographic area for comparison. In practice, EPA recommends that the permit applicant consult with the appropriate reviewing authority to determine the relevant hypothetical source and geographic area from which to select representative MERP values.

A comparable hypothetical source is identified to be representative of this source (e.g., western (Rockies) region in Iron County, Utah with elevated release). Here, equation 1 is used with the modeled emissions rates and air quality impact information from the selected comparable source. Since multiple hypothetical sources were modeled at this location with an elevated release the source with the MERP with the most similar emission rate was selected for comparison with the project source, i.e.,

1. NO_X MERP for selected representative hypothetical source (tpy) = 1.0 ppb * (1000 tpy / 1.314 ppb) = 761 tpy
2. VOC MERP for selected representative hypothetical source (tpy) = 1.0 ppb * (500 tpy / 0.0407 ppb) = 12,275 tpy
3. Combining impacts from both NO_X and VOC: (920/761 + 62/12,275) * 100 = 121%

In this case, based on modeling results for a representative hypothetical source, the project source emissions are greater than the calculated 8-hr O_3 MERP such that air quality impacts of O_3 from this source are expected to exceed the EPA recommended 8-hour O_3 SIL.

<u>O_3 cumulative impact analysis</u>: For the cumulative impact analysis, equation 2 is used with the modeled emissions rates and air quality impact information from this representative hypothetical source with an elevated release. Since multiple hypothetical sources were modeled at this location with an elevated release the source with the most similar emission rate was selected for comparison with the project source.

Source impact from NO_X (ppb) = 920 tpy * (1.314 ppb / 1000 tpy) = 1.208 ppb
Source impact from VOC (ppb) = 62 tpy * (0.0407 ppb / 500 tpy) = 0.005 ppb

A representative monitor near the project source has a design value of 62 ppb.

Projected Design Value with Project Source (ppb) = 1.213 ppb + 62 ppb = 63.213 ppb

When the source impact is combined with the nearby monitor design value using equation 3, the projected value is below the level of the O_3 NAAQS.

<u>$PM_{2.5}$ source impact analysis</u>: The project source is not located in an area with unusual circumstances regarding complex terrain, proximity to very large sources of pollutants that impact atmospheric chemistry (i.e., NO_X, SO_2, NH_3) or meteorology. However, the NO_X emissions of 920 are marginally below the lowest (most conservative) daily and annual $PM_{2.5}$ MERP value of any source modeled in the continental U.S., while the SO_2 emissions of 259 tpy are slightly higher than the lowest daily $PM_{2.5}$ MERP value of any source modeled in the western U.S. region.

Thus, for simplicity in this example, even though the project source's surrounding environment does not raise an obvious regional feature that would influence downwind secondary $PM_{2.5}$ impacts, it is likely more appropriate to use a hypothetical source in the same region or other appropriate geographic area for comparison. In practice, EPA recommends that the permit applicant consult with the appropriate reviewing authority to determine the relevant hypothetical source and geographic area from which to select representative MERP values.

A hypothetical source is identified to be representative of this source (e.g., western (Rockies) region in Iron County, Utah). Since multiple hypothetical sources were modeled at this location with an elevated release the source with the lowest MERP was selected for comparison with the project source. The 1,000 tpy MERP was chosen for NO_X and the 500 tpy MERP for SO_2 impacts. Both reflect elevated emissions release.

For this example, EPA recommends that the NO_X and SO_2 precursor contributions to both daily and annual average $PM_{2.5}$ are considered together to determine if the project source's air quality impact of $PM_{2.5}$ would exceed the EPA recommended $PM_{2.5}$ SILs. In this case, the project source's emissions increase can be expressed as a percent of the MERP for each precursor and then the percentages can be summed.

Example calculation for additive precursor impacts on daily $PM_{2.5}$:

(920 tpy NO_X from source/25,754 tpy NO_X daily $PM_{2.5}$ MERP) + (259 tpy SO_2 from source/6,386 tpy SO_2 daily $PM_{2.5}$ MERP) = 0.04 + 0.04 = 0.08 * 100 = 8%

Example calculation for additive precursor impacts on annual $PM_{2.5}$:

(920 tpy NO_X from source/166,670 tpy NO_X daily $PM_{2.5}$ MERP) + (259 tpy SO_2 from source/33,561 tpy SO_2 daily $PM_{2.5}$ MERP) = 0.0055+ 0.0077 = 0.013 * 100 = 1.3%

The emissions rates for both NO_X and SO_2 are much lower than the daily and annual $PM_{2.5}$ MERP based on the modeling results for a representative hypothetical source. However, for purposes of illustration in this hypothetical example, an assumption is made that primary $PM_{2.5}$ modeling with AERMOD (daily impact assumed to be 1.8 $\mu g/m^3$ and annual impact assumed to be 0.02 $\mu g/m^3$) showed an exceedance of the EPA recommended daily (but not annual) $PM_{2.5}$ SIL so that a cumulative impact analysis example is presented below for the daily form of the NAAQS. Note that no AERMOD simulations were done to relate primary $PM_{2.5}$ emissions and downwind impacts; the levels of impact used here are purely to support this illustrative example. When considering primary and secondary impacts for the annual form of the NAAQS, the source's impact would be expected to be less than the EPA recommended $PM_{2.5}$ SIL.

<u>$PM_{2.5}$ cumulative impact analysis</u>: For the cumulative impact analysis, equation 2 is used with the modeled emissions rates and air quality impact information from this representative hypothetical source with an elevated release.

> Source nitrate impact ($\mu g/m^3$) = 920 tpy * (0.047 $\mu g/m^3$ / 1000 tpy) = 0.043 $\mu g/m^3$
> Source sulfate impact ($\mu g/m^3$) = 259 tpy * (0.094 $\mu g/m^3$ / 500 tpy) = 0.049 $\mu g/m^3$

A representative monitor near the project source has a daily $PM_{2.5}$ design value of 11 $\mu g/m^3$. A hypothetical downwind primary $PM_{2.5}$ impact from other analysis for this source was determined to be 1.8 $\mu g/m^3$, which is included in the CIA together with the secondary impact analysis.

> Projected Design Value with Project Source ($\mu g/m^3$) = 0.043 $\mu g/m^3$ + 0.049 $\mu g/m^3$ + 11 $\mu g/m^3$ + 1.8 $\mu g/m^3$ = 12.89 $\mu g/m^3$

When the project source primary impact (from AERMOD) and secondary impacts (from MERP equation) are combined with the nearby monitor design value using equation 3, the projected value is below the level of the daily $PM_{2.5}$ NAAQS.

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Appendix A. Hypothetical Sources Included in the EPA's Modeling Assessment

Table A-1. Complete list of EPA modeled hypothetical sources presented in this document. A list of emission rates and stack height combinations modeled for each domain are provided in Table A-2. The "Max Nearby Urban (%)" column provides the highest percentage urban landcover in any grid cell near (within 50 km) the source. Source locations are shown in Figures A-1, A-2, A-3, and A-4.

FIPS	State	County	Domain	Source	Latitude	Longitude	Max Nearby Terrain (m)	Max Nearby Urban (%)
1001	Alabama	Autauga	12EUS2	4	32.522	-86.550	179	25
1123	Alabama	Tallapoosa	12EUS3	19	32.848	-85.809	306	10
4005	Arizona	Coconino	12US2	36	35.428	-111.270	2483	7.4
4007	Arizona	Gila	12WUS1	14	33.469	-110.789	1592	4.3
4012	Arizona	La Paz	12WUS1	17	33.400	-113.408	757	0.9
5119	Arkansas	Pulaski	12EUS2	13	34.724	-92.275	235	32.2
6029	California	Kern	12WUS1	26	35.356	-119.508	1195	49.1
6037	California	Los Angeles	12WUS1	21	34.696	-118.414	1528	39.9
6047	California	Merced	12WUS1	25	37.274	-120.708	547	14.6
6063	California	Plumas	12WUS1	24	39.920	-121.263	1773	17.5
6107	California	Tulare	12WUS1	20	36.324	-119.404	566	18.1
8011	Colorado	Bent	12WUS1	4	37.685	-102.994	1698	1.4
8069	Colorado	Larimer	12WUS1	8	40.841	-105.826	3288	0.5
8093	Colorado	Park	12US2	31	38.919	-105.990	3535	2.2
8109	Colorado	Saguache	12WUS1	9	37.965	-106.234	3374	2.7
8109	Colorado	Saguache	12WUS1	9	37.965	-106.234	3374	2.7
8123	Colorado	Weld	12WUS1	3	40.621	-104.037	1609	6.2
12005	Florida	Bay	12EUS2	5	30.269	-85.700	55	9.8
17021	Illinois	Christian	12US2	16	39.509	-89.092	209	11.6
17145	Illinois	Perry	12EUS2	7	38.078	-89.547	194	6.8
17155	Illinois	Putnam	12EUS2	6	41.200	-89.446	243	16.4
17177	Illinois	Stephenson	12US2	15	42.455	-89.606	296	14.4
18011	Indiana	Boone	12US2	11	40.009	-86.574	290	47.3
18037	Indiana	Dubois	12EUS2	2	38.255	-86.724	224	4.4
18053	Indiana	Grant	12EUS3	17	40.623	-85.589	285	10.3
18127	Indiana	Porter	12EUS2	1	41.380	-87.185	235	52.3
19027	Iowa	Carroll	12US2	20	42.092	-94.693	435	3.9
19095	Iowa	Iowa	12EUS2	11	41.674	-92.060	295	17.3
20091	Kansas	Johnson	12EUS2	17	38.746	-94.949	325	38.8
20109	Kansas	Logan	12US2	26	38.909	-101.173	1121	1.6
20155	Kansas	Reno	12EUS2	22	38.121	-97.899	542	12.7

21009	Kentucky	Barren	12EUS3	18	36.828	-85.830	269	4.5
21187	Kentucky	Owen	12US2	33	38.536	-84.707	279	7.4
22001	Louisiana	Acadia	12EUS2	15	30.241	-92.616	16	6.5
22061	Louisiana	Lincoln	12EUS2	14	32.476	-92.711	97	5.8
22071	Louisiana	Orleans	12EUS2	10	30.092	-89.879	10	50.4
23003	Maine	Aroostook	12EUS3	1	46.772	-67.850	365	4.6
23031	Maine	York	12EUS3	2	43.367	-70.580	237	13.3
25011	Massachusetts	Franklin	12EUS3	4	42.582	-72.459	583	21.6
25021	Massachusetts	Norfolk	12EUS3	3	42.139	-71.234	224	60
26099	Michigan	Macomb	12EUS3	11	42.822	-82.872	317	63.9
26103	Michigan	Marquette	12EUS3	15	46.570	-87.395	518	4
26117	Michigan	Montcalm	12EUS3	16	43.319	-85.368	309	42.8
26129	Michigan	Ogemaw	12US2	5	44.164	-84.069	382	4.4
26159	Michigan	Van Buren	12US2	10	42.410	-86.027	273	25.3
27037	Minnesota	Dakota	12US2	19	44.785	-93.311	339	52.4
27137	Minnesota	St Louis	12US2	13	47.913	-92.331	485	2.8
27159	Minnesota	Wadena	12US2	18	46.401	-95.086	464	2.2
28129	Mississippi	Smith	12EUS2	9	32.177	-89.345	142	2.3
29029	Missouri	Camden	12EUS2	12	38.014	-93.006	378	6.2
29155	Missouri	Pemiscot	12US2	17	36.223	-89.851	104	5.1
29177	Missouri	Ray	12US2	21	39.504	-94.135	305	39
30013	Montana	Cascade	12US2	28	47.367	-111.447	1803	18.1
30075	Montana	Powder River	12WUS1	7	45.299	-105.895	1238	0.6
30083	Montana	Richland	12WUS1	6	47.367	-104.447	862	2.3
30111	Montana	Yellowstone	12WUS1	11	45.786	-108.207	1641	22.2
31001	Nebraska	Adams	12EUS2	21	40.673	-98.327	655	18.2
31055	Nebraska	Douglas	12EUS2	16	41.364	-96.155	424	43.3
31101	Nebraska	Keith	12US2	25	41.247	-102.006	1197	2.1
32001	Nevada	Churchill	12WUS1	19	39.941	-118.748	1599	9.2
34041	New Jersey	Warren	12US2	2	41.017	-75.000	577	31.2
35031	New Mexico	Mc Kinley	12US2	32	35.368	-107.382	2577	3.6
35035	New Mexico	Otero	12WUS1	10	32.757	-105.767	2618	4.4
36005	New York	Bronx	12EUS3	5	40.819	-73.909	273	75.4
36019	New York	Clinton	12US2	1	44.477	-73.836	889	3.2
36051	New York	Livingston	12EUS3	7	42.877	-77.603	532	34
37009	North Carolina	Ashe	12EUS3	13	36.301	-81.374	1168	6.9
37109	North Carolina	Lincoln	12US2	8	35.439	-81.154	457	32.1
37127	North Carolina	Nash	12US2	4	35.922	-78.187	123	22.1
38057	North Dakota	Mercer	12WUS1	1	47.287	-101.879	719	1.8
38059	North Dakota	Morton	12WUS1	2	46.861	-101.925	799	1
39103	Ohio	Medina	12US2	6	41.238	-81.813	344	51.7
39157	Ohio	Tuscarawas	12EUS3	12	40.541	-81.396	356	26.9
40017	Oklahoma	Canadian	12EUS2	23	35.463	-97.913	473	43.1

40101	Oklahoma	Muskogee	12EUS2	18	35.751	-95.507	236	30.4
40127	Oklahoma	Pushmataha	12US2	22	34.390	-95.567	294	2.5
40149	Oklahoma	Washita	12US2	27	35.311	-99.187	662	4.4
41049	Oregon	Morrow	12WUS1	18	45.790	-119.475	894	8.2
42001	Pennsylvania	Adams	12EUS3	8	40.009	-77.111	364	26.9
42029	Pennsylvania	Chester	12US2	3	39.940	-75.822	188	32.2
45005	South Carolina	Allendale	12EUS3	14	32.973	-81.407	84	2.2
45051	South Carolina	Horry	12EUS3	10	34.083	-79.187	33	7.1
46055	South Dakota	Haakon	12US2	23	44.287	-101.879	842	1.4
46097	South Dakota	Miner	12US2	24	43.861	-97.425	535	5.4
47001	Tennessee	Anderson	12US2	12	36.079	-84.149	611	25.4
47055	Tennessee	Giles	12EUS2	3	35.291	-86.897	286	8.4
47157	Tennessee	Shelby	12EUS2	8	35.124	-90.002	117	42.4
48187	Texas	Guadalupe	12EUS2	25	29.553	-97.991	349	43.8
48201	Texas	Harris	12EUS2	20	29.592	-95.418	41	64.7
48213	Texas	Henderson	12EUS2	19	32.314	-95.556	155	27.6
48367	Texas	Parker	12EUS2	24	32.610	-97.736	384	35.7
48445	Texas	Terry	12WUS1	5	33.369	-102.146	1112	31.9
49013	Utah	Duchesne	12WUS1	12	40.407	-110.618	3395	0.9
49015	Utah	Emery	12US2	35	38.804	-110.630	2090	0.6
49021	Utah	Iron	12WUS1	16	37.608	-113.092	2870	5.5
49037	Utah	San Juan	12WUS1	13	37.905	-109.899	2450	0.2
49049	Utah	Utah	12WUS1	15	40.110	-111.936	2235	21.7
51053	Virginia	Dinwiddie	12EUS3	9	36.919	-77.707	133	9
53039	Washington	Klickitat	12WUS1	23	45.938	-121.191	1699	4.9
53057	Washington	Skagit	12WUS1	22	48.466	-122.559	497	9.6
54017	West Virginia	Doddridge	12US2	7	39.299	-80.633	454	10.4
55107	Wisconsin	Rusk	12US2	14	45.596	-90.768	482	2.3
55115	Wisconsin	Shawano	12US2	9	44.733	-88.263	309	32.2
56001	Wyoming	Albany	12US2	30	41.829	-105.857	2898	0.3
56005	Wyoming	Campbell	12US2	29	44.299	-105.895	1532	8.1
56023	Wyoming	Lincoln	12US2	34	41.905	-110.326	2585	1.3

Table A-2. A list of emission rates and stack release height combinations modeled for each domain. A complete list of hypothetical sources in each domain are provided in Table A-1. Figures showing the location of specific sources by domain are provided in Figures A1-A4.

				NAAQS & Precursors Modeled		
Geographic Region	**# hypothetical sources within the region**	**Release Type**	**Emission Rate (tpy)**	**8-hr O3**	**Daily PM2.5**	**Annual PM2.5**
12EUS3	18	H	3000	NOX, VOC	NOX, SO2	NOX, SO2
(eastern US)	18	H	1000	NOX, VOC	NOX, SO2	NOX, SO2
	18	H	500	NOX, VOC	NOX, SO2	NOX, SO2
	18	L	500	NOX, VOC	NOX, SO2	NOX, SO2
12EUS2	25	H	3000	NOX, VOC	NOX, SO2	NOX, SO2
(central US)	25	H	1000	NOX, VOC	NOX, SO2	NOX, SO2
	25	L	1000	VOC	NOX, SO2	NOX, SO2
	25	H	500	NOX	NOX, SO2	NOX, SO2
	25	L	500	NOX, VOC	NOX, SO2	NOX, SO2
12WUS1	26	H	3000	NOX, VOC	NOX, SO2	NOX, SO2
(western US)	26	H	1000	NOX, VOC	NOX, SO2	NOX, SO2
	26	H	500	NOX, VOC	NOX, SO2	NOX, SO2
	26	L	500	NOX, VOC	NOX, SO2	NOX, SO2
12US2	36	H	1000	NOX	NOX, SO2	NOX, SO2
(contiguous US)	36	H	500	NOX	NOX, SO2	NOX, SO2
	36	L	500	NOX, VOC	NOX, SO2	NOX, SO2

Figure A-1. Hypothetical source locations for the eastern U.S. (12EUS3) domain.

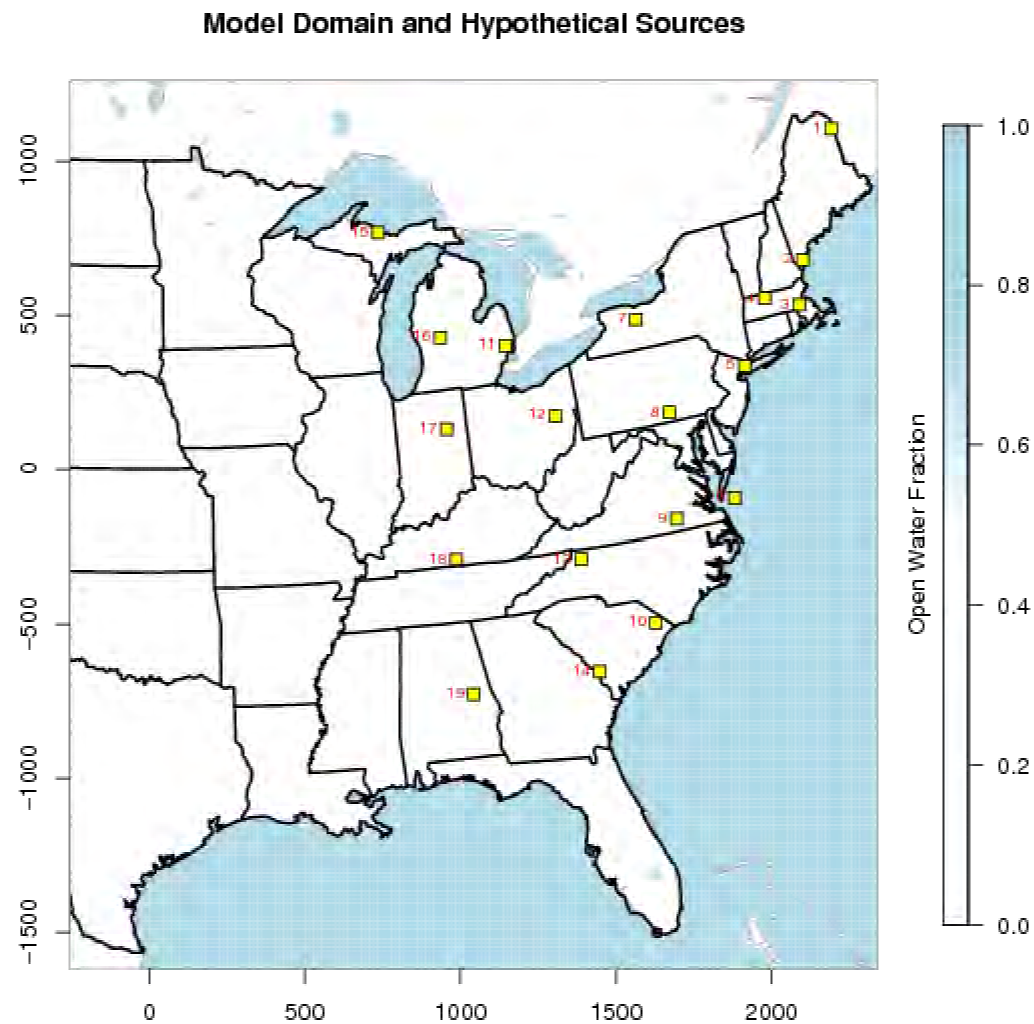


Figure A-2. Hypothetical source locations for the central U.S. (12EUS2) domain.

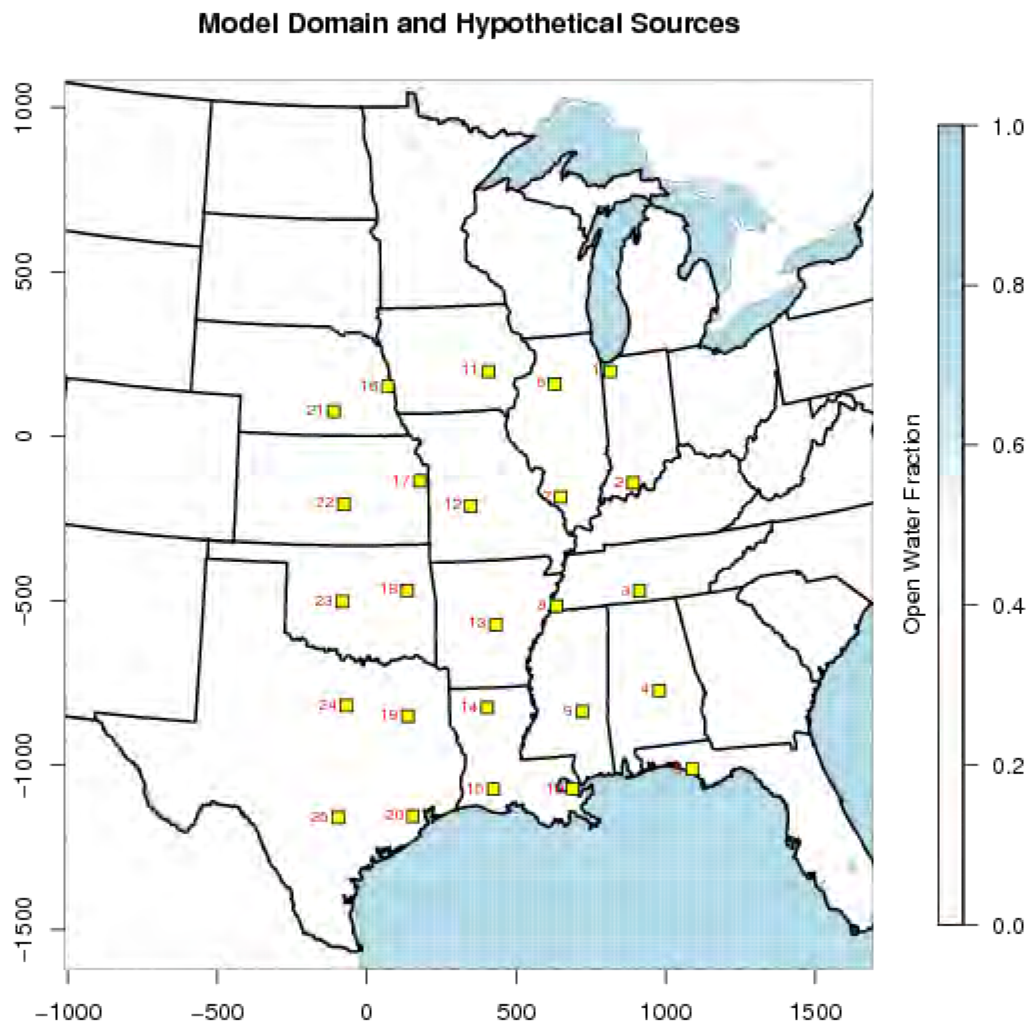


Figure A-3. Hypothetical source locations for the western U.S. (12WUS1) domain.

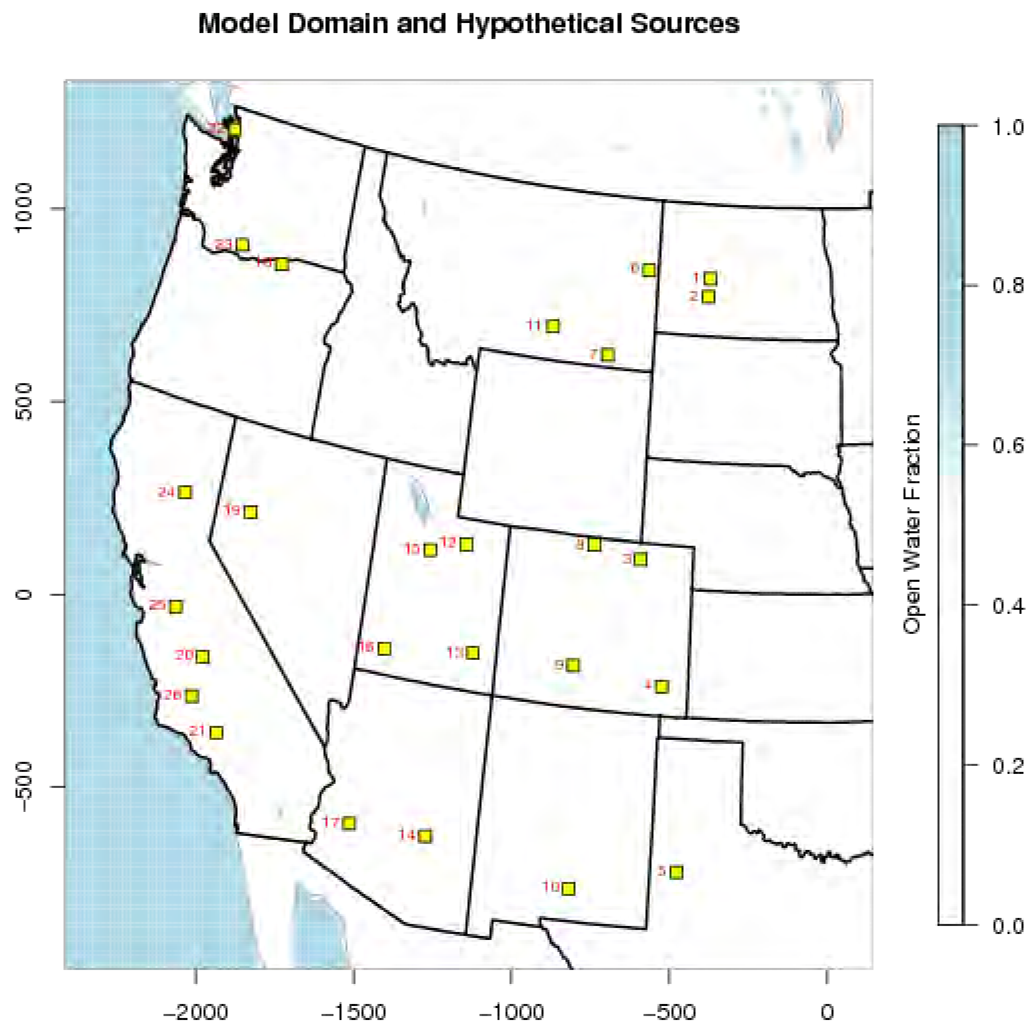
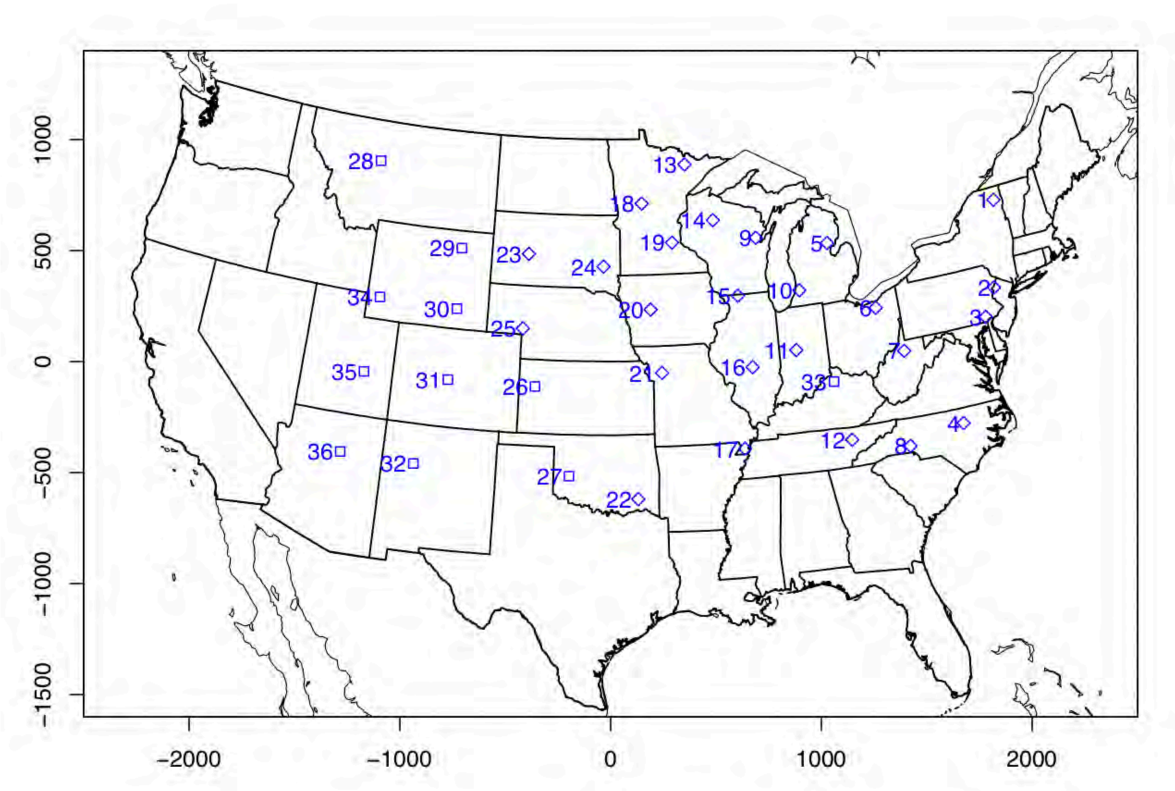


Figure A-4. Hypothetical source locations for the contiguous U.S. (12US2) domain.



United States Environmental Protection Agency	Office of Air Quality Planning and Standards Air Quality Assessment Division Research Triangle Park, NC	Publication No. EPA-454/R-19-003 April 2019

EXHIBIT 5

Rebuttal Testimony of Lori Marquez and Jeff Bennett

New Mexico EIB No. 20-21(A)

Final Ozone NAAQS Regulatory Impact Analysis

EPA-452/R-08-003
March 2008

Final Ozone NAAQS Regulatory Impact Analysis

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Health and Environmental Impacts Division
Air Benefit and Cost Group (C439-02)
Research Triangle Park, North Carolina

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Chapter 2: Characterizing Ozone and Modeling Tools Used in This Analysis

Synopsis

This chapter describes the chemical and physical properties of ozone, general ozone air quality patterns, key health and environmental impacts associated with exposure to ozone, and key sources of ozone precursor emissions. In order to evaluate the health and environmental impacts of trying to reach a tighter ozone standard in the year 2020, it was necessary to use models to predict concentrations in the future. The tools and methodology used for the air quality modeling are described in this chapter. Subsequent chapters of this RIA rely heavily on the results of this modeling.

2.1 Ozone Chemistry

Ozone occurs both naturally in the stratosphere to provide a protective layer high above the earth, and at ground-level (troposphere) as the prime ingredient of smog. Tropospheric ozone, which is regulated by the NAAQS, is formed by both naturally occurring and anthropogenic sources. Ozone is not emitted directly into the air, but is created when its two primary components, volatile organic compounds (VOC) and oxides of nitrogen (NOx), combine in the presence of sunlight. VOC and NOx are often referred to as ozone precursors, which are, for the most part, emitted directly into the atmosphere.

Ambient ozone concentrations are directly affected by temperature, solar radiation, wind speed and other meteorological factors. Ultraviolet radiation from the sun plays a key role in initiating the processes leading to ozone formation. However, there is little empirical evidence directly linking day-to-day variations in observed surface ultraviolet radiation levels with variations in tropospheric ozone levels.

The rate of ozone production can be limited by either VOCs or NOx. In general, ozone formation using these two precursors is reliant upon the relative sources of hydroxide (OH) and NOx. When the rate of OH production is greater than the rate of production of NOx, indicating that NOx is in short supply, the rate of ozone production is NOx-limited. In this situation, ozone concentrations are most effectively reduced by lowering current and future NOx emissions, rather than lowering emissions of VOCs. When the rate of OH production is less than the rate of production of NOx, ozone production is VOC-limited. Here, ozone is most effectively reduced by lowering VOCs. Between the NOx- and VOC-limited extremes there is a transitional region where ozone is nearly equally sensitive to each species. However ozone is relatively insensitive to marginal changes in both NOx and VOC in this situation. In urban areas with a high population concentration, ozone is often VOC-limited. Ozone is generally NOx-limited in rural areas and downwind suburban areas. Additional information on ozone formation can be found in "Atmospheric Chemistry and Physics" (Seinfeld et. al., 1998).

Due to the complex photochemistry of ozone production, NOx emissions lead to both the formation and destruction of ozone, depending on the local quantities of NOx, VOC, and ozone catalysts such as the OH and HO2 radicals. In areas dominated by fresh emissions of NOx, ozone catalysts are removed via the production of nitric acid, which slows the ozone formation rate. Because NOx is generally depleted more rapidly than VOC, this effect is usually short-lived and the emitted NOx can lead to ozone formation later and further downwind. The terms "NOx disbenefits" or "ozone disbenefits" refer to the ozone increases that can result from NOx emission reductions in these localized areas.[1]

2.1.1 Temporal Scale

Ground-level ozone forms readily in the atmosphere, usually during hot weather. The effects of sunlight on ozone formation depend on its intensity and its spectral distribution. Ozone levels tend to be highest during the daytime, during the summer or warm season. Changing weather patterns contribute to day to day and interannual differences in ozone concentrations. Differences in climatic regime, amount and mixture of emissions, and the extent of transport contribute to variations in ozone from city to city.

2.1.2 Geographic Scale and Transport

In many urban areas, ozone nonattainment is not caused by emissions from the local area alone. Due to atmospheric transport, contributions of precursors from the surrounding region can also be important. Thus, in designing control strategies to reduce ozone concentrations in a local area, it is often necessary to account for regional transport within the U.S.

In some areas, such as California, global transport of ozone from beyond North America can contribute to nonattainment areas. In a very limited number of areas, including areas such as Buffalo, Detroit and El Paso, which are located near borders, emissions from Canada or Mexico may contribute to nonattainment. In these areas, our illustrative implementation strategies may have included more controls on domestic sources than would be required if cross-border transport did not occur. However, we have not conducted formal analysis, and as such cannot determine the contribution of non-U.S. sources to ozone design values. The transport of ozone is determined by meteorological and chemical processes which typically extend over spatial scales of several hundred kilometers. Additionally, convection is capable of transporting ozone and its precursors vertically through the troposphere, with resulting mixing of stratospheric ozone for periods of a month or more with tropospheric ozone.

The Technical Support Document (TSD) for the Clean Air Interstate Rule (CAIR) suggests that ozone transport constitutes a sizable portion of projected nonattainment in most eastern areas based on a 2010 analysis. A listing of Eastern states and the extent of transported ozone they receive in the CAIR analysis is located in the CAIR TSD.[2] We used this information to help guide the design of emissions control strategies in this analysis.

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[1] U.S. EPA. Final Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines. EPA420-R-04-007. May 2004.
[2] http://www.epa.gov/interstateairquality/pdfs/finaltech02.pdf, Table VI-2.

2.2 Sources of Ozone

The anthropogenic precursors of ozone originate from a wide variety of stationary and mobile sources. In urban areas, both biogenic (natural) and anthropogenic VOCs are important for ozone formation. Hundreds of VOCs are emitted by evaporation and combustion processes from a large number of anthropogenic sources. Current data show that solvent use and highway vehicles are the two main sources of VOCs, with roughly equal contributions to total emissions. Emissions of VOCs from highway vehicles account for roughly two-thirds of the transportation-related emissions.[3] By 2020, EPA emission projections show that VOC emissions from highway vehicles decrease significantly. Solvent use VOC decreases as well, but by 2020 solvent use VOC is projected to be a slightly more significant VOC contributor than mobile VOC. On the regional and global scales, emissions of VOCs from vegetation are much larger than those from anthropogenic sources.

Anthropogenic NOx emissions are associated with combustion processes. The two largest sources of NOx are electric power generation plants (EGUs) and motor vehicles. EGU NOx is approximately 40% less than onroad mobile NOx in 2001. Both decrease between 2001 and 2020, with onroad mobile NOx decreasing more, so that their emissions are similar in 2020. It is not possible to make an overall statement about their relative impacts on ozone in all local areas because EGUs are more sparse than mobile sources, particularly in the west and south (See Chapter 3 for a discussion of emission reductions projected in 2020 for the 8-hr ozone current standard baseline and the more stringent alternative control scenario). Natural NOx sources include stratospheric intrusions, lightning, soils, and wildfires. Lightning, fertilized soils, and wildfires are the major natural sources of NOx in the United States. Uncertainties in natural NOx inventories are much larger than for anthropogenic NOx emissions.

A complete list of emissions source categories, for both NOx and VOCs, is compiled in the final ozone Staff Paper (EPA, 2007a, pp. 2-3 to 2-6).

2.3 Modeling Ozone Levels in the Future

In order to evaluate the predicted air quality in 2020, it is necessary to use modeling to derive estimated air quality concentrations. The modeling analysis uses an emissions inventory and historical meteorological conditions to simulate pollutant concentrations. The predictions from the modeling are used to (a) project future ozone design values (a representation of the resultant air quality concentration in 2020 representing the 4th highest maximum 8-hr concentration) and (b) create spatial fields of ozone and $PM_{2.5}$ for characterizing human health impacts from reducing ozone precursors, which in the case of NOx will also affect the formation of $PM_{2.5}$. The air quality model used in this RIA is the Community Multi-Scale Air Quality (CMAQ) model[4]. The modeling for ozone and $PM_{2.5}$ was performed for a one year time period. All controls in the illustrative 0.070 scenario were applied similarly to all months. There were no controls applied

[3] U.S EPA. 2007. Review of the National Ambient Air Quality Standards for Ozone: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper. North Carolina. EPA-452/R-07-003.
[4] See CMAQ references listed at end of this chapter.

specifically for $PM_{2.5}$ co-benefits because the controls developed to reduce summer ozone were applied to all months (see Chapter 3).

2.3.1 CMAQ Model and Inputs

A national scale air quality modeling analysis was performed to estimate future year attainment/nonattainment of the current and alternative ozone standards. In addition, the model-based projections of ozone and $PM_{2.5}$ were used as inputs to the calculation of expected incremental benefits from the alternative ozone standards considered in this assessment. The 2002-based modeling platform (EPA, 2008) was used as the basis for air quality modeling of the future baseline emissions and illustrative control scenario. This modeling platform includes a number of updates and improvements to data and tools compared to the 2001-based platform that was used for the proposal modeling. For the final rule modeling we used the new 2002 National Emissions Inventory along with updated versions of the models used to project future emissions from electric generating units (EGUs) and onroad and nonroad vehicles. The proposal modeling was based on the 2001 National Emissions Inventory. The new platform also includes 2002 meteorology and more recent ambient design values which were used as the starting point for projecting future air quality. For proposal, we used meteorology for 2001 for modeling the East and 2002 for modeling the West. The updates[5] to CMAQ between proposal and final include (1) an in-cloud sulfate chemistry module that accounts for the nonlinear sensitivity of sulfate formation to varying pH; (2) improved vertical convective mixing; (3) heterogeneous reaction involving nitrate formation; (4) an updated gas-phase chemistry mechanism, Carbon Bond 2005 (CB05); and (5) an aqueous chemistry mechanism that provides a comprehensive simulation of aerosol precursor oxidants.

The key non-emissions inputs to the CMAQ model include meteorological data, and initial and boundary concentrations. The CMAQ meteorological input files were derived from simulations of the Pennsylvania State University/National Center for Atmospheric Research Mesoscale Model (Grell, Dudhia, and Stauffer, 1994). This model, commonly referred to as MM5, is a limited-area, nonhydrostatic, terrain-following system that solves for the full set of physical and thermodynamic equations which govern atmospheric motions. The lateral boundary and initial species concentrations for the 36 km continental scale modeling domain, described below, were obtained from a three-dimensional global atmospheric chemistry model, the GEOSChem model (Yantosca, 2004). The global GEOSChem model simulates atmospheric chemical and physical processes driven by assimilated meteorological observations from the NASA's Goddard Earth Observing System (GEOS). We used GEOSChem results for 2002 to provide initial and boundary concentrations for our final rule air quality modeling. For proposal we used GEOSChem results for 2001.

EPA performed an extensive evaluation of CMAQ using the 2002 inputs for emissions, meteorology, and boundary conditions. Details of the model performance methodology and results are described in the 2002-Based Modeling Platform Report (EPA, 2008). As in the evaluation for previous model applications, the "acceptability" of model performance for the ozone RIA modeling was judged by comparing the results to those found in recent regional

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[5] Additional documentation on the updates in CMAQ version 4.6 can be found at the following web site: http://www.cmascenter.org/.

ozone model applications for other EPA and non-EPA studies (see Appendix B of EPA, 2007b). Overall, the performance for the CMAQ application is generally within the range of these other applications.

Figure 2.1 shows the modeling domains that were used as a part of this analysis. The geographic specifications for these domains are provided in Table 2.1. All three modeling domains contain 14 vertical layers with a top at about 16,200 meters, or 100 mb. Two domains with 12 km horizontal resolution were used for modeling the 2002 base year, 2020 baseline and 2020 control strategy scenarios. These domains are labeled as the East and West 12 km domains in Figure 2.1. Simulations for the 36 km domain were only used to provide initial and boundary concentrations for the 12 km domains. As indicated above, the model produces spatial fields of gridded air quality concentrations on an hourly basis for the entire modeling domain. These gridded concentrations can be processed to produce a number of air quality metrics, including the 8-hr ozone design values, and can be used as inputs for the analysis of costs and benefits. The air quality modeling results are used in a relative sense to project concentrations for the future year scenarios using procedures consistent with EPA guidance (EPA, 2007b). For the final rule projections we used ambient design values for the period 2000 through 2004 as the starting point for projections. For the proposal, design values from 1999 through 2003 were used. The change between proposal and final in terms of the period of design values was made, in accordance with EPA guidance, in order to align the central year of design values with the base year of the emissions (i.e., 2001 for the proposed rule and 2002 for the final rule).

For this analysis, predictions from the East domain were used to provide data for all areas that are east of approximately 104 degrees longitude. Model predictions from the West domain we used for all areas west of this longitude.

Figure 2.1: Map of the CMAQ Modeling Domains Used for Ozone NAAQS RIA

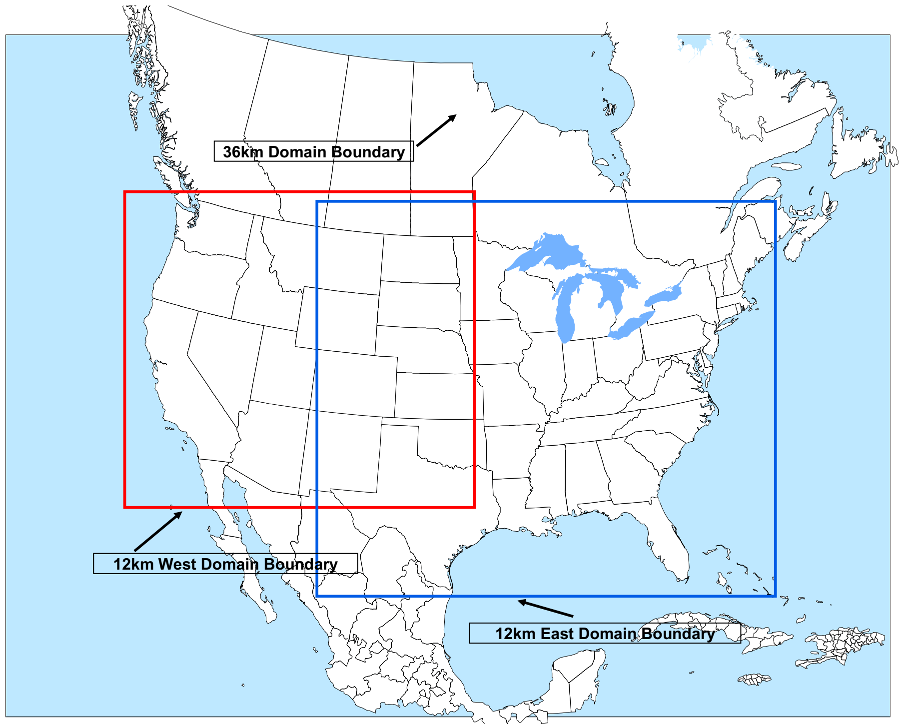

Table 2.1: Geographic Specifications of Modeling Domains

36 km Domain (148 x 112 Grid Cells)			12 km East Domain (279 x 240 Grid Cells)			12 km West Domain (213 x 192 Grid Cells)		
	Lon	**lat**		**lon**	**lat**		**lon**	**lat**
SW	−121.77	18.17	SW	−106.79	24.99	SW	−121.65	28.29
NE	−58.54	52.41	NE	−65.32	47.63	NE	−94.94	51.91

2.3.2 Emissions Inventory

The 2020 inventory, projected from the 2002 Version 3 emissions modeling platform (EPA, 2008), is the starting point for the baseline and control strategy for the Final Ozone NAAQS emissions inventory. The 2002 documentation describes the 2002 base year inventory as well as the projection methodology and controls applied to create year 2020 emissions. The 2020 inventory includes activity growth for some sectors, and controls including: the Clean Air Interstate Rule, the Clean Air Mercury Rule, the Clean Air Visibility Rule, the Clean Air Nonroad Diesel Rule, the Light-Duty Vehicle Tier 2 Rule, the Heavy Duty Diesel Rule, known plant closures, and consent decrees and settlements. Table 2.2 provides a comprehensive list of the rules/control strategies and projection assumptions in the 2020 inventory; full discussion of the 2020 inventory is provided in the 2002 Version 3 emissions modeling platform (EPA, 2008a). The data for the controls and projection strategies can be found in the Loco-Marine docket (EPA, 2008b).

Table 2.2: Control Strategies and Projection Assumptions in the 2020 Emissions Inventory

Control Strategies (Grouped by Affected Pollutants or Standard and Approach Used to Apply to the Inventory)	**Pollutants Affected**	**Approach or Reference**
Non-EGU Point Controls		
NOx SIP Call (Phase II): Cement Manufacturing Large Boiler/Turbine Units Large IC Engines	NOx	1
DOJ Settlements: plant SCC controls Alcoa, TX MOTIVA, DE	NOx, SO_2	2
Refinery Consent Decrees: plant/SCC controls	NOx, PM, SO_2	3
Closures, pre-2007: plant control of 100% Auto plants Pulp and Paper Municipal Waste Combustors Plants closed in preparation for 2005 inventory	all	4
Industrial Boiler/Process Heater plant/SCC controls for PM	PM	5
MACT rules, national, VOC: national applied by SCC, MACT Boat Manufacturing Polymers and Resins III (Phenolic Resins) Polymers and Resins IV (Phenolic Resins) Wood Building Products Surface Coating Generic MACT II: Spandex Production, Ethylene manufacture Large Appliances Miscellaneous Organic NESHAP (MON): Alkyd Resins, Chelating Agents, Explosives, Phthalate Plasicizers, Polyester Resins, Polymerized Vinylidene Chloride Manufacturing Nutritional Yeast Oil and Natural Gas Petroleum Refineries—Catalytic Cracking, Catalytic Reforming, & Sulfur Plant Units Pesticide Active Ingredient Production Publicly Owned Treatment Works Reinforced Plastics Rubber Tire Manufacturing Asphalt Processing & Roofing Combustion Sources at Kraft, Soda, and Sulfite Paper Mills Fabric Printing, Coating and Dyeing Iron & Steel Foundries Metal: Can, Coil Metal Furniture Miscellaneous Metal Parts & Products Municipal Solid Waste Landfills Paper and Other Web Plastic Parts Plywood and Composite Wood Products Wet Formed Fiberglass Production Wood Building Products Surface Coating Carbon Black Production Cellulose Products Manufacturing Cyanide Chemical Manufacturing	VOC	EPA, 2007f

(continued)

Table 2.2: Control Strategies and Projection Assumptions in the 2020 Emissions Inventory (continued)

Control Strategies (Grouped by Affected Pollutants or Standard and Approach Used to Apply to the Inventory)	Pollutants Affected	Approach or Reference
Friction Products Manufacturing Leather Finishing Operations Miscellaneous Coating Manufacturing Organic Liquids Distribution (Non-Gasoline) Refractory Products Manufacturing Sites Remediation		
Solid Waste Rules (Section 129d/111d) Hospital/Medical/Infectious Waste Incinerator Regulations	NOx, PM, SO_2	EPA, 2005
MACT rules, national, PM: Portland Cement Manufacturing Secondary Aluminum	PM	6
MACT rules, plant-level, VOC: Auto Plants	VOC	7
MACT rules, plant-level, PM & SO_2: Lime Manufacturing	PM, SO_2	8
MACT rules, plant-level, PM: Taconite Ore	PM	9
Stationary Non-point (Area) Assumptions		
Municipal Waste Landfills: projection factor of 0.25 applied	VOC	EPA, 2007f
Livestock Emissions Growth	NH_3, PM	10
Residential Wood Combustion Growth reflects increase in use of lower polluting wood stoves, and decrease in use of higher polluting stoves	all	11
Gasoline Stage II growth and control (also impacts non-EGU point sources in a couple of states)	VOC	12
Portable Fuel Container growth and control	VOC	13
EGU Point Controls		
CAIR/CAMR/CAVR IPM Model 3.0	NOx, SO_2, PM	14
Onroad Mobile and Nonroad Mobile Growth and Controls		
Onroad and Nonroad Growth: Onroad growth is based on VMT growth from Annual Energy Outlook (AEO) 2006 estimates of growth by vehicle type. Nonroad growth is based on activity increases from NONROAD model default growth estimates	all	
National Onroad Rules: Tier 2 Rule 2007 Onroad Heavy-Duty Rule Final Mobile Source Air Toxics Rule (MSAT2) Renewable Fuel Standard	all	
Local Onroad Programs: National Low Emission Vehicle Program (NLEV) Ozone Transport Commission (OTC) LEV Program	VOC	15

(continued)

Table 2.2: Control Strategies and Projection Assumptions in the 2020 Emissions Inventory (continued)

Control Strategies (Grouped by Affected Pollutants or Standard and Approach Used to Apply to the Inventory)	Pollutants Affected	Approach or Reference
National Nonroad Controls: Clean Air Nonroad Diesel Final Rule—Tier 4 Control of Emissions from Nonroad Large-Spark Ignition Engines and Recreational Engines (Marine and Land Based): "Pentathalon Rule"	all	16
Aircraft, Locomotives, and Commercial Marine Assumptions		
Aircraft: Itinerant (ITN) operations at airports	all	17
Locomotives: Energy Information Administration (EIA) fuel consumption projections for freight rail Clean Air Nonroad Diesel Final Rule—Tier 4 Locomotive Final Rulemaking, December 17, 1997	all	EPA, 2007e, 18
Commercial Marine: EIA fuel consumption projections for diesel-fueled vessels Freight-tonnage growth estimates fro residual-fueled vessels Clean Air Nonroad Diesel Final Rule—Tier 4 Emissions Standards for Commercial Marine Diesel Engines, December 29, 1999 Tier 1 Marine Diesel Engines, February 28, 2003	all	18, (EPA, 2007e)

APPROACHES:

1. Used *Emission Budget Inventories* report (EPA, 1999) for list of SCCs for application of controls, and for percent reductions (except IC Engines). Used Federal Register on Response to Court decisions (Federal Register, 2004) for IC Engine percent reductions and geographic applicability
2. For ALCOA consent decree, used http:// cfpub.epa.gov/compliance/cases/index.cfm; for MOTIVA: used information sent by State of Delaware
3. Used data provided by Brenda Shine, EPA, OAQPS
4. Closures obtained from EPA sector leads; most verified using the world wide web.
5. Used data list of plants provided by project lead from 2001-based platform; required mapping the 2001 plants to 2002 NEI plants due to plant id changes across inventory years
6. Same as used in CAIR, except added SCCs appeared to be covered by the rule: both reductions based on preamble to final rule. (Portland Cement used a weighted average across two processes)
7. Percent reductions recommended and plants to apply to reduction to were based on recommendations by rule lead engineer, and are consistent with the reference: EPA, 2007e
8. Percent reductions recommended are determined from the existing plant estimated baselines and estimated reductions as shown in the Federal Register Notice for the rule. SO2 % reduction will therefore be 6147/30,783 = 20% and PM10 and $PM_{2.5}$ reductions will both be 3786/13588 = 28%
9. Same approach used in CAIR: FR notice estimates reductions of "PM emissions by 10,538 tpy, a reduction of about 62%." Used same list of plants as were identified based on tonnage and SCC from CAIR.
10. Except for dairy cows and turkeys (no growth), based in animal population growth estimates from USDA and Food and Agriculture Policy and Research Institute.
11. Expected benefits of woodstoves change-out program: http://www.epa.gov/woodstoves/index.html
12. VOC emission ratios of year 2020 to year 2002 from the National Mobile Inventory Model (NMIM) results for onroad refueling including activity growth from VMT, Stage II control programs at gasoline stations, and phase in of newer vehicles with onboard Stage II vehicle controls.
13. VOC emission ratios of year 2020 to year 2002 from MSAT rule (EPA, 2007c, EPA, 2007d)
14. http://www.epa.gov/airmarkets/progsregs/epa-ipm/docs/summary2006.pdf
15. Only for states submitting these inputs: http://www.epa.gov/otaq/lev-nlev.htm
16. http://www.epa.gov/nonroad-diesel/2004fr.htm
17. Federal Aviation Administration (FAA) Terminal Area Forecast (TAF) System, February 2006: http://www.apo.data.faa.gov/main/taf.asp
18. http://www.epa.gov/nonroad-diesel/2004fr.htm

Differences between the 2020 emissions modeling platforms—particularly the inventories—used in the Ozone NAAQS Proposal and here in the Ozone NAAQS Final are discussed in the Appendix for Chapter 2.

The development of the 2020 baseline inventory and the modeled control scenarios are discussed in Chapter 3. The 2020 baseline inventory includes the same year 2020 Canada and year 1999 Mexico emissions as the Final PM NAAQS (EPA, 2006b).

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EXHIBIT 6

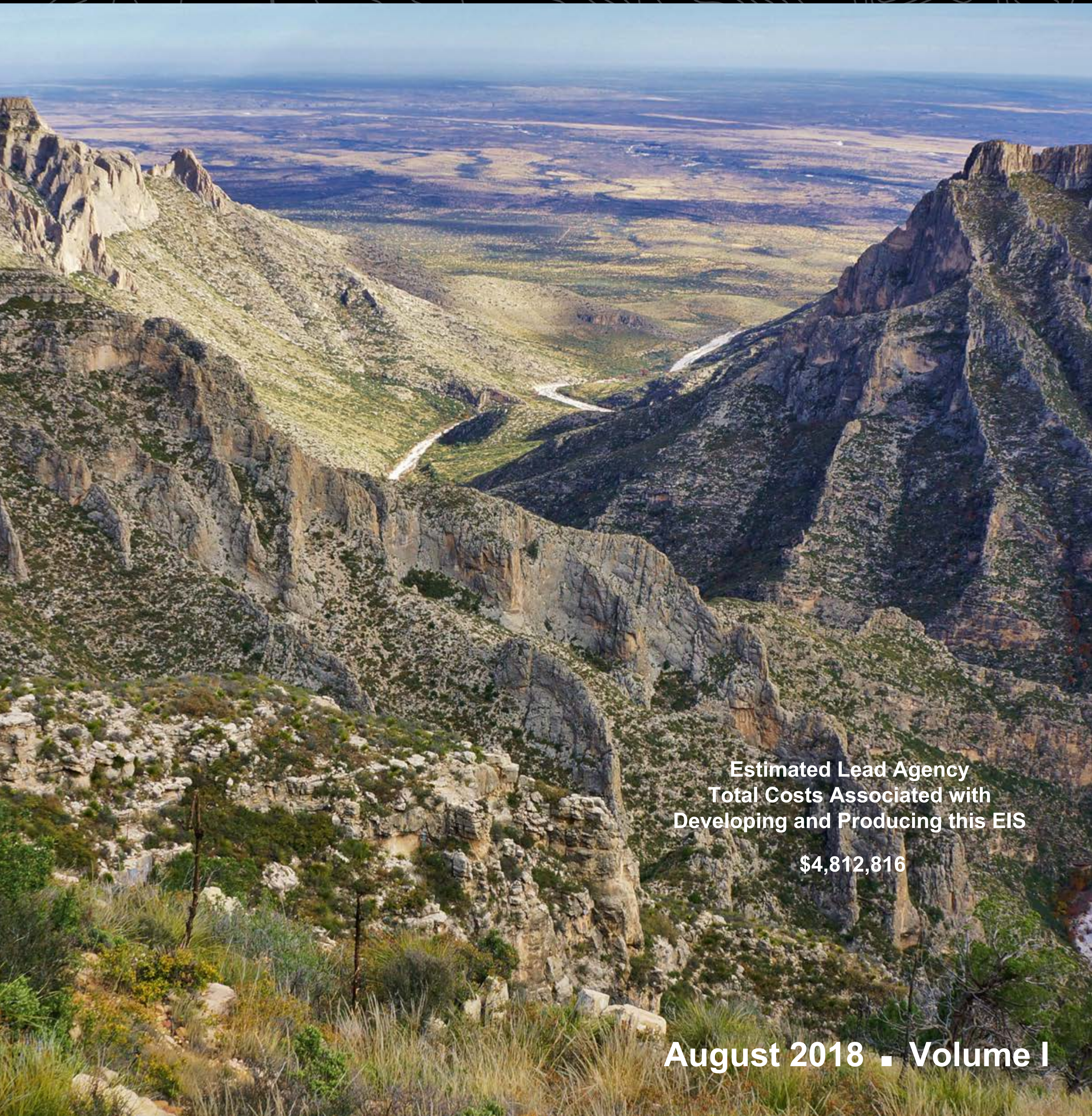
Rebuttal Testimony of Lori Marquez and Jeff Bennett

New Mexico EIB No. 20-21(A)

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

Draft Resource Management Plan and Environmental Impact Statement

Carlsbad Field Office, Pecos District, New Mexico



Estimated Lead Agency
Total Costs Associated with
Developing and Producing this EIS

$4,812,816

August 2018 ▪ Volume I

BLM/NM/PL-18-01-1610

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
New Mexico State Office
PO Box 27115
Santa Fe, New Mexico 87502-0115
www.blm.gov/nm

In Reply Refer To:
BLM/NM/PL-16-07-1610

Dear Reader:

For your review and comment, enclosed is the Draft Resource Management Plan/Environmental Impact Statement (RMP/EIS) for the public lands managed by the Bureau of Land Management (BLM) Carlsbad Field Office (CFO). The Draft RMP/EIS proposes and analyzes alternatives for future management of approximately 2.8 million acres of federal lands and subsurface minerals in Lea, Eddy, and Chaves Counties in southeastern New Mexico. Volume 1, Chapter 1 of the enclosed Draft RMP/EIS introduces the planning area and the framework for the BLM's decision-making process.

In developing the Draft RMP/EIS, the BLM has considered issues raised through public scoping and consultation and coordination with cooperating agencies and tribes, as well as internal BLM resource specialists, along with planning criteria and a range of options to resolve resource conflicts. This process has resulted in the development of four alternative management scenarios for analysis, along with the No Action Alternative (carrying forward current management). The four proposed management alternatives are A, B, C, and D. These alternatives are described in their entirety in Volume 1, Chapter 2 of the Draft RMP/EIS. Volume 1, Chapter 3 presents the affected environment baseline from which to compare impacts, and Volume 1, Chapter 4 is the analysis of potential impacts to resources or resource uses from implementation of the alternatives. Volume 1, Chapter 5 describes the CFO's consultation and coordination efforts throughout the process.

Based on the alternatives described and the associated analysis of impacts, Alternative C is identified as the Preferred Alternative. Designation of a Preferred Alternative does not represent a BLM decision and should not be viewed as the final outcome. Information received during the public comment period on the Draft RMP/EIS, new information, or changes in BLM policies or priorities may lead to a new or modified alternative being selected in the next iteration of the RMP/EIS, the Proposed RMP/Final EIS. For these reasons, it is essential that you carefully review all alternatives and consider the components of all alternatives when commenting.

Please note that acreage figures in Chapter 2 and throughout the document are based on geographical information system (GIS) data which is subject to constant refinement. Because the data is undergoing changes, however slight, there are potential discrepancies within the acreage figures. Despite these potential discrepancies, the acreages are adequate to provide for a detailed quantitative analysis and comparison of alternatives. This is a draft document and editorial corrections are expected between the draft EIS and the Final EIS.

Once approved, this RMP/EIS will replace the 1988 RMP and subsequent amendments and guide public land management by the CFO into the future. The Draft RMP/EIS and supporting information are available on the project website at: https://www.blm.gov/programs/planning-and-nepa/plans-in-development/new-mexico/carlsbad-rmp. You are invited to provide written comments, which will be used to prepare the Proposed RMP/Final EIS. Comments regarding this Draft RMP/EIS can be sent via any of the following methods:

- **Project Website (ePlanning):** www.blm.gov/new-mexico/carlsbad-rmp
- **Email:** blm_nm_cfo_rmp@blm.gov
- **Fax:** Attn: RMP Lead at (575) 234-5927

- **Mail:** RMP Lead
BLM Carlsbad Field Office
620 East Greene Street
Carlsbad, New Mexico 88220

Comment letters, faxes, and emails must include your complete name, address, and phone number. Anonymous comments will not be considered. Comments for this document must be received within 90 days from the date of the U.S. Environmental Protection Agency's publication of the Notice of Availability in the *Federal Register*.

As a member of the public, your timely, substantive comments on the Draft RMP/EIS will help agency managers and staff to formulate the Proposed RMP/Final EIS. In developing this latter document, which is the next phase of the planning process, the decision maker may select various actions from each of the alternatives analyzed in the Draft RMP/EIS to create a management strategy. This strategy will be designed to best meet the needs of the resources and values of the CFO under the BLM's mandates of multiple use and sustained yield.

We are particularly interested in feedback concerning the adequacy and accuracy of the proposed alternatives, the analysis of the potential environmental impacts of implementing the alternatives, and any new information that would aid in the analysis. Comments are most useful when they address one or more of the following:

- Errors in the analysis
- New information that would have a bearing on the analysis
- Misinformation that could affect the outcome of the analysis
- Requests for clarification

Where possible, refer to the pages and paragraphs on which you are commenting. Comments containing only opinion or preferences will be considered and included as part of the decision-making process, although they will not receive a formal response from the BLM.

The BLM will hold several public meetings to discuss the Draft RMP/EIS. Dates, times, and locations of these meetings will be distributed via newsletter and local news media and posted on the project website. Copies of the Draft RMP/EIS have been sent to affected federal, tribal, state, and local government agencies. They are also available for public inspection at the following BLM locations:

Pecos District Office
2909 West Second Street
Roswell, New Mexico 88201

Hobbs Field Station
414 West Taylor
Hobbs, New Mexico 88240

Carlsbad Field Office
620 East Greene Street
Carlsbad, New Mexico 88220

New Mexico State Office
301 Dinosaur Trail
Santa Fe, New Mexico 87508

The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in federal documents be accessible to individuals with disabilities. Efforts have been made to ensure that the information in the Draft RMP/EIS is accessible. If you have problems accessing information, or if you have questions or would like to obtain an additional copy of the Draft RMP/EIS in either hardcopy or PDF, please contact Hector Gonzalez, RMP Lead, at (575) 234-5968 or blm_nm_cfo_rmp@blm.gov.

Thank you for your participation in this planning effort. For additional information or clarification regarding this document, please contact Hector Gonzalez, RMP Lead, at (575) 234-5968 or blm_nm_cfo_rmp@blm.gov.

Sincerely,

Aden L. Seidlitz

Aden Seidlitz
Acting State Director

Abbreviations

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ABBREVIATIONS

ACEC	areas of critical environmental concern
AML	abandoned mine lands
ANC	acid neutralizing capacity
APD	Application for Permit to Drill
AQB	Air Quality Bureau
AQRVs	air quality related values
ARTSD	Air Resources Technical Support Document
ATV	all-terrain vehicle
BLM	Bureau of Land Management
BMP	best management practice
CFO	Carlsbad Field Office
CFR	Code of Federal Regulations
CMA	Core Management Area
CO	carbon monoxide
COA	condition of approval
CONUS	Continental United States (used in a figure)
CSU	controlled surface use
DAT	deposition analysis threshold
db	decibel
dBa	A-weighted decibel
DOI	U.S. Department of the Interior
DPS	distinct population segment
DSL	dunes sagebrush lizard
dv	deciview
DVF	future design value
DVs	design value
EA	environmental assessment
EGS	enhanced geothermal system
EIS	environmental impact statement
EMNRD	New Mexico Energy, Minerals, and Natural Resources Department
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERMA	extensive recreation management area
FCRPA	Federal Cave Resources Protection Act
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FLPMA	Federal Land Policy and Management Act
FMP	fire management plan
FRCC	Fire Regime Condition Class
GHG	greenhouse gas
GIS	geographic information system
H_2S	hydrogen sulfide

HAP	hazardous air pollutant
HMP	habitat management plan
IDLH/10	immediately dangerous to life or health values divided by 10
IM	instruction memorandum
IPA	isolated population area
kg/ha/yr	kilograms per hectare per year
KPLA	known potash leasing area
LAC	limit of acceptable change
LOC	level of concern
LPC	lesser prairie-chicken
LWC	lands with wilderness characteristics
LWCF	Land and Water Conservation Fund
MEI	maximally exposed individual
µeq/L	microequivalents per liter
mg/L	milligrams per liter
MLE	most likely exposure
MLRA	major land resource area
MSC	microbiotic soil crusts
MSHA	Mine Safety and Health Administration
mtpy	metric tons per year
NAAQS	National Ambient Air Quality Standards
NCSS	National Cooperative Soil Survey
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants for Oil & Natural Gas Production
NHPA	National Historic Preservation Act
NMAAQS	New Mexico Ambient Air Quality Standards
NMAC	New Mexico Administrative Code
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMOCD	New Mexico Oil Conservation District
NMOSE	New Mexico Office of the State Engineer
NOI	notice of intent
NO_x	nitrogen oxide(s)
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NWSRS	National Wild and Scenic River System
OHV	off-highway vehicle
ONA	outstanding natural area
OSHA	Occupational Safety and Health Administration

PFC	proper functioning condition
PFYC	Potential Fossil Yield Classification
PL	Public Law
PM_{10}	particulate matter with an aerodynamic diameter less than a nominal 10 micrometers
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than a nominal 2.5 micrometers
POD	plan of development
PPA	primary population area
ppb	parts per billion
ppm	parts per million
PSD	prevention of significant deterioration
psi	pounds per square inch
R&PP	Recreation and Public Purposes Act
RAMP	Recreation Area Management Plan
RELs	reference exposure levels
RfCs	reference concentrations for chronic inhalation
RFD	reasonably foreseeable development
RMP	resource management plan
RMZ	Recreation Management Zone
RNA	research natural area
ROD	Record of Decision
ROW	right-of-way
RV	recreational vehicle
SESA	social and economic study area
SHPO	State Historic Preservation Office
SMA	special management area
SO_2	sulfur dioxide
SRMA	special recreation management area
SSPA	Sparse and Scattered Population Areas
Standards and Guidelines	*New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management*
TCP	traditional cultural property
TDS	total dissolved solids
tpy	tons per year
TSP	total suspended particulates
URF	unit risk factors
USC	United States Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
VRI	Visual Resource Inventory
VRM	Visual Resource Management
VRU	vapor recovery units

WSA	wilderness study area
WSR	wild and scenic river
WSRA	Wild and Scenic River Act
WUI	wildland urban interface

Glossary

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GLOSSARY

ACQUIRED LANDS. Lands in federal ownership that were obtained by the government through purchase, condemnation, gift, or exchange.

ACRE-FOOT (AC-FT). Volume of water that will cover 1 acre of land to a depth of 1 foot; equals 43,560 cubic feet or 325,851 gallons.

ACTIVE LESSER PRAIRIE-CHICKEN LEK SITE. A lek is considered active when, with sufficient annual surveys, two or more males have been seen strutting during the mating season at least one year out of the last five.

ADJUDICATION. A formal court proceeding that results in the determination of the validity and extent of a water right.

AERIAL PHOTOGRAPHY. Photographs taken of the earth's surface from an aircraft. Both color and infrared aerial photographs can be produced that show surface features. Photographs can indicate vegetation changes and water content associated with fractures where caves may be located.

AGGREGATE. Any of several hard, inert materials, such as sand, gravel, slag, or crushed stone, used for mixing with a cementing or bituminous material to form concrete, mortar, or plaster, or used alone, as in railroad ballast or graded fill.

AIR POLLUTION. The general term alluding to the undesirable addition of substances (gases, liquids, or solid particles) to the atmosphere that are foreign to the natural atmosphere or are present in quantities exceeding natural concentrations.

ALKALI LAKES. Shallow plate-like depressions in central portions of basins that drain internally, collect runoff and evaporate rapidly; salt playas.

ALLOTMENT. An area of land designated and managed for grazing of livestock.

ALLOTMENT CATEGORIES. Allotments were placed in one of three categories based on Bureau of Land Management (BLM) criteria shown below. The criteria for each category were numerous and seldom would an allotment meet all criteria for a category.

I or "Improve" category:

- present range condition is unsatisfactory allotments have a moderate or high resource production potential, and are producing at low to moderate levels
- serious resource-use conflicts/controversy exist
- opportunities exist for positive economic return from public investments
- present management appears unsatisfactory

M or "Maintain" category:

- present range condition is satisfactory
- allotments have a moderate or high resource production potential, and are producing near their potential (or trend is moving in that direction)
- no serious resource-use conflicts/controversies exist opportunities may exist for positive economic return from public investments
- present management appears satisfactory

C or "Custodial" category:

- present range condition is not a factor allotments have a low resource production potential, and are producing at low to moderate levels
- limited resource-use conflicts/controversy may exist
- opportunities for positive economic return on public investments do not exist or are constrained by technological or economic factors
- opportunities exist to achieve the allotments potential through changes in management

ALLOTMENT MANAGEMENT PLAN (AMP). A livestock grazing activity plan for a specific allotment based on multiple-use resource management objectives. The AMP considers livestock grazing in relation to other uses of the rangelands and in relation to renewable resources (i.e., watershed, vegetation and wildlife). An AMP includes the seasons of use, number of livestock permitted on the allotment, grazing system, and the rangeland developments needed. AMPs are prepared in consultation, cooperation and coordination with the permittee(s), lessee(s) or other involved affected parties.

ANIMAL UNIT MONTH (AUM). The amount of forage necessary for the sustenance of one cow with a nursing calf or its equivalent for a period of one month.

ANNUAL WATER YIELD. The total stream flow volume that passes a specified point in a watershed during a year. It generally equals total precipitation and irrigation, less evapotranspiration losses and deep seepage losses.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN (ACEC). Areas within the public land where special management attention is needed to protect and prevent irreparable damage to important historical, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and provide safety from natural hazards.

AUTHORIZED OFFICER. Any person authorized by the Secretary of the Interior to administer regulations.

AVOIDANCE AREA. An environmentally sensitive area where rights-of-way would be granted only in cases where there is a prevailing need and no practical alternative location exists, and then only with appropriate provisions to protect the sensitive environmental components.

BENEFICIAL USE. The basis, the measure, and the limit of a water right. Agricultural, commercial, industrial, and recreational uses are all considered to be beneficial.

BERM. An embankment or mound of earth or other material. Examples of the use of a berm include use around a tank battery in an oil field to contain spilled fluids or as a barrier across a road or trail to prohibit travel by motor vehicles.

BEST MANAGEMENT PRACTICE (BMP). Method, measure, or practice selected on the basis of site-specific conditions to ensure environmental quality will be maintained or restored to its highest practicable level. BMPs include, but are not limited to, structural and non-structural controls, operations, and maintenance procedures. BMPs can be applied before, during, or after activities to reduce or eliminate impacts to soil, air, water, or vegetation resources.

BIODIVERSITY. Refers to the variety of life and its processes and includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

BLM SPECIAL STATUS PLANT SPECIES. Collectively, species federally listed or proposed for listing under the Endangered Species Act (ESA) and BLM sensitive species, which include both federal candidate species and delisted species within 5 years of delisting.

BUREAU SENSITIVE SPECIES. Species that require special management consideration to avoid potential future listing under the ESA and that have been identified in accordance with BLM Reference Manual 6840.

CALICHE. A brown or white material commonly found as a subsoil deposit in and or semiarid climates that is composed largely of calcium carbonate.

CAVE. Any naturally occurring void, cavity, recess, or system of interconnected passages that occurs beneath the surface of the earth or within a cliff or ledge (including any cave resource therein, but not including any vug, mine, tunnel, aqueduct, or other human-made excavation) and that is large enough to permit an individual to enter, whether or not the entrance is naturally formed or manmade. The term "cave" includes any natural pit, sinkhole, or other feature that is an extension of the entrance. Refer also to "Significant Cave."

CAVE EXPLORATION*.* The act of entering a naturally occurring void, cavity, recess or system of interconnected passages that occurs beneath the surface of the earth, ledge, or cliff to investigate, study or analyze contents, hazards and extent; to travel into new territories for adventure or discovery.

CLASSIFICATION OF LANDS. The process of determining whether the lands are more valuable or suitable for transfer or use under particular or various public land laws than for retention in federal ownership for management purposes.

COMMERCIAL USE. Defined as recreational use of the public lands and related waters for business or financial gain. When any person, group, or organization makes or attempts to make a profit, receive money, amortize equipment, or obtain goods or services, as compensation from participants in recreational activities occurring on public lands, the use is considered commercial. An activity, service, or use is commercial if anyone collects a fee or receives other compensation that is not strictly a sharing of, or is in excess of, actual expenses incurred for the purposes of the activity, service or use. Commercial use is also characterized by situations where a duty of care or expectation of safety is owed participants as a result of compensation. It may also be characterized by public advertising for participants.

Use by scientific, educational, and therapeutic institutions or non-profit organizations is considered commercial when the above criteria are met and subject to a permit when the above conditions exist. Non-profit status of any group or organization does not, in itself, determine whether an event or activity arranged by such a group or organization is noncommercial. Profit-making organizations are automatically classified as commercial, even if that part of their activity covered by the permit is not profit-making.

COMMUNITY. A group of plants and animals living together in a common area having close interactions.

COMMUNITY PIT. A site from which non-exclusive disposals of mineral materials can be made.

COMPETITIVE USE. Any organized, sanctioned, or structured use, event, or activity on public land in which two or more contestants compete and any of the following elements apply:

(1) Participants register, enter, or complete an application for the event; or
(2) A predetermined course or area is designated.

It also means one or more individuals contesting an established record such as speed or endurance.

CONDITION OF APPROVAL (COA). A requirement appended to a use authorization that must be met in order to be in conformance with the authorization. Conditions of approval may be standard practices that are routinely applied or may be special requirements developed through the National Environmental Policy Act (NEPA) process. Conditions of approval usually are applied to mitigate the impacts of an action. Conditions of approval do not modify any rights granted by a lease (e.g., an oil and gas lease).

CONSERVATION (ARCHAEOLOGY). A level of management applied to cultural resources exhibiting uniqueness or relative scarcity of similar cultural properties; research potential that surpasses current state of the art; or singular historic importance or architectural interest.

COORDINATED RESOURCE MANAGEMENT PLAN. A plan for management of one or more grazing allotments that involve all the affected resources, e.g., range, wildlife, watershed, minerals, and recreation.

CORRIDOR. A linear strip of land forming a passageway between two points in which transportation and/or utility systems exist or may be located. A designated corridor is the preferred location for existing and future rights-of-way grants that have been identified by law, by secretarial order, through land use planning, or by other management decision.

CRITICAL HABITAT. BLM adheres to U.S. Fish and Wildlife Service (USFWS) definitions for designated critical habitats. In general, these are specific geographic areas, whether occupied by the listed species or not, that are determined to be essential for the conservation and management of an ESA of 1973 listed species, and that have been formally described in the *Federal Register*.

CULTURAL RESOURCE. The fragile and non-renewable remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that were of importance in human events. These resources consist of physical remains, areas where significant human events occurred even though evidence of the event no longer remains, and the environment immediately surrounding the actual resource and oral history or ethnographic accounts of life ways and customs.

DESIGNATION. The official identification and naming of a general area or site on public land. Lands may be designated when they are either (1) withdrawn, (2) given special status by act of Congress, or (3) established by an approved land use plan.

DESIGNATED USES. Surface water uses specified by the Water Quality Control Commission for which water quality standards have been established. Designated uses apply whether or not they are being attained.

DESIRED PLANT COMMUNITY (DPC). The plant community that provides the vegetation attributes required for meeting or exceeding Resource Management Plan (RMP) vegetation objectives. The DPC must be within an ecological site's capability to produce these attributes through natural succession, management action, or both. A specific description of the vegetation needed to meet the vegetation objectives of a detailed activity plan or implementing action can be described as a desired plant community. Seeding mixtures under DPC would emphasize the use of native species and avoid noxious weeds and exotic species.

DISTRICT. The specific area of public land administered by a District Manager.

DIVERSION. A human-made construction that diverts water from its natural source to be put to beneficial use.

DIVERSITY. The relative degree of abundance of wildlife species, plant species, communities, habitats, or habitat features per unit area.

DRAINAGE. A term used in oil and natural gas extraction meaning the pool of either resource is “drained” or removed either through existing pressure or pumping. These pools may extend beyond the surface ownership boundaries and a well drilled on one surface owner may drain the resource underneath an adjacent surface owner.

DRASTIC. A method developed by the U.S. Environmental Protection Agency for evaluating the potential for groundwater pollution. The name "DRASTIC" is an acronym for the seven hydrogeologic factors that the method uses to produce the Drastic Index. The Index is a numerical value that helps prioritize areas with respect to groundwater contamination vulnerability. The factors are: Depth to water; Recharge; Aquifer media; Soil media; Topography (i.e., slope); Impact of the vadose zone; and, Conductivity (hydraulic) of the aquifer.

ECOLOGICAL SITE INVENTORY (ESI). The effort and documentation needed to establish realistic, achievable, and measurable vegetation management objectives.

ECOSYSTEM. A complex self-sustaining natural system that includes living and nonliving components of the environment and the circulation of matter and energy between organisms and their environment.

ENDANGERED SPECIES (FEDERAL). An animal or plant species whose prospects of survival and reproduction are in immediate jeopardy and in danger of extinction throughout all or a significant portion of its range, as defined by the USFWS under the authority of the ESA of 1973, as amended. Whether a species is threatened or endangered is determined by the following factors: (1) present or threatened destruction, modification, or curtailment of its habitat or range; (2) over utilization for commercial, sporting, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors. Also, see "Threatened Species (Federal)" in the Glossary.

ENDANGERED SPECIES (STATE). Any species or subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy. Also, see "Threatened Species (State)" in the Glossary.

ENVIRONMENTAL ASSESSMENT (EA). The procedure for analyzing the impacts of some proposed action on a given environment and the documentation of that analysis. An EA is similar to an environmental impact statement (EIS) but is generally smaller in scope. An EA may be preliminary to an EIS.

ENVIRONMENTAL IMPACT STATEMENT (EIS). The procedure for analyzing the impacts (both beneficial and adverse) of a proposed action on a given environment, and the documentation of that analysis.

ENVIRONMENTAL JUSTICE. The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

ENVIRONMENTAL QUALITY INCENTIVES PROGRAM (EQIP). A voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land.

EPHEMERAL. A stream or portion of a stream that flows in direct response to precipitation, lasts for a short period of time, and is not influenced by ground water sources. Also pertains to playa lakes that can be intermittently wet.

ESSENTIAL HABITAT. Habitat in which threatened and endangered species occur, but which has not been declared as critical habitat. Occupied habitat or suitable unoccupied habitat necessary for the protection and recovery of a federally designated proposed, candidate, threatened, or endangered species.

EXCEPTION. Case-by-case exemption from a lease stipulation. The stipulation continues to apply to all other sites within the leasehold to which the restrictive criteria apply.

EXCHANGE. A trading of public land (surface or subsurface estates) that usually does not have high public value, for lands in other ownerships that do have value for public use, management and enjoyment. The exchange may be for the benefit of other federal agencies as well as the BLM.

EXCLUSION AREAS. Areas where future rights-of-way may be granted only when mandated by law.

EXTENSIVE RECREATION MANAGEMENT AREA (ERMA). Areas where recreation is unstructured and dispersed and where minimal recreation-related investments are required. ERMAs provide recreation visitors the freedom of choice with minimal regulatory constraint. These areas consist of the remainder of land areas not included in Special Recreation Management Areas within a District or Field Office area.

FEDERAL CAVE RESOURCES PROTECTION ACT (FCRPA) OF 1988. The purposes of this act are (1) to secure, protect, and preserve significant caves on federal lands for the perpetual use, enjoyment, and benefit of all people; and (2) to foster increased cooperation and exchange of information between governmental authorities and those who utilize caves located on federal lands for scientific, education, or recreational purposes.

FEDERAL LAND. Land owned by the United States and administered by the federal government. Federal land includes public land (see Public Land in the Glossary).

FEDERAL LAND POLICY AND MANAGEMENT ACT (FLPMA) OF 1976. Public Law 94-579, gives the BLM legal authority to establish public land policy; to establish guidelines for administering such policy; and to provide for the management, protection, development, and enhancement of the public land. Often referred to and pronounced "flipma."

FEDERAL RESERVED WATER RIGHT. A water right that is reserved by the federal government when land is withdrawn from the public domain for a particular purpose, such as national parks, forests, and monuments. The amount of water reserved is only that necessary to fulfill the intended purpose.

FIELD OFFICE. The smallest administrative subdivision of a BLM district. A Field Office is administered by a Field Manager and is the equivalent of a resource area.

FIRE MANAGEMENT UNIT (FMU). A land management area definable by objectives, management constraints, topographic features, access, values to be protected, political boundaries, fuel types, major fire regime groups, etc. that set it apart from the characteristics of an adjacent FMU. The FMU may have dominant management objectives and pre-selected strategies assigned to accomplish these objectives.

FIRE REGIME CURRENT CONDITION CLASS (FRCC). A qualitative measure classified into three classes describing the relative degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings.

FLOODPLAIN. See "One Hundred-Year Floodplain" in the Glossary.

FLOWLINE. The surface pipe through which oil, water, or gas travels from a well to processing equipment or to storage.

FRAGILE SOIL. A soil that is easily damaged by use or disturbance. Examples include soils that are susceptible to compaction or other mechanic damage to their structure, or soils that are highly erodible when disturbed.

GEOGRAPHIC INFORMATION SYSTEM (GIS). Through the use of computer technology, GIS allows the input, storage, analysis, and display of a great volume and variety of physically locatable data (i.e., data that are known to exist at some specific place or area on the ground).

GRANT. A gift of public land either in quantity or in place. Also, the document or the action that conveys land or an interest in land.

GRAZING CAPACITY. The maximum livestock stocking rate possible without inducing damage to vegetation or related resources such as watershed. This incorporates factors such as suitability of the rangeland for grazing a well as the proper use that can be made on all of the plants within the area. Normally expressed in terms of acres per animal unit month (AUM) or sometimes referred to as the total AUMs that are available in any given area, such as an allotment. Areas that are unsuitable for livestock use are not computed in the grazing capacity. Grazing capacity may or may not be the same as the stocking rate.

GRAZING DISTRICT. Means the specific area within which the public land are administered under Section 3 of the Taylor Grazing Act. Public land outside grazing district boundaries is administered under Section 15 of the Taylor Grazing Act.

GROUND WATER. Subsurface water contained in interconnected pores between soil or rock particles in a zone of saturation. Groundwater includes underground lakes and streams in karst areas.

HABITAT. The location where a particular taxon of plant or animal lives and its surroundings (both living and nonliving) and includes the presence of a group of particular environmental conditions surrounding an organism, including air, water, soil, mineral elements, moisture, temperature and topography.

HABITAT MANAGEMENT PLAN (HMP). A written and officially approved plan for a specific geographical area of public land that identifies wildlife habitat and related objectives, establishes the sequence of actions for achieving objectives, and outlines procedures for evaluating accomplishments.

HAZARDOUS MATERIAL. Any substance posing a threat to the health or safety of persons or the environment. These includes but is not limited to Resource Conservation and Recovery Act hazardous wastes, Comprehensive Environmental Response, Compensation, and Liability Act and Clean Water Act hazardous substances, U.S. Department of Transportation hazardous materials, Occupational Safety and Health Administration hazardous chemicals, Superfund Amendments and Reauthorization Act Title III toxics and extremely hazardous substances, and biological and disease-causing agents.

HISTORICAL USE. The average of the highest two use seasons in the preceding five-year period.

INFORMATION (ARCHAEOLOGY). A level of management applied to cultural resources. Most sites fall into this category and would be studied for the information that could be retrieved from them. The process of extracting information often destroys the site. These sites could be lithic scatters, campsites, and other types of sites.

INTERMITTENT STREAM. A stream that does not flow year round but has some association with groundwater for surface or subsurface flows.

KARST. A landform where the topography has been formed chiefly by the dissolving of rock. In some cases, the dissolving of rock may be extensive enough to form passages through which an individual could pass. Surface expressions include sinking streams, swallets, springs and resurgences, and the presence of sinkholes and caves. Surface streams are few, with most of the drainage being underground. These features are important for groundwater recharge of karst systems.

KNOWN POTASH LEASING AREA. Identified areas with valuable deposits of potash where prospecting permits may not be issued, and any leasing must be done on a competitive basis. **LEASABLE MINERALS.** Minerals or materials administered under the Mineral Leasing Act of 1920, as amended and supplemented (30 USC 181, et seq.), the Mineral Leasing Act for Acquired Lands of 1947, as amended and supplemented (30 USC 351, et seq.), and the Geothermal Steam Act of 1970, as amended and supplemented (30 USC 1001, et seq.). These include cloal, phosphate, asphalt, sulphur, potassium, sodium, oil, gas and geothermal.

LEASE. An authorization to possess and use public land for a fixed period of time (usually long term). Also, any contract, profit-share arrangement, joint venture, or other agreement issued or approved by the United States Government under a mineral leasing law that authorizes exploration for, extraction of, or removal of oil and gas resources.

LEASE NOTICE. An attachment to an oil and gas lease that transmits information at the time of lease issuance to assist a lessee in submitting acceptable plans of operation, or to assist in administration of leases. A lease notice is used to disclose a situation or condition known to exist that could affect lease operations. Lease notices are not a basis for denial of lease operations.

LEGAL ACCESS. In the context of access to public land, especially public land tracts that may be adjacent to or surrounded by land of other ownerships, legal access exists when a person can reach a given public land tract without trespassing, such as from a public road or highway, or from another tract of public land. (See "Physical Access.")

LENTIC. Pertaining to static, calm, or slow moving water or aquatic habitats, such as a marsh.

LEK. A specific area (also termed display, gobbling, booming or strutting grounds) where two or more lesser prairie-chicken cocks congregate, typically year after year, for courtship displays in early spring, and vary in size from one-eighth acre to several acres.

LOCATABLE MINERALS. Minerals subject to disposal and development through the Mining Law of 1872 (as amended). Includes all "valuable mineral deposits" including metallic and nonmetallic minerals such as gold, lead, barite, fluorspar or high calcium limestone. It also includes uncommon varieties of sand, stone, gravel, cinders, pumice, pumicite and clay. Also included are all valuable minerals that are not excluded under the leasable and salable minerals.

MANAGEMENT FRAMEWORK PLAN (MFP). A planning decision document now replaced by RMPs that establishes for a given planning area land use allocations, coordination guidelines for multiple use, and management objectives to be achieved for each class of land use or protection.

MINERAL MATERIALS. Minerals such as common varieties of sand, stone, gravel, pumice, pumicite and clay that are not obtainable under the mining or leasing laws but that can be obtained under the Materials Act of 1947, as amended. Also known as saleable (or salable) minerals.

MODERN URBAN. Areas with recreation opportunities to experience affiliation with individuals and groups are prevalent as in the convenience of sites and opportunities. Experiencing the natural environment and the use of outdoor skills are largely unimportant. One of the six classes of the Recreation Opportunity Spectrum (ROS).

MODIFICATION. A fundamental change in the provisions of a lease stipulation, either temporarily or for the term of the lease. A modification may, therefore, include an exemption from or an alteration to a stipulated requirement. Depending on the specific modification, the stipulation may or may not apply to all other sites within the leasehold to which the restrictive stipulation applies.

MULTIPLE USE MANAGEMENT. Management of public land and their various resource values so they are used in the combination best meeting the present and future needs of the American people. Such a concept allows for the most judicious use of some or all of the resources over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions. Relative resource values are considered, not necessarily the combination of uses that would give the greatest potential economic return or the greatest unit output.

NATIONAL REGISTER OF HISTORIC PLACES (NRHP). A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture.

NATIONAL TRAILS SYSTEM. The National Trails System is composed of four types of trails: (1) national recreation trails; (2) national scenic trails; (3) national historic trails; and (4) connecting or side trails. National recreation trails provide for numerous outdoor recreation activities in a variety of urban, rural, and remote areas. They may be designated by the Secretary of the Interior or by the Secretary of Agriculture where lands administered by that agency are involved.

NONCOMMERCIAL USE. A recreational activity on public land or related waters where actual expenses are shared equally among all members or participants. Any person, group, or organization seeking to qualify as noncommercial must establish to the satisfaction of BLM that no financial or business gain will be derived from the proposed use. Fund raising, for any purpose, renders an activity a commercial use.

NONPOINT SOURCE POLLUTION (NPS). The alteration of waters by activities not regulated as point sources, which degrade the quality or adversely affect the biological community inhabiting the waters.

NO SURFACE OCCUPANCY (NSO). A condition of surface use attached to a lease or other authorization applied to minerals exploration and development that prohibits occupancy of only the land surface or to protect other identified resource values.

NOXIOUS WEED. A plant that causes disease or has other adverse effects on the human environment and is, therefore, detrimental to the agriculture and commerce of the United States and public health. Generally, noxious weeds possess one or more of the characteristics of being aggressive and difficult to manage, parasitic, a carrier or host of harmful insects or disease, and being either native, new to, or not common in, the United States. In most cases, however, noxious weeds are non-native species. Noxious weeds are designated and regulated by various state and federal laws.

OCCUPIED HABITAT. Unless previously defined for a particular species, an area where a species' physical occupation has been observed and documented as active, wholly or in part of its lifecycle or range. In the case of life phases, species or habitats that are difficult to survey (e.g., annual plants, cliffs), where surveys may not include the full distribution of the species, suitable habitat adjacent to known occupied habitat may also be treated as occupied habitat. For pants, occupied habitat includes immediately adjacent areas where seeds are likely in the ground (an additional 10 meters will account for most seed dispersal).

OCCUPIED LESSER PRAIRIE-CHICKEN HABITAT. Suitable habitat within 3 miles of any lesser prairie-chicken (LPC) detection within the past 5 years.

OCCUPIED RAPTOR NEST. An occupied raptor nest is defined as a large stick nest with the observation of one or more raptors within the nest or within the immediate vicinity of the nest and/or evidence of raptor occupation (e.g. recent nest material, prey remains) during the breeding season (March–June).

OFF-HIGHWAY VEHICLE (OHV). Any motorized vehicle capable of, or designed for, travel on or immediately over land, water, or other natural terrain, excluding: (1) any non-amphibious registered motorboat; (2) any military, fire, emergency, or law enforcement vehicle while being used for emergency purposes; (3) any vehicle whose use is expressly authorized by the authorized officer, or otherwise officially approved; (4) vehicles in official use; and (5) any combat or combat support vehicle when used for national defense.

Open: Vehicle travel is permitted in the area (both on and off roads) if the vehicle is operated responsibly in a manner not causing, or unlikely to cause significant, undue damage to or disturbance of the soil, wildlife, wildlife habitat, improvements, cultural, or vegetative resources of other authorized uses of the public land.

Limited: Designated areas and trails where the use of an OHV is subject to restrictions, such as limiting the number on types of vehicles allowed, or dates and times of use (seasonal restrictions); limiting use to designated roads and trails. Combinations of restrictions are possible, such as limiting use to certain types of vehicles during certain times of the year.

Closed: Designated areas, roads, and trails where the use of an OHV is permanently or temporarily prohibited. Emergency use of vehicles allowed.

ONE HUNDRED-YEAR FLOOD. The flood that will be equaled or exceeded an average of once every 100 years; i.e., the flood that has a 1% chance of being equaled or exceeded in any given year.

ONE HUNDRED-YEAR FLOODPLAIN. The area adjacent to a stream or body of water that would be inundated at the peak of the one hundred-year flood. The floodplain delineated on Flood Insurance Rate Maps (FIRMs) or Flood Hazard Boundary Maps (FHBMs) published by the Federal Emergency Management Agency will be used for management purposes. When a FIRM or FHBM is not available for the area of interest, the best available information will be used.

OPERATING PLAN. An applicant's/permittee's plan to conduct their activity or event on public lands or related waters in conjunction with a Special Recreation Permit. An operating plan will describe at a minimum how services will be delivered, how an event will be conducted, and describes measures that will be implemented to protect resources and provide for public health and safety.

ORGANIZED GROUP ACTIVITY OR EVENT. A structured, ordered, consolidated, or scheduled event or occupation of public lands for the purpose of recreational use that is not commercial or competitive, and which the BLM has determined needs a special recreation permit based on planning decisions, resource concerns, potential user conflicts, or public health and safety.

PAYMENT IN LIEU OF TAXES (PILT). Payments to local or state governments based on ownership of federal land and not directly dependent on production of outputs or receipt sharing.

PERENNIAL STREAM. Surface water normally flows throughout the year except during infrequent years of drought.

PERMIT (GRAZING). A document authorizing use of the public land within grazing districts under Section 3 of the Taylor Grazing Act for the purpose of grazing livestock.

PERMIT. An authorization, revocable by or at the discretion of the BLM, to utilize public lands for a fixed period of time. A permit conveys no possessory interest in the land.

PERMITTEE. An individual, group or organization who has fulfilled all the requirements for and has been awarded a permit.

PETROGLYPH. A form of rock art manufactured by incising, scratching, or pecking designs into rock surfaces.

PHREATOPHYTE. A type of plant common to all regions that has an extensive root system to draw water directly from the water table.

PHYSICAL ACCESS. In the context of access to public land, especially public land tracts that may be adjacent to or surrounded by land of other ownerships, physical access exists when a person can physically reach a given public land tract. The existence of physical access does not always mean that legal access exists. In some cases, taking advantage of physical access may involve trespass. (See "Legal Access.")

PIPELINE. A system of connected lengths of steel or plastic pipe, laid either in the earth or on the surface that is used for transporting petroleum, petroleum products, chemicals, natural gas, or other fluids.

PLAN OF DEVELOPMENT. A document submitted with a right-of-way application that includes project details such as the purpose and need for the project, location details, design factors, additional temporary workspace, agencies and jurisdictions involved, construction and reclamation plans, operations plans, and environmental constraints.

PLAYA. A shallow, nearly level, often saline, dry lake bed. Playas vary considerably in materials, salinity, and hydrologic regime. In general, playas: (1) collect surface runoff in closed basins; (2) are poorly vegetated; (3) are ephemerally flooded; and (4) have a thin surface of non-gravelly, fine-textured sediment.

POINT SOURCE POLLUTION. Pollution discharged from any discernible, confined, and discrete conveyance into a water body; e.g., effluent from a pipe. Point source pollution does not include return flow from irrigated agricultural land.

POTENTIAL HABITAT. Unless previously defined for a particular species, areas predicted to be suitable for a species' occupation, wholly or in part of its lifecycle or range. These areas have been modeled or assessed through mapping (i.e., GIS, aerial imagery) to contain elements expected to provide suitable habitat for the target species. Models and assessments may be based on proximity to occupied habitat, associated species, canopy cover, specific substrates (i.e., formation soil units), climate, hydrological features, slopes, aspects and/or elevation ranges, but are not limited to these factors. Potential habitat may or may not have been assessed.

POTENTIALLY SUITABLE LESSER PRAIRIE-CHICKEN HABITAT. Unoccupied areas of appropriate vegetation type, but in patches of less than 320 acres and/or falling within Robel impact/avoidance distances around infrastructure.

PRECIPITATION. Any or all forms of water particles, liquid, or solid that fall from the atmosphere and reach the ground.

PRESCRIBED FIRE. Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements (where applicable) must be met, prior to ignition.

PRESCRIPTION. A written statement defining objectives to be attained as well as temperature, humidity, wind direction and wind speed, fuel moisture content, and soil moisture under which a fire will be allowed to burn, generally expressed as acceptable ranges of the various indices, and the limit of the geographic area to be covered.

PRIMITIVE (P). Areas with recreation opportunities for isolation from the sights and sounds of man, to feel a part of the natural environmental, to have a high degree of challenge and risk, and to use outdoor skills. One of the six classes of the Recreation Opportunity Spectrum (ROS).

PUBLIC LAND. Any land and interest in land owned by the United States within the several states and administered by the Secretary of the Interior through the Bureau of the Land Management, without regard to how the United States acquired ownership, except (1) land located on the Outer Continental Shelf; and (2) land held for the benefit of Indians, Aleuts, and Eskimos.

PUBLIC VALUES AND INTERPRETATION (ARCHAEOLOGY). A level of management of cultural sites that contribute to the belief systems and folkways of a cultural group such as locations having religious significance. Public interpretive sites would have qualities that would lend themselves to being utilized as recreation, education, and interpretive areas.

QUARRYING (MINING). The extraction of building stone or other valuable nonmetallic constituent from a surface mine, or quarry.

RANGE IMPROVEMENT. An authorized activity or program on or relating to rangelands that is designed to improve production of forage; range vegetative composition; control patterns of use; provide water; stabilize soil and water conditions; and provide habitat for livestock, wild horses or burros, and wildlife. The term includes, but is not limited to structures, treatment projects, and use of mechanical means to accomplish the desired results.

RANGELAND. Land used for grazing by livestock and big game animals on which the vegetation is dominated by grasses, grass-like plants, forbs, or shrubs.

RAPTOR. A bird of prey, such as an eagle, hawk, or owl.

RECLAMATION. The reconstruction of disturbance by returning the land to a condition approximate or equal to that which existed prior to disturbance, or to a stable and productive condition compatible with the land use plan. The immediate goal of reclamation is to stabilize disturbed areas and protect both disturbed and adjacent undisturbed areas from unnecessary degradation.

RECREATION AND PUBLIC PURPOSES ACT (R&PP). The Act of June 14, 1926, as amended (43 United States Code 869, 869-4). Allows the disposal of public land to any state, local, federal, or political instrumentality or nonprofit organization or any recreational or public purpose, at the discretion of the authorized officer.

RECREATION AREA/SITE. An area of recreation may be a site, complex of sites, or a high impact recreation area that, at a minimum, meets all of the conditions in REA Chapter 3(f)(4)(A-D). Further Definition: High-Impact Recreation Area, Geographic area, or Waterway Corridor: A high impact recreation area or geographic area or waterway corridor of concentrated recreation use that includes a variety of developed sites providing a similar recreation opportunity. High-impact recreation areas incur significant expenditures for restoration, public safety, sanitation facilities, education, maintenance, and other activities necessary to protect the health and safety of visitors, cultural resources and the natural environment. They may contain sub-areas of little development and use that results in environmental impacts such as noticeable litter, vandalism, soil compaction, or erosion. These areas require intensive management to enhance visitor experiences, address environmental impacts, and manage conflicting uses. An area of high recreation impact is not an administrative unit such as a National Forest, BLM Field Office, or Reclamation Project. In addition, it is contiguous areas directly associated with a clearly identified special, natural, or cultural features, place or activity that is the focal point of recreation use and have clearly defined access points and clearly described area boundaries.

Typically, a high impact recreation area is comprised of a complex of individual sites and displays one or more of the following characteristics:

(1) Has a population of one million or more within two hours of driving time;
(2) Contains rivers, streams, lakes or interpreted scenic byways corridors;
(3) Designed and conducted to maintain or enhance the recreational opportunities through Natural Resource Management Activities;
(4) Has regionally or nationally recognized recreation resources; and
(5) Is regionally or locally marketed for its tourism value.

RECREATION EXPERIENCES. Psychological outcomes realized either by recreation-tourism participants as a direct result of their onsite leisure engagements and recreation-tourism activity participation or by non-participating community residents as a result of their interaction with visitors and guests within their community and/or interaction with the BLM and other public and private recreation-tourism providers and their actions.

RECREATION OPPORTUNITIES. Favorable circumstances enabling visitors' engagement in a leisure activity to realize immediate psychological experiences and attain more lasting, value-added beneficial outcomes.

RECREATION-TOURISM MARKET. Recreation-tourism visitors, affected community residents, affecting local governments and private sector businesses, or other constituents and the communities or other places where these customers originate (local, regional, national, or international). Based on analysis of supply and demand, land use plans strategically identify primary recreation-tourism markets for each SRMA—destination, community, or undeveloped.

RECREATION OPPORTUNITY SPECTRUM (ROS). A continuum used to characterize recreation opportunities in terms of setting, activity, and experience opportunities. Six classes are included: primitive (P), semiprimitive nonmotorized (SPNM), semi-primitive motorized (SPM), roaded natural (RN), rural (R), and modern urban (U). Refer to the individual definitions in this glossary.

RELATED WATERS. Waters that lie directly over or adjacent to public lands and require some management control to protect federally administered resources or to provide for enhanced visitor safety.

RESERVATION. A withdrawal of a permanent nature, dedicated to a specific public purpose.

RESOURCE MANAGEMENT PLAN (RMP). A written land use plan that outlines BLM's decisions and strategies for management of the resources in a particular area. The RMP has been used by the BLM since 1980.

RESTRICTED AREAS. Areas where mitigation such as seasonal restrictions is required to protect resource values.

ROADED NATURAL (RN). Areas with about equal recreation opportunities for affiliation with other user groups and for isolation from sights and sounds of humans. Involves the opportunity to have a high degree of interaction with the natural environmental. Challenge and risk opportunities are not very important except in specific challenging activities. The practice of outdoor skills may be important. Opportunities for both motorized and nonmotorized recreation are present. One of the six classes of the Recreation Opportunity Spectrum (ROS).

RURAL (R). Areas with recreation opportunities to experience affiliation with individuals and groups are prevalent as is the convenience of sites and opportunities. These factors are generally more important than the natural setting. Opportunities for wild land challenges, risk taking, and testing of outdoor skills are unimportant, except in activities involving challenge and risk. One of the six classes of the Recreation Opportunity Spectrum (ROS).

SCOPING PROCESS. An early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. Scoping may involve public meetings, field interviews with representatives of agencies and interest groups, discussions with resource specialists and managers, written comments in response to news release, direct mailings and articles about the proposed action, and scoping meetings.

SUITABLE HABITAT. Unless previously defined for a particular species, areas that contain or exhibit the components necessary to support a target species' persistence, wholly or in part of its lifecycle or range, regardless of documented species' presence.

RIGHT-OF-WAY (ROW). The legal right for use, occupancy, or access across land or water areas for a specified purpose or purposes. Also, the lands covered by such a right. Examples are roads, power lines, pipelines, water wells, and communication sites. It does not grant an estate of any kind.

RIPARIAN AREAS. Riparian areas are a form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers, and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil.

RIPARIAN AREA. A riparian area is an area of land occurring adjacent to streams, rivers, and other water bodies that is directly influenced by water. A riparian community is characterized by certain types of vegetation, soils, hydrology, and fauna and requires free or unbound water or conditions more moist than normally found in the area. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent on free water in the soil.

Saleable (or salable) minerals. See mineral materials.

SEDIMENT YIELD. A quantitative measure of the total sediment outflow from a watershed over a given period of time at a specified point in the channel. Sediment yield is the difference between the total erosion from slopes, channels, and mass wasting, and the amount of sediment deposited before reaching the specified point in the channel.

SEEPS. Is where ground water percolates to the surface and forms a saturated area.

SELF-SUSTAINING POPULATION. A population that survives at, or increases beyond, what is assessed to be a viable stable level in a natural state in the wild.

SEMI-PRIMITIVE MOTORIZED (SPM). Areas with some recreation opportunity for isolation from the sights and sounds of humans, but not as important as for primitive opportunities. Involves the opportunity to have a high degree of interaction with the natural environment, to have moderate challenge and risk, and to use outdoor skills. Provides an explicit opportunity to use motorized equipment while in the area. One of the six classes of the Recreation Opportunity Spectrum (ROS).

SEMI-PRIMITIVE NON-MOTORIZED (SPNM). Areas with some recreation opportunity for isolation from the sights and sounds of humans, but not as important as for primitive opportunities. Involves the opportunity to have a high degree of interaction with the natural environmental, to have moderate challenge and risk, and to use outdoor skills. One of the six classes of the Recreation Opportunity Spectrum (ROS).

SIGNIFICANT CAVE. A cave located on federal lands that possesses one or more of the following features, characteristics, or values (1) Biota; (2) Cultural; (3) Geologic/Mineralogic/Paleontologic; (4) Hydrologic; (5) Recreational; (6) Educational or Scientific.

SIGNIFICANT KARST. An area in which sinkholes or other features, such as lineaments, provide points of recharge to an aquifer that is the source of water for human, livestock, or wildlife use, or which provides a primary recharge zone for cave-related hydrologic systems.

SINKHOLE. A closed depression formed when the ground surface collapses above voids created by the solution of carbonate or evaporate rocks. Water levels typically fluctuate rapidly in sinkholes because of their close connection to groundwater.

SITES. An area, such as a mountaintop, where a holder locates one or more communication or other right-of-way facilities.

SLOPE. The inclination of the land surface to the horizontal. When expressed as a percent, slope equals the change in elevation divided by the horizontal distance, with the result multiplied by 100 percent. Thus, a slope of 20 percent is a change in elevation of 20 feet for every 100 feet horizontally.

SPECIAL AREAS. Designated by statute, Executive, or Secretarial order, State Director special rule making authority, or an area covered by joint agreement between the BLM and a state under Title II of the Sikes Act (16 United States Code 670a et seq.).

SPECIAL HABITAT FEATURE. A specific component of a habitat site requiring individual consideration, including geological anomalies (cliffs), aquatic situations (seeps), or human-made structures (windmill). A feature may be present in the habitat site because of animal use (booming grounds). Special habitat features may affect wildlife positively or negatively.

SPECIAL MANAGEMENT AREAS. An area containing one or a combination of unique resources or values that receive more intensive management (e.g., ACECs, Wilderness Study Areas [WSAs], and SRMAs).

SPECIAL RECREATION MANAGEMENT AREA (SRMA). Areas requiring explicit recreation management to achieve BLM's recreation objectives and to provide specific recreation opportunities. SRMAs are listed in this plan, which also define SRMA management objectives. The BLM's recreation investments are concentrated in these areas.

SPECIAL RECREATION PERMIT. An authorization that allows specified recreational uses of the public lands and related waters. Special Recreation Permits are issued as a means to manage visitor use, protect natural and cultural resources, and as a mechanism to authorize commercial, competitive, and vending use; organized group activities and events; and individual or group use of special areas.

SPECIAL STATUS SPECIES. Wildlife and plant species either federally listed or proposed for listing (candidates) as endangered or threatened, state-listed species, or BLM determined priority species (sensitive species).

SPRING. Where water is discharged from a fixed point and the flow usually forms a small channel.

SOLID LEASABLE MINERALS. The chlorides, sulfates, carbonates, borates, silicates or nitrates of potassium or sodium and related products; sulphur in the States of Louisiana and New Mexico and on all acquired lands; phosphate, including associated and related minerals; asphalt in certain lands in Oklahoma; and gilsonite (including all vein-type solid hydrocarbons).

STATE APPROPRIATIVE WATER RIGHT. A water right licensed by the New Mexico State Engineer once proof of beneficial use is established.

STATE HISTORIC PRESERVATION OFFICER (SHPO). A position within state governments responsible for coordinating State participation in the implementation of the National Historic Preservation Act. This officer serves as an assistant and consultant when identifying cultural properties, assessing effects to them, and considering alternatives to avoid or reduce those effects.

STIPULATION. A requirement, usually dealing with protection of the environment that is made a part of a lease, grant, or other authorizing document. In the case of oil and gas leases, a provision that modifies standard lease rights and is attached to and made a part of the lease. Also, refer to "CONDITION OF APPROVAL (COA)" in the Glossary. The following represent the major stipulations on BLM land:

> **No Surface Occupancy Stipulation (NSO):** A stipulation in which use or occupancy of the land surface for fluid mineral exploration or development is prohibited to protect identified resource values.
>
> **Timing Limitation Stipulation:** A stipulation that prohibits surface use during specified time periods to protect identified resource values. This stipulation does not apply to the operation and maintenance of production facilities unless the findings of analysis demonstrate the continued need for such mitigation and that less stringent, project specific mitigation measures would be insufficient.
>
> **Controlled Surface Use Stipulation (CSU):** A stipulation in which use and occupancy is allowed (unless restricted by another stipulation), but identified resources values require special operational constraints that may modify the lease rights.

STRUTTING GROUND. Synonymous with lek.

SUITABILITY. The adaptability of an area to grazing by livestock or wildlife.

SUITABLE LESSER PRAIRIE-CHICKEN HABITAT. Unoccupied areas of appropriate vegetation type, in patches of 320 acres or more falling entirely outside of Robel impact/avoidance distances around infrastructure.

SUITABLE RANGE. Rangeland that is accessible to livestock that can be grazed on a sustained yield basis without damaging the resource.

SURFACE DISTURBANCE. Any action that removal of soil or vegetation and expose the mineral soil to erosive processes. Used in the literal context of actual, physical disturbance and movement or removal of the land surface and vegetation.

SURFACE USE PLAN OF OPERATIONS (SUPO). The purpose of a SUPO is to manage development so that impacts to special status species habitat are minimized or eliminated. A SUPO would incorporate applicable best management practices and disclose all future well locations; the location and arrangement of well infrastructure (e.g., tank batteries, compressors, power lines and poles); road locations; and rights-of-way. SUPOs contain proprietary information and therefore are not subject to disclosure under the Freedom of Information Act.

SURFACE WATER. All water located at the surface of the land, such as streams, rivers, and lakes.

THREATENED SPECIES (Federal). Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Whether a species is threatened or endangered is determined by the following factors: (1) present or threatened destruction, modification, or curtailment of its habitat or range; (2) over utilization for commercial, sporting, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors. Also, see "Endangered Species (Federal)" in the Glossary.

THREATENED SPECIES (State). Any species or subspecies that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico. Also, see "Endangered Species (State)" in the Glossary.

TRAVEL MANAGEMENT AREAS. Polygons or delineated areas where a rational approach has been taken to classify areas open, closed, or limited, and have identified and/or designated network of roads, trails, ways, and other routes that provide for public access and travel across the planning area. All designated travel routes within travel management areas should have a clearly identified need and purpose as well as clearly defined activity types, modes of travel, and seasons or timeframes for allowable access or other limitations.

TURBIDITY. A condition in water caused by the presence of suspended matter that results in the scattering and absorption of light. Generally, a measure of fine suspended matter in water.

UNDEVELOPED RECREATION-TOURISM MARKET. National, regional, and/or local recreation-tourism visitors, communities, or other constituents who value public lands for the distinctive kinds of dispersed recreation produced by the vast size and largely open, undeveloped character of their recreation settings. Major investments in facilities are excluded within SRMAs where the BLM's strategy is to target demonstrated undeveloped recreation-tourism market demand. Here, recreation management actions are geared toward meeting primary recreation-tourism market demand to sustain distinctive recreation setting characteristics; however, major investments in visitor services are authorized both to sustain those distinctive setting characteristics and to maintain visitor freedom to choose where to go and what to do—all in response to demonstrated demand for undeveloped recreation.

UNITIZATION. The joint development of an oil field that includes territory controlled by different owners. A unitized field allows participants to share both royalties and risks in the development of the field and to utilize the field's natural features without damaging the field through excessive competition.

UNSUITABLE LESSER PRAIRIE-CHICKEN HABITAT. Areas outside appropriate vegetation. This may include urban and agricultural areas, areas where shinnery oak is naturally not present or has been eliminated by chemical treatment, and other areas where natural vegetation has been greatly altered or degraded.

USE OF WILDLAND FIRE. Either wildland fire use or prescribed fire applications to meet resource objectives.

VALUE. As used in the RMP/EIS, a value refers to a natural resource or characteristic of a natural resource that is not usually a commodity or is difficult to quantify in terms of a unit of measurement. Examples of values in this context are listed in FLPMA and include scientific, scenic, air and atmospheric, historical, archeological and ecological resources.

VEGETATION TREATMENTS. Methods used to manage the growth and spread of vegetation. A vegetative management practice can either be a direct management of the vegetation itself, for example prescribed fire or indirect management like a change in the number of livestock utilizing the vegetation, or a change in the time frames when livestock are utilizing the vegetation.

VISUAL RESOURCES MANAGEMENT (VRM). The inventory and planning actions taken to identify visual values and to establish objectives for managing those values; and the management actions taken to achieve the visual management objectives.

VISUAL RESOURCE MANAGEMENT (VRM) CLASSES. VRM classes are based on relative visual ratings of inventoried lands. Each class describes the different degree of modification allowed to the basic elements of the landscape. The following are the minimum management objective for each class.

Class 1: Natural ecological changes and very limited management activity are allowed. Any contrast created within the characteristic landscape must not attract attention. This classification is applied to visual ACECs, wilderness areas, wild and scenic rivers, and other similar situations.

Class II: Changes in any of the basic elements (form, line, color, texture) caused by a management activity should not be evident in the landscape. A contrast may be seen but should not attract attention.

Class III: Contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the landscape. The changes, however, should remain subordinate in the existing landscape.

Class IV: Contrasts may attract attention and be a dominant feature in the landscape in terms of scale. However, the changes should repeat the basic elements of the landscape.

Rehabilitation Area: Change is needed or change may add acceptable visual variety to an area. This class applies to areas where the naturalistic character has been disturbed to a point where rehabilitation is needed to bring it back into character with the surrounding landscape. This class would apply to areas identified in the scenic evaluation where the quality class has been reduced because of unacceptable cultural modification. The contrast is inharmonious with the characteristic landscape. It may also be applied to areas that have the potential for enhancement; i.e., add acceptable visual variety to an area or site. It should be considered an interim or short term classification until one of the other VRM class objectives can be reached through rehabilitation or enhancement. The desired visual resource management class should be identified.

WAIVER. Permanent exemption from a lease stipulation. The stipulation no longer applies anywhere within the leasehold.

WATER QUALITY STANDARD. Regulations that specify designated uses for surface waters of the state, and water quality criteria to protect those uses. Standards are specified by the Water Quality Control Commission, in accordance with Section 303 of the Clean Water Act.

WETLANDS. Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that, under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, shallows, swamps, lake shores, bogs, muskegs, wet meadows, estuaries, and riparian areas.

WILDERNESS. The definition contained in Section 2(c) of the Wilderness Act of 1964 is as follows: “A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.” Wilderness is an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features or scientific, educational, scenic, or historical value.

WILDERNESS AREA. An area formally designated by Congress as part of the National Wilderness Preservation System.

WILDERNESS STUDY AREA (WSA). A roadless area that has been found to have wilderness characteristics.

WILDERNESS CHARACTERISTICS. Those characteristics of wilderness as described in Section 2(c) of the Wilderness Act. These include size, naturalness, solitude, primitive and unconfined type of recreation, and supplemental values.

WILDFIRE. An unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

WILDFIRE SUPPRESSION. An appropriate management response to wildfire, escaped wildland fire use or prescribed fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire.

WILDLAND FIRE. Any non-structure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire, wildland fire use, and prescribed fire.

WILDLAND FIRE USE. The application of the appropriate management response to naturally-ignited wildland fires to accomplish specific resource management objectives in predefined designated areas outlined in Fire Management Plans.

WILDLIFE. Includes all species of animals, birds, mammals, mollusks, crustaceans, amphibians, fish, insects, reptiles, or their progeny or eggs that, whether raised in captivity or not, are normally found in a wild state. Feral horses and burros are excluded.

WITHDRAWAL. Removal or withholding of public land, by statute or secretarial order, from operation of some or all of the public land laws. A mineral withdrawal is the closing of an area to mineral location and development activities. A mineral withdrawal includes public lands potentially valuable for solid leasable minerals, precluding the disposal of the lands except with a mineral reservation clause unless the lands are found not to contain a valuable deposit of minerals.

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Executive Summary

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Executive Summary

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INTRODUCTION

The U.S. Department of the Interior (USDI) is the steward and manager of America's natural resources, including oil, gas, coal, hydropower, and renewable energy resources. The USDI manages lands, subsurface rights, and offshore areas that produce approximately 19% of the nation's energy. Energy development on public lands increases domestic energy production, provides alternatives to overseas energy resources, creates jobs, and enhances the nation's energy security. The Office of Natural Resources Revenue (ONRR) collects an average of over $10 billion in annual revenue from onshore and offshore energy production, one of the federal government's largest sources of non-tax revenue.

The Bureau of Land Management (BLM) Carlsbad Field Office (CFO) has prepared this Draft Resource Management Plan and Environmental Impact Statement (Draft RMP/EIS) to provide potential direction for managing public lands within the CFO planning area and to analyze the environmental effects of the proposed actions.

The Draft RMP/EIS, once approved, will replace the Carlsbad Resource Management Plan (RMP), which was signed in 1988 and amended in 1997 and 2008 (BLM 1988). The Draft RMP/EIS covers the same area as that covered by the 1988 RMP as amended, which is all of Lea and Eddy Counties and the "bootheel" or southwest portion of Chaves County. The Carlsbad planning area comprises approximately 6,260,000 acres of land, of which BLM administers approximately 2,090,000 acres of public land and 2,744,000 acres of subsurface federal mineral estate of some of the most prodigious oil and natural gas minerals in the United States.

The public lands and federal mineral estate managed by the CFO possess unique geology containing prodigious oil and natural gas reserves in the Delaware Basin, which includes the Wolfcamp Shale Formation. The planning area is mostly rural in nature, is primarily a desert landscape, and includes parts of three ecoregions, the Chihuahuan Desert, Arizona/New Mexico Mountains, and High Plains. The terrain consists mostly of basins broken up by small mountain ranges. The planning area ranges in elevation from 866 to 7,487 feet above mean sea level. The lowest point in the state of New Mexico is located on the Red Bluff Reservoir in Eddy County, where the impounded Pecos River flows out of New Mexico into Texas. The highest point in the planning area is Dog Canyon Rim in the Guadalupe Escarpment. The planning area also includes the Delaware, Pecos, and Black Rivers.

BLM land within this planning effort will support guidance outlined in Executive Order 13790 Promoting Agriculture and Rural Prosperity in America by using public lands in the planning area to foster jobs and the rural community associated with oil and gas development, other mineral development (e.g., potash, sodium), livestock grazing, and recreation. The preferred alternative projects 14,668 direct/indirect jobs in the next 10 years and 15,573 direct/indirect jobs in the next 20 years, improving existing conditions by adding 1,584 total jobs in the next 10 years and 2,489 in the next 20 years.

The Draft RMP/EIS was prepared using the BLM's planning regulations and guidance issued under the authority of the Federal Land Policy and Management Act (FLPMA) of 1976. An Environmental Impact Statement (EIS) is incorporated into this document to meet the requirements of the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality regulations for implementing NEPA (40 Code of Federal Regulations 1500–1508), and requirements of the BLM's NEPA Handbook 1790-1 (BLM 2008).

PURPOSE AND NEED

Purpose

The purpose of the Draft RMP/EIS is to provide guidance for managing the use of BLM-administered lands and a comprehensive management framework for future land management actions in the CFO planning area. The BLM is tasked with allocating resources and resource uses pursuant to FLPMA's multiple use and sustained yield mandate. In addition, the purposes of this plan are as follows:

- Consolidate the existing land use plan and amendments into a complete RMP/EIS.
- Re-evaluate, with public involvement, existing conditions, resources, and uses, and reconsider the mix of resource allocations and management decisions designated to balance uses and the protection of resources pursuant to FLPMA and applicable laws.
- Resolve multiple-use conflicts or issues between resource values and resource uses.
- Maintain or improve ecosystem functions.
- Promote diversity and resilience of biological resources, including special status species.
- Preserve important cultural, historical, and physical resources as well as tribal rights and interests.
- Provide opportunities for sustainable uses of public lands.

Need

A revision to the 1988 RMP is necessary because a number of changes have occurred in the CFO planning area since its publication. New resource issues have emerged, new resource data are available for consideration, and new policies, guidelines, and laws have been established. These changes are outlined in the *Carlsbad Resource Management Plan and the Carlsbad Resource Management Plan Amendment. RMP Evaluation Report* (BLM 2010a). The changes are in part due to continuing fluid and solid mineral extraction and energy developments in the area and new technologies being used to extract those resources. Concurrent extraction of both fluid and solid mineral reserves presents a new management challenge not addressed adequately in the 1988 RMP and its amendments.

There is also a need to update the RMP to address several interrelated issues and management concerns, including renewable energy, recreation, special status species, visual resources, cultural resources, and wildlife habitat. Special designations, such as Areas of Critical Environmental Concern (ACECs), need to be considered for designation to address concerns in resource sensitive areas. The BLM must evaluate situations where development of commercial energy and mineral resources or high-value recreation resources may be impacted by the management prescription being considered for the protection of the R&I values identified for potential ACECs. Management prescriptions for potential ACEC designation that could limit development of 1) commercial coal, oil, gas, solar, wind, or geothermal resources; or 2) recreation or other resources important primarily for their economic benefit to the planning area must be evaluated to avoid unnecessarily restricting these activities. The boundaries of the ACEC designation should be defined as the smallest area necessary to protect those R&I values and minimize impacts to other uses.

Planning Issues

Chapter 1 provides a description of the planning issues and sub-issues identified during the Draft RMP/EIS process and development. The primary issues are as follows:

- Minerals development
- Renewable energy and lands and realty
- Special designations
- Watershed management
- Recreation and travel management

ALTERNATIVES

No Action Alternative

The No Action Alternative would be a continuation of existing management under the 1988 RMP and its amendments (BLM 1988).

Alternative A

Alternative A has been developed to address watershed management and restoration-related planning issues. This alternative would allow development in existing leased/developed areas but would use restoration as a tool to avoid the net loss of natural resources. This alternative focuses on the restoration of previous surface disturbance before new disturbance occurs. High-quality habitat areas would be prioritized for no net loss. Possible restoration focus areas include dunes sagebrush lizard (*Sceloporus arenicolus*) and lesser prairie-chicken (*Tympanuchus pallidicinctus*) habitat. Under this alternative certain reclamation measures would be required in certain areas (i.e., priority restoration areas) to enhance overall restoration of the area. The amount of available forage for livestock grazing would be moderately reduced under this alternative. Also, there may be more widespread treatment of noxious weeds and/or more restoration-related vegetation treatments. Alternatively, these efforts may be focused on priority restoration areas based on a set of criteria. Acres available for livestock grazing may be reduced under this alternative with an emphasis on reducing livestock grazing in priority restoration areas. Acres available for leasable mineral development may also be reduced, particularly in priority restoration areas. Under this alternative Visual Resource Management (VRM) designations may tend more toward VRM Class I, II, and III.

Alternative B

Alternative B has been developed to address resource user or resource use conflicts related to leasable mineral development, recreation, and watershed management. This theme would address the resource user or resource use conflicts by geographically separating conflicting uses to the extent possible. This alternative would include resource focus areas where certain resource users/uses are prioritized over other resource users/uses occurring in the same general area. This alternative would also focus on maintaining the existing nature of undeveloped areas (for non-motorized recreation or wildlife uses, for example) and concentrating development in areas where development is already substantially present (for example, in areas of existing oil and gas development or where motorized recreation is concentrated). This alternative would focus on maintaining the existing nature of undeveloped key or unique areas or habitats (gypsum soil areas, undisturbed cave/karst areas, shinnery oak [*Quercus havardii*] habitat, dunes sagebrush lizard habitat, etc.). Additionally, key areas for human use would be "protected" to the extent possible by allowing relatively unfettered access and exclusion of competing uses (e.g., Hackberry Lake Off-highway Vehicle [OHV] Area use).

Alternative C (Preferred Alternative)

Alternative C has been preliminarily identified as the Preferred Alternative, which is the alternative that best meets the purpose and need of the Draft RMP/EIS and best addresses the key planning issues while providing for a balanced approach of protection and preservation of natural resources, while providing for commodity production and extraction.

Alternative C would rely on management restrictions and/or direction to address resource conflict rather than geographic separation of uses or focused use or preservation areas. Competing uses and resource values would continue to occur in the same areas. For example, this alternative theme would rely on timing limitations and Controlled Surface Use (CSU) stipulations for mineral development rather than closing areas to mineral development or requiring No Surface Occupancy (NSO). Another example would be permitting recreational use with accompanying required practices for users instead of closing areas to recreational access or confining that use to a specific area. This alternative would allow the decision maker to determine if it is possible to manage conflict and allow true multiple use without geographically separating "conflicting" uses.

Alternative D

This theme is primarily intended to address leasable mineral development, lands and realty, and recreation issues. This alternative would manage resources and resource uses within the mandates of existing laws and regulations without additional restrictions. This alternative may focus on maximizing leasable mineral development and other commercial uses of the land (such as rights-of-way [ROWs] for wind and solar development and livestock grazing), while at the same time maximizing motorized and non-motorized recreation opportunities. This alternative may include focus areas where the viability of commercial activities would be prioritized over most other resource users/uses. Under this alternative, more areas may be open to leasable mineral development, perhaps with fewer stipulations. Likewise, fewer areas may be closed to motorized recreation or other recreation uses. Under this alternative, VRM designations may tend more toward VRM Class III and IV. Acres available for livestock grazing would be greater than under the other alternatives.

Differences among Alternatives

Table ES-1 presents a summary of allocation decisions by alternative, and compares allocation acreages for travel management, visual resource management, grazing, minerals, renewable energy, land use, land use authorizations, recreation, and special designations. Also included are the acreage of lands managed to protect their wilderness characteristics.

Table ES-1. Comparison of Allocations across Alternatives

(All allocations are shown in acres.)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Livestock Grazing Allocations					
Available	2,086,103	1,598,198	1,937,725	2,083,232	2,087,759
Unavailable	5,226	493,120	153,583	8,115	3,594
Visual Resource Management Class Allocations					
VRM Class I	7,058	37,764	42,102	7,171	7,171
VRM Class II	43,613	235,946	315,700	60,791	41,092
VRM Class III	402,725	367,205	294,177	549,329	546,205
VRM Class IV	2,330,462	2,142,600	2,131,501	2,166,266	2,189,116
Special Designation Allocations					
Areas of Critical Environmental Concern	13,435	495,041	561,433	98,562	28,894
Lands with Wilderness Characteristics (11 inventory units: 66,666 acres met criteria)					
Managed to protect wilderness characteristics	0	66,666	47,611	5,119	1,220
Managed to emphasize other multiple uses while applying management restrictions	0	0	0	30,596	0
Managed to emphasize other multiple uses as a priority over protecting wilderness characteristics (I.e. manage to emphasize and allow for mineral and renewable development, land use authorizations, livestock grazing and recreation, among other uses as a priority over protecting wilderness characteristics.)	0	0	19,055	30,951	65,446

(All allocations are shown in acres.)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Mineral Resource Allocations					
Leasable					
Open	1,598,870	1,142,802	1,089,481	1,750,774	1,997,681
Open with Controlled Surface Use (CSU)	956,410	799,649	449,759	786,381	631,634
Open with No Surface Occupancy (NSO)	54,602	80,394	162,013	158,401	70,142
Closed	174,391	761,404	1,082,972	88,502	84,687
Salable					
Open	2,637,465	1,160,064	1,121,118	1,784,431	2,028,324
Open with Special Terms and Conditions	–	1,062,192	726,270	752,286	602,621
Closed	146,568	561,995	936,799	247,323	153,174
Locatable					
Open	2,751,856	2,403,114	2,110,098	2,651,855	2,661,705
Recommended for Withdrawal	32,374	380,990	673,996	132,249	122,444
Renewable Energy Allocations					
Geo – Open	964,322	1,788,890	1,411,281	2,175,070	2,319,907
Geo – Close	1,819,929	995,285	1,372,791	608,850	464,187
Wind – Avoid	949,539	624,734	418,812	883,051	926,749
Wind – Open	1,134,948	800,762	760,560	1,002,986	1,092,311
Wind – Exclude	7,056	666,783	912,860	206,184	73,143
Solar – Exclude	1,820,409	768,020	833,305	734,636	630,302
Solar – Variance	271,316	1,323,157	1,257,870	1,356,451	1,460,801
Land Tenure					
Disposal	218,318	18,703	26,125	31,123	51,579
Retention	1,872,747	2,070,580	2,063,155	2,058,155	2,037,362
Land Use Authorization Allocations					
Open to ROW	2,051,927	798,544	757,380	1,610,692	1,749,782
Avoid ROW	30,965	629,149	413,654	313,619	270,360
Excluded to ROW	7,056	662,038	918,701	165,378	69,540
Recreation Management Areas					
Extensive Recreation Management Areas	–	2,975	26,564	17,302	9,456
Special Recreation Management Areas	68,194	49,991	49,988	49,669	49,673
Travel Management Designations					
OHV Limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737

ENVIRONMENTAL CONSEQUENCES

A detailed summary of the environmental consequences projected to result from implementation of each alternative is included in Chapter 2, Summary of Impacts. The full and complete analysis of impacts to each resource and resource use, by alternative, is provided in Chapter 4, Environmental Consequences. Context and intensity of impacts are provided through a comparison of the alternatives with existing conditions (as identified in Chapter 3, Affected Environment and the No Action Alternative).

The primary impact to the landscape and associated resources and resource uses analyzed in the RMP would be from future proposed mineral development including oil and gas development and mining. Therefore, the biggest differences in impacts from the range of alternatives can be derived from looking at the proposed allocations for minerals cited above in Table ES-1. Based on this high-level view, Table ES-2 provides a brief description of the biggest difference in impacts between the alternatives.

Table ES-2. High-level Summary of Impacts by Alternative

No Action Alternative	The No Action alternative provides the least constraints on where minerals may be developed, and allows for the most acres allocated to potential development, carrying forward the management from the 1988 RMP and its amendments (BLM 1988). The 1988 RMP and its amendments allocated the fewest acres into special designation areas with their associated constraints on development. Therefore, the No Action alternative would have the greatest impact on physical and biological resources**,** including sensitive vegetation and soil types, and wildlife habitats.
Alternative A	Alternative A is the most restrictive alternative on development next to Alternative B. Alternative A proposes constraints on where minerals may be developed through acres allocated as special designation areas and no surface occupancy, and it allows for fewer acres available for future potential development than the No Action alternative and Alternatives C and D. Next to Alternative B, Alternative A would have the least impact on physical and biological resources, although it would also have the potential for adverse impacts to mineral extraction–dependent businesses.
Alternative B	Alternative B is similar to Alternative A, but proposes even greater constraints on mineral development and fewer acres available for future potential development. Similarly, this alternative allocates the most acres into special designation areas with their associated resource protections and constraints on development. Therefore, Alternative B would have the least potential to adversely impact physical and biological resources and would protect a variety of vegetation and soil types and wildlife habitats. Alternative B would have the potential for adverse impacts to businesses that depend on public land for resource extraction.
Alternative C	Alternative C proposes constraints on where mineral development could occur to a greater degree than the No Action alternative, but does not limit development or propose adoption of as many special designation acres to the same degree as Alternative A and B. Impacts to physical and biological resources would continue to occur, though some areas not closed to development under the No Action alternative would be closed under Alternative C. Alternative C would allow for many uses to continue, but would constrain certain activities to maintain or protect important natural resources. Alternative C could result in some short-term adverse impacts to resource extraction businesses, in comparison to the No Action alternative, but long-term economic benefits would be gained from the emphasis on a diversity of public lands uses.
Alternative D	Alternative D is most similar to Alternative C, though it proposes fewer constraints and limits on development than Alternative C. Resource extraction uses would generally be least encumbered by management decisions under this alternative. Alternative D offers the greatest potential benefits to the local economy from resource extraction. Acres allocated as special designation areas are fewer than all of the other action alternatives, and as a result, Alternative D would result in greater impacts on the physical and biological environment.

CONSULTATION AND COORDINATION

Chapter 5 describes the consultation and coordination efforts by the CFO throughout the planning process. Public involvement has been an integral part of BLM's RMP effort. The scoping period for the Carlsbad RMP began on June 10, 2010, and ended on September 10, 2010. Comments obtained from the public during the scoping period were used to define the relevant issues that would be resolved by presenting a broad range of alternative management actions.

The CFO hosted 10 public scoping meetings where the public was encouraged to submit oral or written comments regarding management of BLM-administered lands in the planning area. In addition to the 10 scoping meetings, multiple public workshops were held during the development of the Preliminary RMP/DEIS to inform the public of the planning status and to obtain comments from the public. Two social and economic workshops were held on November 15 and 16, 2011, in Carlsbad and Hobbs respectively, to discuss the issues related to the local economies and social conditions of the counties, towns, and cities in the planning area and the role public lands serve in those economies. On January 18, 2012, the CFO presented to the Pecos District Resource Advisory Council. Four public workshops were held on February 1 and 2, 2012, to discuss the potential management alternatives for special designations, visually sensitive areas, and BLM transportation routes within the planning area. Four public workshops were held on July 8 and 9, 2014, to discuss lands with wilderness characteristics, including the BLM's policy for these lands and the results of the inventory conducted for the RMP.

Other public meetings where the RMP was presented and discussed include the following:

- Multiple use interface with ranching community, oil and gas and potash industry (Carlsbad, May 4, 2011)
- Public Lands Advisory Council (Roswell, February 9, 2012)

To date, the CFO has consulted with the U.S. Fish and Wildlife Service (USFWS) informally regarding the RMP process. The USFWS has an employee embedded in the CFO to assist with issues involving federally listed species. Although not a formal cooperating agency, the USFWS was represented at the alternatives development workshop with cooperating agencies on November 13 and 14, 2014.

The BLM is also conducting government-to-government coordination and consultation with seven federally-recognized Native American tribes: Mescalero Apache Tribe, Apache Tribe of Oklahoma, Comanche Indian Tribe, Pueblo of Isleta, Kiowa Tribe of Oklahoma, Ysleta del Sur Pueblo, and Hopi Tribal Council.

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Chapter 4: Environmental Consequences

Chapter 4: Environmental Consequences

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4.1 INTRODUCTION

This chapter presents the environmental consequences of the management actions proposed under the five alternatives described in Chapter 2. These management actions were developed to look at a full range of reasonable options in the management of public lands within the current Carlsbad planning area, including management and allocation of public land resources, their uses, and protection. Bureau of Land Management (BLM) decisions about resource use and management in the planning area will be based on this analysis.

Five alternatives are analyzed. The No Action Alternative would be a continuation of existing management practices defined in the Carlsbad Resource Management Plan (RMP) as amended (BLM 1988). The 1988 RMP was amended in 1997 and in 2008 (see Chapter 1 for more information on the amendments). Alternative A would offer more protection to watershed health and emphasize restoration. Alternative B would focus on maintaining the existing nature of undeveloped areas and concentrating development in areas where development is already substantial. Alternative C would rely on management restrictions and/or direction to address resource conflicts rather than geographic separation of uses. Alternative D would manage resources and resource uses within the mandates of existing laws and regulations without additional restrictions. See Chapter 2 for more details on the alternative themes.

This RMP/Environmental Impact Statement (EIS) provides a landscape-scale “big picture” level of analysis, and in most cases the exact locations of projected development and other changes are not known at this time. The analysis in this chapter is an impact analysis of the alternative management actions and prescriptions as they would impact the affected environment. Impacts are defined as modifications to the existing environment brought about by implementing an alternative. For the analysis, BLM staff used existing data, science, current methodologies, professional judgments, and projected actions and levels of use. The analysis takes into account the stipulations described in Chapter 2.

4.1.1 Chapter Organization

Chapter 4 details the environmental consequences of program decisions on each listed resource or resource use. Resources and resource uses are presented in the same general order as the *BLM Land Use Planning Handbook*’s outline for EISs. The environmental consequences of the decisions imposed by other programs on that resource are delineated for each of the five alternatives. For example, the impacts of recreation decisions on riparian resources are listed by the decisions imposed by recreation under each of the five alternatives.

4.1.2 Analysis Methods

Impact analyses and conclusions are based on interdisciplinary team knowledge of the resources, resource uses, and the planning area, information provided by BLM experts or experts from other agencies, and information in pertinent existing literature. The analysis takes into account the Conditions of Approval (COAs) and best management practices (BMPs) described in Appendix O and stipulations described in Appendix C. Spatial analysis was performed using Environmental Systems Research Institute, Inc. (ESRI) ArcGIS computer software.

4.1.2.1 Analysis Assumptions

Mineral development potential was assessed in the Reasonably Foreseeable Development (RFD) Scenario prepared for the Carlsbad Field Office (CFO). The RFD scenario prepared for the RMP identified high development potential areas for oil and gas (leasable mineral resources) within the CFO planning area.

To assess the potential for effects from oil and gas development, it was assumed that the average surface disturbance per existing well was representative of future well sites. In the RFD, past development, industry trends, and mineral data information were used to predict future development. The total number of existing oil and gas wells and their associated roads and pipelines was used to calculate the projected, approximate surface disturbance per well: 2.0 acres per vertical well and 1.75 acres per horizontal well. The 0.25 acreage difference captures the difference in surface impacts for vertical and horizontal wells. Typically, there is less surface disturbance for horizontal wells because more wells can be clustered onto a single pad. Sub-surface impacts would depend on many factors including the depth of drilling, length of the horizontal bore, etc.

The RFD scenario is a 20- year glance into Oil and Gas Development potential. Based on the water usage in the RFD scenario (32,769 AF), water usage per year is expected to increase by 1638.5 AF. This is 0.25 percent of the total water usage for PDO in 2010 (Longworth, Valdez, Magnuson, & Richard, 2013). Since the percentage of water use for the RMP is such a small portion of the overall usage in the PDO, BLM does not expect RMP to have a significant impact on ground and surface water resources.

It is not possible to know the impacts to any particular aquifer because the water is sourced for each individual project from different locations, even outside the state, and that to the extent feasible, the BLM will undertake that analysis at the individual project at the APD stage when the BLM will know better the source and impacts of the water used for that project.

Predicted surface disturbance for oil and gas development by alternative on BLM surface and split estate lands were calculated by multiplying the percentage of BLM lands open for development under each of the alternatives and by the total number of wells predicted for all lands. The resultant number of wells was multiplied by surface disturbance assumptions per well (see Table 4-1) to arrive at total predicted surface disturbance. Note that there is no way to accurately predict surface disturbance on split estate lands because the surface is owned by private parties. However, to disclose potential impacts, the same methodology used for surface impacts are also applied to split estate lands where appropriate. The CFO estimates that approximately 25% of the surface disturbance on BLM-administered lands within the planning area would be reclaimed during the life of the plan. Surface disturbance acres disclosed in this chapter include the 25% reclamation factor. Finally, 7.3 acre-feet of water use per horizontal well and 1.53 acre-feet of water use per vertical well is expected for construction and development of a single well. This assumption is based on an average current use of water per well in the CFO planning area. The RFD well totals were developed for the purposes of assessing impacts for decision-making. The total number of wells permitted would be determined through site-specific National Environmental Policy Act (NEPA) analysis of field development projects.

BLM administers surface and subsurface (split estate) lands. The calculations developed for resource impacts may apply to surface and/or subsurface lands depending on the resource. For the purposes of this analysis, both surface and subsurface acreages were used for all resources and resource uses except for 1) livestock grazing, travel, solar, wind, land tenure, and land use authorizations; 2) rights-of-way where only surface lands were calculated; and 3) geothermal where only subsurface lands were included.

Note that for all calculations, the total acreage between all alternatives can vary up to 250 acres due to the intersect in geographic information system (GIS) shapefiles that creates slivers when two or more layers are intersected.

Table 4-1. Summary of Predicted Wells and Surface Disturbance for Oil and Gas Activity on BLM Surface Lands

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open with standard terms and conditions (acres)	1,598,870	1,142,802	1,089,481	1,750,774	1,997,681
Open with moderate constraints (controlled surface use) (acres)	956,410	799,649	449,759	786,381	631,634
Open with major constraints (no surface occupancy) (acres)	54,602	80,394	162,013	158,401	70,142
Closed (acres)	174,391	761,404	1,082,972	88,502	84,687
Total (acres)	2,784,273	2,784,248	2,784,224	2,784,058	2,784,145
Total acres open to surface disturbance (open with standard stipulations and moderate constraints)	**2,555,280**	**1,942,451**	**1,539,240**	**2,537,155**	**2,629,315**
Percentage of total area open to surface disturbance (open with standard stipulations and moderate constraints)	**92%**	**70%**	**55%**	**91%**	**94%**
Number of RFD predicted wells	**6,400**	**6,400**	**6,400**	**6,400**	**6,400**
Number of predicted wells based on percentage of land open to surface disturbance	**5,874**	**4,465**	**3,538**	**5,832**	**6,044**
Number of predicted vertical wells, BLM (vertical wells = 12.0%)	**705**	**536**	**425**	**700**	**725**
Number of predicted horizontal wells, BLM (horizontal wells = 88.0%)	**5,169**	**3,929**	**3,114**	**5,133**	**5,319**
Predicted surface disturbance from vertical wells (1.67 acres per vertical well) (acres)	**1,177**	**895**	**709**	**1,169**	**1,211**
Predicted surface disturbance from horizontal wells (2.0 acres per horizontal well) (acres)	**10,338**	**7,858**	**6,227**	**10,265**	**10,638**
Total predicted surface disturbance/acres (acres)	**11,515**	**8,753**	**6,936**	**11,434**	**11,849**
Reclamation factor (percentage of area reclaimed during the life of the plan)	0.25%	0.25%	0.25%	0.25%	0.25%
Amount of reduction in surface disturbance (acres)	2,879	2,188	1,734	2,858	2,962
Predicted surface disturbance after reclamation (acres)	**8,636**	**6,565**	**5,202**	**8,575**	**8,887**

4.1.3 Types of Impacts

4.1.3.1 Impact Terminology

Direct impacts are attributable to implementation of an alternative that affects a specific resource, and generally occur at the same time and place. Indirect impacts can result from one resource affecting another (e.g., soil erosion and sedimentation affecting water quality) or can occur later in time or removed in location, but are still reasonably foreseeable. Long-term impacts are those that would substantially remain for many years or for the life of the project. Temporary impacts are short-term or ephemeral changes to the environment, which would return to the original condition once the activity stopped, such as air pollutant emissions caused by earthmoving equipment during construction. Short-term impacts result in changes to the environment that are stabilized or mitigated rapidly and without long-term impacts. Cumulative impacts could also occur as the result of past, present, and reasonably foreseeable future actions by federal, state, and local governments; private individuals; and entities in or near the CFO planning area. Cumulative impacts could result from individually minor but collectively significant actions that take place over time.

Management Common to All Alternatives refers to decisions and impacts that apply to all the alternatives; the No Action Alternative and Alternatives A through D. Management Common to All Action Alternatives refers to decisions and impacts that apply to Alternatives A through D.

4.1.4 Incomplete or Unavailable Information

This analysis was done using the best-available information believed to be sufficient for a programmatic analysis of the impacts of multidiscipline decisions on management direction on a planning area–wide basis. This includes but is not limited to landscape-level data such as major land resource areas (MLRAs), soils data, and field-office information on wildlife habitat boundaries. Additional site-specific data (including cultural resources surveys, threatened and endangered species surveys, etc.) will be required to complete site-specific NEPA analysis necessary prior to implementation of vegetation management activities proposed.

According to Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1502.22), for incomplete or unavailable information, the agency must provide:

1. A statement that such information is incomplete or unavailable;
2. A statement of relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
3. A summary of existing credible scientific evidence that is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and
4. The agency’s evaluation of such impacts based upon theoretical approaches or resource methods generally accepted in the scientific community.

The following resources have incomplete or unavailable information; therefore, impacts analysis is limited:

- A transportation inventory is not complete for all BLM-administered lands in the planning area. Information on levels of use in the planning area is limited. To date, route inventories have been completed for lands within all proposed Areas of Critical Environmental Concern (ACECs) in the planning area. A Travel Management Plan would also be developed and implemented after approval of the revised RMP. At that time, the CFO would designate specific roads, primitive roads, and trails (routes) available for public and administrative travel, along with specific limitations on such travel. For this Draft RMP/EIS, off-highway vehicle (OHV) area designations (“open,” “limited,” and “closed”) are listed by alternative. Within the “limited” designation, routes would be limited to existing roads, primitive roads, and trails. It is possible that field staff knowledge and/or information from the public would not encompass all areas with high demand for access. However, the field staff and the public are aware of the areas where vehicle travel is common, and where it may be presenting resource conflicts. As such, it is unlikely that having a completed transportation inventory would change the results of this impact analysis.

- The locations and extent of future renewable energy projects on BLM-administered lands are largely unknown, but are likely to occur in areas identified as high potential for wind, solar, and geothermal energy projects. Similarly, future oil and gas development in the planning area is based on the best available information, as described in the RFD scenario (Engler et al. 2012). For both renewable energy and mineral development, generalized effects are described based on typical surface-disturbing scenarios experienced by the BLM in similar developments. Knowing the precise location and size of future development projects would not likely change the reasonably foreseeable significant adverse impacts because renewable energy and mineral developments are most likely to occur where potential for the resources is high, which is how the impacts for these resources were evaluated. The resources that could be impacted by these resource developments, such as wildlife, have a sufficiently broad distribution in the planning area that moving a development from one site to another would not change the impacts significantly. Existing scientific evidence that is relevant to evaluating reasonably foreseeable impacts related to renewable energy and mineral development, and the evaluation of those impacts, is contained in Sections 4.2 through 4.5.
- A comprehensive inventory of biological resources, including rare plants, special status species, and invasive species, has not been completed for the CFO. These biological resources are known to occur in the planning area, and certain areas have been inventoried and recorded. This incomplete information is relevant to reasonably foreseeable significant effects if land use planning decisions allocated uses that would result in adverse impacts to rare plants and special status species or result in the spread or introduction of invasive species. This incomplete information is not essential for a reasoned choice among alternatives. Potential impacts to rare plants, special status species, and invasive species are similar among all action alternatives because other environmental laws and regulations would greatly reduce the potential for significant adverse effects under each alteration, and because site-specific NEPA analysis would be required prior to implementation of activities that would prescribe BMPs to address biological resource issues. Existing scientific evidence that is relevant to evaluating reasonably foreseeable impacts to vegetative communities and special status species are contained in Sections 4.2.3 and 4.2.5, respectively.
- No formal surveys of visitors regarding their preferences for recreation settings and experiences have been conducted. This information would be relevant to identify previously unknown recreation uses within the planning area and to evaluate reasonably foreseeable significant adverse impacts to those recreation uses. This information may have changed the estimated impacts of land use plan decision to particular types of recreation. However, it is unlikely that field staff would be unaware of the type and extent for demand of recreational opportunities on the lands administered by the CFO. Interaction with public inquiries, special recreation permittees, and user groups has given the CFO a reasonable understanding of the desired recreational opportunities in the planning area. Existing scientific evidence that is relevant to evaluating reasonably foreseeable impacts to recreation is contained in Section 4.3.5.
- The archeological inventory for the CFO is incomplete and existing inventories cover approximately 18% of BLM-administered lands in the planning area. This incomplete information is relevant to reasonably foreseeable significant adverse effects, given the possibility that management decisions would allocate land uses to activities that would irreversibly damage currently unknown sites, which would constitute a significant adverse effect. This incomplete information is, however, not essential for a reasoned choice among alternatives. Potential impacts to cultural resources are similar among all action alternatives because other environmental laws and regulations (Section 106 of the National Historic Preservation Act [NHPA] and Archaeological Resources Protection Act) would greatly reduce the potential for significant adverse effects under each alternative and because site-specific NEPA would be required prior to implementation of proposed activities. Incomplete information regarding the location of cultural resources is in this sense less useful to the decision maker, who is assured that no matter which alternative he or she selects, significant adverse effects to cultural resources would be avoided. Existing scientific evidence that is relevant to evaluating reasonably foreseeable impacts to cultural resources, and the evaluation of those impacts, is contained in Section 4.2.7.

- The BLM CFO has limited information about the specific areas of significance to tribes, including locations of Traditional Cultural Properties (TCPs) and sacred sites, in the planning area. This information is relevant to reasonably foreseeable significant adverse effects, given the possibility that management decisions could allocate land uses to activities that would irreversibly damage unknown TCPs and sacred sites. Similar to the archeological resource discussion above, there are laws and regulations in place, such as the American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, NHPA, Archaeological Resources Protection Act, and Executive Order 13175: *Consultation and Coordination with Indian Tribal Governments*, which reduce the potential for signification adverse effects under each alternative. In addition, the CFO conducts tribal consultation efforts throughout the year based on the proposed implementation-level activities that are being considered for BLM decision making. Tribal consultation was also conducted during development of the RMP. Through these tribal consultation efforts, the CFO would learn of sacred sites and TCPs to be avoided when implementing site-specific projects. Existing scientific evidence that is relevant to evaluating reasonably foreseeable impacts to tribal rights and interests, and the evaluation of those impacts, is contained in Section 4.5.1.
- There is limited information about past surface disturbance within the planning area. Information and estimates of surface disturbance from past management decisions within the planning area is important to inform cumulative impacts analysis. The CFO has records from past right-of-way (ROW) authorizations, approved Applications for Permit to Drill (APDs), and mineral material contracts, from which acreage estimates for surface disturbance can be developed. However, less information is available about surface disturbance resulting from past recreation, livestock grazing, travel management, and non-federal activities. This information is relevant to reasonably foreseeable significant adverse effects, considering that the BLM is directed to include past actions within the planning area to provide context for cumulative effects analysis (BLM 2008a). The information available to the BLM for this RMP provides a representative sample of the types of activities and associated levels of surface disturbance within the planning area. Knowing the precise location and size of all past disturbance in the planning area would not likely change the reasonably foreseeable significant adverse impacts because the past disturbance is one element of cumulative impacts (which also includes present and reasonably foreseeable future actions) and the representative sample provides a dependable estimate that serves as a base for incremental impacts to be analyzed. Complete information about past disturbance activities and associated surface disturbance impacts is not essential to a reasoned choice among alternatives because “once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects” (CEQ 2005). This approach was used for the cumulative impacts analysis contained in Section 4.1.6.
- The karst inventory for the CFO is incomplete, and existing inventories cover approximately 2% of BLM-administered lands containing high or medium karst potential in the planning area. This incomplete information is relevant to reasonably foreseeable significant adverse effects, given the possibility that management decisions would allocate land uses to activities that may damage currently unknown karst resources, which would constitute a significant adverse effect. This incomplete information is, however, not essential for a reasoned choice among alternatives. Potential impacts to karst resources are similar among all action alternatives because other environmental laws and regulations (Federal Cave Resources Protection Act, Clean Water Act, and Safe Drinking Water Act) would reduce the potential for significant adverse effects under each alternative and because site-specific NEPA would be required prior to implementation of proposed activities. Incomplete information regarding the location of karst resources is, in this sense, less useful to the decision maker, who is assured that no matter which alternative selected, significant adverse effects to karst resources could be avoided. Existing scientific evidence that is relevant to evaluating reasonably foreseeable impacts to karst resources, and the evaluation of those impacts, is contained in Section 4.2.2.

4.1.5 Mitigation

There are several mitigative prescriptions proposed in this RMP, and they vary by alternative. COAs and BMPs (Appendix O), and stipulations (Appendix C) also serve to mitigate impacts.

4.1.6 Irreversible and Irretrievable Impacts

Section 1502.16 of CEQ regulations requires that the discussion of environmental consequences include a description of “any irreversible or irretrievable commitment of resources which would be involved in the proposal should it be implemented.” An irreversible commitment of a resource refers to decisions impacting the use of nonrenewable resources, and results in the resource being permanently lost. For example, the production of oil and gas is an irreversible commitment of these resources. An irretrievable commitment of a resource refers to decisions resulting in the loss of production or use of a resource. For example, in the construction of a road, the vegetation is lost for as long as the road remains.

No irreversible and irretrievable commitment of resources is anticipated for karst resources, air resources, renewable energy, travel management, recreation, land use authorizations, social and economic conditions, and health and safety,

4.1.6.1 Soil and Water Resources

Surface-disturbing activities may result in soil erosion. Soil formation requires thousands of years to replenish. Eroded soil and lost productivity cannot be recovered. The loss of topsoil from soil erosion results in an irreversible loss of soil productivity. Depletion of water from BLM actions may result in an irretrievable commitment of water. The production of water from oil and gas wells in the planning area may be an irretrievable commitment of groundwater once it reaches the surface. Disposal of produced wastewater into authorized aquifers may be an irretrievable loss of a resource that has been pumped to the surface, as well as added contamination of the aquifer with the produced water contaminants.

4.1.6.2 Vegetation

Surface-disturbing activities associated with development, OHV use, and other activities may result in irretrievable impacts to vegetation communities and diversity through vegetation loss and proliferation of noxious or invasive weeds. Irretrievable loss of riparian habitat could occur due to grazing, visitor trampling, and construction-related removal of riparian habitat. Noxious weed infestation of disturbed riparian areas could become an irreversible impact based on past difficulties controlling invasive species in riparian habitat. An irretrievable loss of riparian habitat could also occur if riparian habitat is converted to upland habitat (by filling, draining, or other landscape alterations) in association with the placement of utility corridor infrastructure.

4.1.6.3 Fish, Wildlife and Special Status Species

Surface disturbance associated with mineral development, fire treatments, or OHV use may result in irretrievable impacts to fish and wildlife resources, including special status species habitat, because watershed health and overall riparian condition would be degraded.

4.1.6.4 Wildland Fire and Fuels Management

The prohibition of fuels reduction and vegetation treatments could result in irretrievable losses in habitat value as vegetation types move away from desired future condition. However, non-surface-disturbing vegetation treatments and/or effective suppression followed by effective rehabilitation/restoration could prevent these impacts from being irreversible.

4.1.6.5 Cultural Resources

Because the location and nature of all cultural resources in the area under consideration are unknown, it is not possible to determine the amount or level of irreversible and/or irretrievable impacts to cultural resources in the CFO planning area. However, it is likely that, in spite of compliance with Section 106 of the NHPA and BLM policy and guidelines, some non-mitigatable impacts would occur and would likely be irreversible because restoration of an archaeological site is typically very difficult.

4.1.6.6 Paleontological Resources

Although many impacts to paleontological resources are addressed through mitigation (collection and curation to benefit scientific research and education), there would be an irreversible impact to the in-situ value of the resource when removed. Irretrievable and irreversible impacts would also occur when unavoidable adverse impacts destroy paleontological resources.

4.1.6.7 Lands with Wilderness Characteristics

In lands not managed to protect, preserve, and maintain their wilderness characteristics, the loss of naturalness and/or solitude due to surface-disturbing activities (such as mineral development or cross-country OHV use) could be irretrievable.

4.1.6.8 Visual Resources

In areas that are not managed to protect visual resources, irretrievable impacts to visual resources would occur from surface disturbance caused by construction and development and by fire management (until vegetation regrowth occurs).

4.1.6.9 Minerals

The extraction and development of mineral resources from the CFO planning area would result in both an irreversible and irretrievable loss of those mineral resources due to their finite nature. The impacts would be irretrievable and irreversible because, once extracted, the mineral resource could not be used again, nor could they be replaced in the foreseeable future.

4.1.6.10 Livestock Grazing

Loss of forage from development and other activities would constitute an irretrievable impact to livestock grazing. Grazing closures within the planning area would also constitute an irretrievable impact to livestock grazing until those areas are made available for grazing again.

4.1.6.11 Land Tenure

All alternatives permit land tenure adjustments (sales, exchanges) that may result in the irretrievable loss of lands from public ownership when they are transferred to state or private ownership.

4.1.6.12 Special Designations

In ACECs or wild and scenic rivers (WSRs) not designated in an alternative, surface-disturbing activities (such as mineral development and cross-country OHV use) could result in adverse impacts to relevant and important values and outstandingly remarkable values, respectively. However, these impacts would not be expected to result in an irreversible and irretrievable commitment of these resource values.

4.2 RESOURCES

4.2.1 Soil and Water Resources

This section discusses potential impacts to soil and water resources from proposed management actions of other resources and resource uses. Existing conditions concerning soil and water resources are described in Section 3.2.2.

4.2.1.1 Analysis Methods

4.2.1.1.1 Indicators

For the purposes of this broad-scale analysis, the primary indicator of impacts to soil and water resources is the amount of surface disturbance caused by management decisions made for other resources, particularly surface disturbance that occurs in highly erodible, reclamation-limited, or other sensitive soils.

4.2.1.1.2 Methods and Assumptions

Management actions associated with the following resources and land uses may result in impacts to soil and water resources and are discussed in detail below: land use authorizations, mineral development, livestock grazing, lands with wilderness characteristics, recreation, special designations, visual resources, renewable energy, and travel management.

Management decisions associated with the following resources would not impact soil and water resources because they either do not include surface-disturbing activities or there are no management decisions proposed in Chapter 2 and are, therefore, not discussed: air resources, cave and karst resources, soils, water resources, wildlife and fish, special status species, paleontological and cultural resources, health and safety, and land tenure.

The following assumptions were used for the analysis of management action impacts on soils and water resources:

- Any surface disturbance proposed on highly erodible soils has the potential to have a major impact to the soil resource, since soil erosion affects an area larger than the physical disturbance. Reclamation in these areas is challenging. Extra steps are necessary to conserve the soil resource.
- The BLM would use soil survey data and interpretations to predict soil behavior, limitation, or suitability for a given activity or action. Soil interpretations are developed by the cooperators in the National Cooperative Soil Survey (NCSS) and maintained by the Natural Resources Conservation Service (NRCS). Soil interpretations (see Glossary) are ever evolving; therefore, as new or updated soil interpretations become available, they would supersede prior interpretations. Soil interpretations do not preclude activities or actions; rather, they provide a reasonable guide to the risks, limitations, and probable outcomes of a particular use or practice. The information is not site specific and does not eliminate the need for on-site investigation of the soil.
- Substantial surface disturbance to soil, including compaction of soil or loss of vegetation cover, could increase water runoff volume and velocity, increase downstream sediment loads, and lower soil productivity, thereby degrading water quality, altering channel morphology, and affecting overall watershed health.
- Linear disturbances such as pipelines, utility corridors, and transmission lines would be managed consistent with other resource requirements and BMPs.

4.2.1.2 Direct and Indirect Impacts

The degree of impact to soil resources would depend on various factors, including soil characteristics and the amount, location, and type of surface disturbance. Resulting impacts from surface-disturbing activities would potentially include decreased permeability, accelerated erosion (from wind and water) and sedimentation, soil and vegetation loss, and overall changes in soil chemistry and potential reduction in productivity. The greatest anticipated adverse impacts on soil resources would come from those surface-disturbing activities occurring on fragile and sensitive soils (including microbiotic soil crusts [MSCs]), steep slopes (Map 3-37), or geologically unstable locations.

Proposed decisions that include surface-disturbing activities that impact soils could also adversely affect water quality. Alternatively, restrictions on surface-disturbing activities would help to protect and maintain current water quality and to minimize erosion and sedimentation. Impacts to water resources, as a result of surface-disturbing activities, such as mineral exploration and development and livestock grazing, would include changes to quantity and quality (water chemistry) of surface water and groundwater, potential changes to water volume and velocity, channel morphology alteration, and effects to overall watershed health. Loss of vegetation or prevention of revegetation would potentially lead to an increase or introduction of noxious weeds that often have greater water requirements than native plants and would, therefore, potentially outcompete them. Increased runoff from bare (unvegetated) surfaces leads to erosion, sedimentation, and potential contaminant delivery to nearby waterways. Industrial contaminants, chemicals associated with vehicles, nutrients and pathogens from livestock, and herbicides for vegetation treatments can migrate to surface water and groundwater.

Management actions that prohibit surface disturbances would benefit both water and soil resources through improvements in ground cover and soil productivity (due to lack of disturbance that would directly remove vegetative cover leading to bare ground and subsequent decreased soil productivity), improvements in water quality and reduction in groundwater depletion, greater retention of organic matter, increased soil moisture storage and reduced soil erosion, sedimentation and compaction.

Effects from soil and water management actions on karst resources, air quality, upland vegetation, noxious weeds, other natural resources, and travel are discussed under those sections.

4.2.1.2.1 Impacts of Land Use Authorization Actions on Soil and Water Resources

Land use authorizations generally include a number of activities and features, such as access roads, transmission lines, and pipelines and their ROWs, that would result in surface disturbances and vehicle and equipment transportation, both of which could contribute to adverse impacts to soil and water resources. Potential impacts would include direct loss of vegetation and topsoil and subsequent decrease in soil productivity, soil compaction, and increased erosion and alterations in overall groundwater and surface water quality. Additional impacts to soils and water would be perpetuated over time by maintenance activities for those features, although mitigation and BMPs in place would help alleviate adverse impacts.

Those areas that are classified as ROW avoidance, exclusion, or withdrawal areas would minimize surface disturbances and, therefore, beneficially impact soil and water resources. The number of acres under each of these categories varies across the alternatives and is depicted in Table 4-2.

Table 4-2. Acreages of Right-of-way Avoidance, Exclusion, and Acres Open by Alternative

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Avoid	30,965	629,149	413,654	313,619	270,360
Exclude	7,056	662,038	918,701	165,378	69,540
Open	2,051,927	798,544	757,380	1,610,692	1,749,782
Total	***2,089,949***	***2,089,731***	***2,089,735***	***2,089,689***	***2,089,682***

Note: Total may be off by an acre due to rounding.

Impacts from Management Common to All Action Alternatives

Under management common to the action alternatives, all projects for which allocations for land use authorizations are not specified as avoidance or exclusion would be open to consideration of granting ROWs subject to site-specific analysis and stipulations applied at the project level. The degree of impact on soils and water would vary, depending on the project, its location, and the soil composition of the area.

Impacts from the No Action Alternative

Under the No Action Alternative, current management pertaining to land use authorizations would continue, as specified in the guidelines in Appendix 2 of the 1997 Carlsbad RMP Amendment. Approximately 184,201 acres, encompassing six ROW corridors, would remain designated for major new utility and transportation facility alignments across the planning area. A total of 37,361 acres, primarily within Special Management Areas (SMAs), would remain designated as avoidance areas, and 7,056 acres would be designated as exclusion areas. Also, approximately 30,965 acres would remain designated as avoidance, areas and 2,051,927 acres would remain open (see Table 4-2). Adverse impacts to soil and water resources, as those described at the beginning of this section, would continue as ROW applications are granted. Mitigation and remediation actions in place, however, would help minimize these impacts.

Impacts from Alternative A

Under Alternative A, 629,149 acres would be designated as avoidance and 662,038 as exclusion. Approximately 788,544 acres would remain open across the planning area (see Table 4-2). Compared to the No Action Alternative, there would be a 31.4% increase in exclusion acreage designated and a 28.6% increase in acres designated as avoidance areas. The magnitude of and potential for adverse impacts to soil and water resources, as those described above, would be smaller under this alternative. Qualitatively, the impacts would be the same.

Impacts from Alternative B

Under Alternative B, 413,654 acres would be designated as avoidance and 918,701 acres as exclusion. Approximately 757,380 acres would remain open across the planning area (see Table 4-2). Compared to the No Action Alternative, there would be a 39.7% increase of exclusion acreage designated and a 18.3% increase in acres designated as avoidance areas, the magnitude of and potential for adverse impacts to soil and water resources, as those described above, would be smaller under this alternative. Qualitatively, the impacts would be the same.

Impacts from Alternative C

Under Alternative C, 313,619 acres would be designated as avoidance and 165,378 acres as exclusion. Approximately 1,610,692 acres would remain open across the planning area (see Table 4-2). Compared to the No Action Alternative, there would be a 7.6% increase in exclusion acreage designated and a 13.5% increase in acres designated as avoidance areas, the magnitude of and potential for adverse impacts to soil and water resources, as those described above, would be smaller under this alternative. Qualitatively, the impacts would be the same.

Impacts from Alternative D

Under Alternative D, 270,360 acres would be designated as avoidance and 69,540 acres as exclusion. Approximately 1,749,782 acres would remain open across the planning area (see Table 4-2). Compared to the No Action Alternative, there would be 3% increase in exclusion acreage designated and a 11.4% increase in acres designated as “avoidance” areas, the magnitude of and potential for adverse impacts to soil and water resources, as those described above, would be smaller under this alternative. Qualitatively, the impacts would be the same.

4.2.1.2.2 Impacts of Livestock Grazing Actions on Soil and Water Resources

The impacts from livestock grazing proposed decisions on soil and water resources would depend on a range of factors including soil type, location and number of acres open to grazing, proximity to riparian systems and water bodies, and the grazing regime used. Nonetheless, as the most widespread land management practice in the western United States, livestock grazing has been shown to have many adverse impacts at both landscape and regional levels (Belsky et al. 1999; Fleischner 1994; Valone et al. 2002). Potential impacts from grazing to soil and water resources include soil compaction and erosion and an overall decrease in soil productivity, loss of stream bank stability and long-term damage to riparian soils and vegetation, decreased water quality, and alterations in stream hydrology. Fecal contamination of surface water runoff and, consequently, potential contamination of wells, aquifers, and springs (Pasquarell and Boyer 1995), some of which are important municipal and agricultural water sources, represents another potential impact.

Sensitive gypsum soils, found throughout the planning area, would be particularly impacted from surface disturbances including livestock grazing, as these soils have minimal vegetative cover and are subject to severe erosion if existing vegetative cover is lost as a result of trampling. Reclamation in areas with gypsum soils is difficult. In areas where cattle congregate, grazing would contribute to excessive soil compaction, trampling, and degradation of the vegetative community resulting in subsequent adverse impact to soil and water resources.

Impacts to soil and water resources resulting from grazing are quantitatively assessed based on the number of acres open or closed to grazing. The number of acres open or closed to grazing varies by each of the alternatives and is shown in Table 4-3.

Table 4-3. Livestock Grazing Management Action Acreages by Alternative

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,086,107	1,598,198	1,937,725	2,083,232	2,087,759
Closed	5,226	493,120	153,583	8,115	3,594
Total	***2,091,333***	***2,091,318***	***2,091,308***	***2,091,347***	***2,091,353***

Note: Difference in total acres between all alternatives can vary up to 250 acres due to geoprocessing operation where slivers of area are created when two or more data sets are intersected.

Impacts from the No Action Alternative

Under the No Action Alternative, current management would continue, including the authorization of approximately 350,000 animal unit months (AUMs) to 200 permittees and approximately 18,000 AUMs to 62 lessees. These numbers would be supported by quantitative field monitoring and any future increase or decrease in authorized numbers would need to be backed with similar data. The exclusion of livestock grazing from 13 SMAs (totaling 4,969 acres) and also from within the Black River Management Area would remove adverse impacts to soil and water resources in those locations.

Overall, under the No Action Alternative, approximately 5,226 acres across the planning area would remain closed to livestock grazing (see Table 4-3). Livestock grazing would be removed from the Black River Management Area, a small portion of land outside the Black River Management Area, and the Delaware River (both sides of U.S. 285), as well as around all riparian springs. A description of the types of impacts resulting from livestock grazing on soil and water resources are discussed at the beginning of this section and also under management common to all.

Impacts from Alternative A

Under Alternative A, 493,120 acres would be closed to grazing, representing approximately 30% of the planning area (see Table 4-3) and would include 5,000 acres of unallotted tracts where the available vegetation would be made exclusively available for wildlife and watershed health.

Under this alternative, all riparian springs and their associated zones would be closed to grazing, as well as the Delaware River riparian area (both sides of U.S. 285), the Black River Management Area, and a small portion of land just outside the Black River Management Area (grazing prohibited within 656 feet of the river bank on either side). Removal of grazing in the areas listed above would improve overall watershed health through the increase in soil stability and a decrease in erosion and subsequent excessive sedimentation.

Compared to the No Action Alternative, which does not remove livestock grazing from as many riparian areas and areas with springs and closes only 5,226 acres to livestock grazing (compared to the 493,120 acres closed under Alternative A), the magnitude of adverse impacts to soil and water resources would be greatly reduced under Alternative A.

Impacts from Alternative B

Under Alternative B, livestock grazing would be excluded on 153,583 acres (see Table 4-3), which represents approximately 7% of the planning area. The following areas would also have grazing excluded under this alternative: riparian spring areas, the Cottonwood Day Use area, the Black River outside the management area (grazing prohibited within 656 feet of the river bank on either side), Pierce Canyon, Yeso Hills, South Texas Hill (sensitive soils), cultural resource ACECs, known heronries, open OHV areas, the dune areas of Hackberry Lake SRMA, the Birds of Prey Grasslands ACEC, the Gypsum Soils ACEC, the Pecos Bluntnose Shiner ACEC, and Pope's Well ACEC. Removal of grazing in the areas listed above would improve the overall watershed health through the increase in soil stability and a decrease in erosion and subsequent excessive sedimentation.

Compared to the No Action Alternative, which does not remove livestock grazing from as many riparian and spring areas and closes only 5,226 acres to livestock grazing (see Table 4-3) (compared to the 153,583 acres closed under Alternative B), the magnitude of adverse impacts to soil and water resources would be greatly reduced under Alternative B.

Impacts from Alternative C

Under Alternative C, 8,115 acres would be closed to livestock grazing (see Table 4-3), representing less than 1% of the planning area. However, sensitive areas would be closed to livestock grazing and include riparian pastures (seasonal) adjacent to the Delaware River (both sides of U.S. 285), as well as those areas around riparian springs and their associated riparian zones. Limiting grazing in these sensitive areas would minimize adverse impacts resulting from grazing, such as erosion, soil compaction, and subsequent excessive sedimentation of the waterways.

Compared to the No Action Alternative which closes only 5,226 acres to livestock grazing (see Table 4-3) across the planning area (compared to the 8,115 acres closed under Alternative C) and does not prohibit grazing around all riparian springs and their associated riparian zones, the magnitude of adverse impacts to soil and water resources would be slightly reduced under Alternative C.

Impacts from Alternative D

Under Alternative D, 3,594 acres would be closed to livestock grazing (see Table 4-3), representing less than 1% of the planning area. Additionally, those areas containing riparian springs and their associated riparian zones would also be closed to grazing, as well as the Black River Management Area. Limiting grazing in these sensitive areas would reduce adverse impacts resulting from grazing, such as trampling, erosion, soil compaction, water contamination, and subsequent excessive sedimentation of the waterways.

Compared to the No Action Alternative, which closes only 5,226 acres to livestock grazing (see Table 4-3) across the planning area (compared to the 3,594 acres closed under Alternative D) and does not prohibit grazing around all riparian springs and their associated riparian zones, the magnitude of adverse impacts to soil and water resources would be slightly reduced under this alternative.

4.2.1.2.3 Impacts of Travel Management and Recreation on Soil and Water Resources

Travel management and recreation would have the potential to adversely impact soil and water resources wherever OHVs operate and wherever recreation activities are not managed. OHVs cause physical destruction to the soil surface and vegetative cover, which can lead to compaction, reduction of infiltration, and reduction of herbaceous cover, all of which can lead to increased erosion and sedimentation. Roads and OHV routes can be primary sources of sediment and salinity delivery to rivers, streams and other water bodies. OHV recreation use during periods of high soil moisture content could exacerbate localized erosion and soil compaction and damage existing vegetation.

Large group recreation events and camping would potentially compact soils, damage streambanks and riparian areas, erode soils, and transport contaminants to surface water and groundwater. Compacted soils increase volume and velocity of runoff and would result in sedimentation in nearby waterways. Groundwater impacts could include depletion from well water use and contamination from transport of chemicals and organics in soil.

Additionally, soil disturbances resulting from OHV and off-trail recreation use would negatively impact soil productivity and water infiltration rates. A recent U.S. Geological Survey (USGS) synthesis of the literature summarizes the impacts of OHV use on soil resources (Ouren et al. 2007). The report concluded that the negative effects of OHV activities on the functioning of soil and water resources included soil compaction, diminished water infiltration, diminished presence and impaired function of MSCs, and accelerated erosion rates. Compacted soils inhibit water infiltration from precipitation which, in turn, limits soil moisture availability for vegetation and increases the volume and velocity of runoff. Where MSCs are disturbed or destroyed, soil erosion from water and wind may increase beyond rates found in undisturbed sites with similar soils and conditions; nutrient-cycling processes are also likely to be disrupted, potentially leading to declines in soil fertility and a decrease in vegetative cover (Ouren et al. 2007). Managing for OHV limited use and closing some areas would minimize and help eliminate adverse impacts to soil and water resources.

Restricting OHV use to designated routes would limit adverse impacts to soil and water resources. However, all alternatives differ in the total number of acres limited or closed to OHVs. Table limiting OHVs to designated and existing routes both generally result in no additional surface disturbance, these two OHV use categories were analyzed together for each alternative (Table 4-4).

Table 4-4. Travel Management Decisions by Alternative (acres)

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
OHV limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed to OHV use	55,966 (2.7%)*	52,028 (2.5%)	41,936 (2.0%)	38,738 (1.9%)	38,737 (1.9%)
Total	2,091,273	2,091,326	2,091,327	2,091,320	2,091,321

* Number in parentheses is the percentage of total area.

Impacts from Management Common to All

Under all of the proposed alternatives, management decisions would include the following: the Phantom Banks Heronries would be designated as limited to OHV use, motorized wheeled cross-country travel would be allowed for any military, fire, search and rescue, or law enforcement vehicle used for emergency purposes and motorized wheeled cross-country travel for leases and permittees would be limited to the administration of a BLM lease or permit. Additional management actions common to all would include the following: Recreation Area Management Plans (RAMPs) would be prepared for all designated Special Recreation Management Areas (SRMAs) and would address the types of management actions necessary to achieve the recreation objectives put forth in this RMP; the Conoco Lake (7 acres) SRMA would be a ROW exclusion area, which would reduce impacts to soil and water resources caused by ROW-related surface disturbance; the Dunes Recreation Management Zone (RMZ) would require a No Surface Occupancy (NSO) stipulation on active dunes and developed leases for future areas; and the Trails RMZ would limit travel to designated trails.

These actions would minimize adverse impacts (as described at beginning of this section) to both soil and water resources resulting from travel and recreation management decisions.

Impacts from Management Common to All Action Alternatives

Proposed travel management and recreation decisions common to all action alternatives that would impact soil and water resources include the requirement that all new road construction adhere to the BLM's *Surface Operating Standards and Guidelines for Oil and Gas Development – The Gold Book* (BLM 2007a) and that all surfacing material on oil and gas roads must be removed at the time of abandonment. Camping is also prohibited within 900 feet of any natural or human-made water source (excluding the Pecos River).

Trails would be designated within the Black River SRMA including extending trails to Ladder Hole from the parking area. These trails would be for non-motorized use only. Increasing the number of trails would increase the potential for impacts to soil and water resources, such as soil compaction, erosion, sedimentation, and the spread of noxious weeds and invasive plants, which can degrade soil productivity. However, restrictions on motorized use would help limit the potential for adverse impacts to soil and water resources caused by OHVs. Hackberry Lake (new boundary minus lesser prairie-chicken [*Tympanuchus pallidicinctus*; LPC] habitat areas and paleontological site) would be managed as an SRMA. Also, trails in the La Cueva SRMA (1,565 acres) would be limited to non-motorized use only (43 CFR 8341.1). Restrictions on motorized use would help reduce the potential for impacts to soils and water resources, as described above. The SRMA would be designated as a ROW corridor. The fewer the acres managed for ROW, the less potential for impacts to soil and water resources from ROW-related surface disturbance.

These management actions would minimize adverse impacts to soil and water resources, such as soil compaction and erosion, contamination, and overall reduction in soil productivity and water quality (see additional impacts described at the beginning of this section).

Impacts from the No Action Alternative

Under the No Action Alternative, current management addressing travel and recreation would continue. Existing OHV closures within 55,966 acres include the Laguna Plata and Pope's Well areas. Approximately 2,035,307 acres would be OHV limited (see Table 4-4).

Management actions regarding campfires, firewood gathering, and equestrian activities would remain unchanged from the 1988 RMP. Thus, impacts to soil and water resources from these recreational activities would be a continuation of the trends under existing conditions. The types of direct and indirect impacts that would be expected are described at the beginning of this section.

Hackberry Lake SRMA (53,560 acres) would be open to leasing subject to the Secretary's Potash Order. The fewer the acres managed for mineral exploration and development, the less potential for impacts to soil and water resources from surface disturbance caused by these activities. The entire SRMA would be managed as OHV limited, which would beneficially maintain soil disturbances along existing trails.

The Pecos River corridor would be managed as an SRMA with NSO stipulations to future oil and gas leases on 6,008 acres. Approximately 6,006 acres of the SRMA would be withdrawn from mining claim location. The fewer the acres managed for mineral exploration and development, the less potential for adverse impacts to soil and water resources from surface disturbance caused by these activities. Surface disturbance would be restricted throughout the SRMA to reduce erosion and minimize other impacts to soil and water resources. Approximately 122 acres around the Red Bluff Reservoir would be closed to OHV use and the remaining SRMA acres would be OHV limited. Restricting OHV use would reduce the potential for adverse impacts to soil and water resources.

OHV limited use would be allowed in the 11,207-acre Pecos River ERMA on 10,124 acres, but no developed trails would be allowed. Likewise, OHV limited use would be allowed in the Hay Hollow area (12,913 acres), but no trails would be developed. The fewer trails, the less potential for adverse impacts to soil and water resources.

Impacts from Alternative A

Under Alternative A, 2,039,299 acres (97.5% of the planning area) would be OHV limited, and 52,028 acres (2.5%) would be closed (see Table 4-4).

Alternative A would have the same impact as described under the No Action Alternative because the acreage differences are relatively small.

Also, under Alternative A Alkali Lake (944 acres) would be managed as an SRMA and would be a ROW exclusion area on dunes and a ROW avoidance area elsewhere. The fewer the acres managed for ROWs, the less potential for soil erosion, sediment loading, alterations in surface drainage patterns, and other adverse impacts to soil and water resources from ROW-related surface disturbance.

The Pecos River Corridor SRMA (6,008 acres) would be managed to provide recreation opportunities on public land parcels with an emphasis on natural and scenic qualities. Travel in the SRMA would be OHV limited, which would help limit adverse impacts to soil and water resources. The SRMA would be managed as open with major constraints for fluid leasables and closed to locatable and salable development. The more restrictions on mineral exploration and development, the less potential for adverse impacts to soil and water resources from surface disturbance caused by these activities.

Square Lake (2,975 acres) would be managed as an ERMA with an objective to provide for open OHV play experiences on open dunes designating OHV limited travel to designated routes between dunes. The ERMA would be closed to camping during the LPC breeding season (March 1–June 15, 3:00–9:00 a.m.). Restricting camping activities would reduce the potential for impacts to soil and water resources where applicable during this period. OHVs would be limited to designated routes between dunes, which would reduce the potential for impacts to these sensitive soils. The fewer the acres managed for mineral exploration and development, the less potential for adverse impacts to soil and water resources from surface disturbance caused by these activities.

The Pecos River Equestrian Trail and Hay Hollow Equestrian ERMAs would be managed the same as is described under the No Action Alternative.

Impacts from Alternative B

Under Alternative B, 2,049,391 acres (98.0% of the planning area) would be OHV limited, and 41,936 acres (2.0%) would be closed. The nature of the impacts would be the same as those described for Alternative A, but the beneficial impacts of closure would occur on a smaller area under this alternative, with more of the planning area designated as limited.

Qualitatively, this is the same impact as described under the No Action Alternative.

Alkali Lake would be managed as an SRMA, with the same prescriptions as Alternative A. Square Lake (2,975 acres) and the West Well Dunes (624 acres) would be managed as ERMAs. Travel in the ERMAs would be limited to designated trails/dunes and trails would be expanded on case-by-case basis, Restrictions on travel would reduce the potential for adverse impacts to soil and water resources, as described at beginning of this section. All 624 acres would be managed as open for mineral development and also open to grazing and renewable energy development.

The Pecos River Equestrian Trail would be managed as an ERMA. The fewer the acres managed for ROWs, the less potential for impacts to soil and water resources from ROW-related surface disturbance. New trails would be designated/constructed in combination with existing trails, excluding the Delaware portion of the ERMA. An increased number of trails would increase the potential for adverse impacts to soil and water resources, as described at the beginning of this resources section. No motorized or mechanized use would be allowed on singles track portions of the equestrian trail. The more restrictions on motorized and mechanized travel, the less potential for adverse impacts to soil and water resources.

The Hay Hollow Equestrian Trail (12,913 acres) would be managed as an ERMA. The ERMA would be open to grazing, which would increase the potential for impacts to soil and water resources, such as soil compaction, sediment loading, and decreased soil productivity and water quality. Mineral designations would include no acreage closed to leasable mineral development and NSO designation on 7,296 acres. Approximately 7,296 acres would be closed to salables and 7,296 acres withdrawn from locatable mineral development. The fewer the acres managed for mineral exploration and development, the less potential for adverse impacts to soil and water resources from surface disturbance caused by these activities.

Impacts from Alternative C

Under Alternative C, 2,052,582 acres (98.1% of the planning area) would be OHV limited, and 38,738 acres (1.9%) would be closed (see Table 4-4). The nature of the impacts would be the same as those described for Alternative A, but there would be fewer beneficial impacts because OHV closure would occur on a smaller area under this alternative, with more of the planning area designated as limited.

Qualitatively, this is the same impact as described under the No Action Alternative.

The Alkali ERMA would be OHV limited and would therefore have the same potential for impacts to soil and water resources as described under the No Action Alternative.

The Pecos River Equestrian Trail would be managed as an ERMA with the same prescriptions described under Alternative B. The Hay Hollow Equestrian ERMA would be managed the same as is described under the No Action Alternative. Square Lake would be managed as an ERMA with the same prescriptions as those described under Alternative A.

Impacts from Alternative D

Under Alternative D, 2,052,584 acres (98.1% of the planning area) would be OHV limited, and 38,737 acres (1.9% of the planning area) would be closed to OHV use (the same as Alternative C).

Qualitatively, this is the same impact as described under the No Action Alternative, with the same impacts as discussed under Alternative C because the acreages are the same.

Pecos River Equestrian Trail ERMA would designate/construct new trail in combination with using existing trails, with no motorized or mechanized use allowed on single track portions of the equestrian trail. The more restrictions on motorized and mechanized travel near riparian areas, the less potential for adverse impacts to soil and water resources, as described at the beginning of this resources section. The West Well Dunes (624 acres) would be managed as an ERMA with the same prescriptions as those described under Alternative B.

4.2.1.2.4 Impacts of Special Designation Areas on Soil and Water Resources

Special designation proposed management actions would potentially impact soil and water resources in cases where portions of these areas were open to surface-disturbing activities, such as livestock grazing and mineral development. Adverse impacts would be particularly magnified in those areas with sensitive soils and MSCs. Impacts associated with these activities would include soil compaction and excessive erosion, decreases in soil productivity and water quality, contaminant delivery to drainages and water bodies, alterations in surface and subsurface drainage patterns and possible degradation of groundwater. Mitigation during surface-disturbing activities would help to reduce or eliminate these impacts to soil and water resources.

ACECs

Under all management alternatives, ACECs would be managed to protect the relevant and important values for which the ACEC is to be designated and would generally reduce long-term impacts to soil and water resources that occur within their boundaries. The various ACECs have specific management goals and actions under each of the alternatives. Those ACECs that have relevant and important soil and/or water resources and also those ACECs with substantial acreage open to surface-disturbing activities would be most susceptible to negative impacts upon soil and water resources. Lands designated as ACECs and associated acreages vary among alternatives and are presented in Table 4-5.

ACEC management impact analysis for soil and water resources was based on the number of acres open to leasable, salable, and locatable mineral management decisions, OHV use, and livestock grazing, which would have direct and indirect impacts on soil and water resources because of the surface disturbances associated with these actions (see Table 4-5). All designated ACECs would be managed as ROW avoidance areas and, therefore, ROW acreage within ACECs is not included in the table.

Table 4-5. ACEC Acreages Closed to Livestock Grazing, OHV Use, and Mineral Development by Alternative

Land Use	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres designated as ACECs	13,435	495,042	561,433	98,562	28,894
Total acres closed to grazing	0	449,747	135,480	5,735	201
Acres closed/limited to OHV use	12,608	479,960	546,867	93,641	27,224
Acres of NSO/closed to leasable mineral development	11,997	422,462	494,794	44,683	28,894
Acres closed to salable mineral development	12,613	197,644	298,343	44,824	26,468
Acres withdrawn from locatable mineral development	13,434	96,781	154,915	43,878	26,470

Impacts from the No Action Alternative

Under the No Action Alternative, current ACEC designations would continue as outlined in the 1988 RMP. Five existing ACECs totaling 13,435 acres (see Table 4-5), would continue to be managed under this alternative with no additional ACECs designated. Under this alternative, approximately 89% of the total ACEC acreage would remain designated as NSO/closed to leasable mineral exploration and development, 94% closed to salable development, and 99% would be recommended for withdrawal from locatable mineral development (see Table 4-5). Virtually all ACEC acres would remain open to livestock grazing. Approximately 12,608 acres (94%) would be closed or OHV limited.

Adverse impacts, such as soil compaction and degradation, as well as vegetation removal, sediment loading, and potential contaminant delivery to water bodies, would continue within these ACEC acreages, all of which contain important soil and water resources.

Impacts from Alternative A

Under Alternative A, nine ACECs would be designated, representing 495,042 acres (see Table 4-5). This would mark a substantial increase in ACEC-designated acres compared to the approximately 13,435 acres designated under the No Action Alternative. Livestock grazing would be prohibited in the Carlsbad Chihuahuan Desert Rivers, Birds of Prey and Pecos Bluntnose Shiner ACECs, and reduced within the Gypsum Soils ACEC. All in all, 449,747 ACEC acres (91%) would be closed to grazing.

Under this alternative, 422,462 acres of total ACEC acreages would be designated as NSO/closed to leasable mineral development and 96,781 acres withdrawn from locatable mineral development. Additionally, 479,960 of total ACEC acreage would be /OHV limited.

Qualitatively, adverse impacts associated with surface-disturbing activities would be the same as those described under the No Action Alternative; however, the magnitude of the impacts would be smaller under this alternative due to the larger number of ACEC designated acres closed to the major surface-disturbing activities depicted in Table 4-5.

Impacts from Alternative B

Under Alternative B, 15 ACECs representing 561,433 acres would be designated, representing a significantly sizable increase in the number of acres designated as ACECs compared to the No Action Alternative. Of this ACEC acreage, 494,794 acres would be designated as NSO/closed to leasable minerals development and 154,915 withdrawn from locatable mineral development (see Table 4-5). Additionally, livestock grazing would be prohibited on 135,480 ACEC acres (24%) and 546,867 acres would be closed/OHV limited. Adverse impacts, such as soil compaction and degradation, as well as vegetation removal and contaminant delivery to water bodies would be minimized within these ACECs.

Qualitatively, adverse impacts associated with surface-disturbing activities would be the same as those described under the No Action Alternative; however, the magnitude of the impacts would be smaller under this alternative due to the larger number of ACEC designated acres closed to the major surface-disturbing activities depicted in Table 4-5.

Impacts from Alternative C

Under Alternative C, eight ACECs representing 98,562 acres would be designated. This would represent a substantial increase in the number of acres designated as an ACEC compared to the No Action Alternative. Under this alternative, 44,683 acres of ACEC acreages would be designated as NSO/closed to leasable minerals development; 43,878 acres withdrawn from locatable minerals development; 5,735 acres closed to livestock grazing and 93,641 acres closed and OHV limited (see Table 4-5). Adverse impacts, such as soil compaction and degradation, as well as vegetation removal and contaminant delivery to water bodies, would be minimized within these ACECs.

Qualitatively, adverse impacts associated with surface-disturbing activities would be the same as those described under the No Action Alternative; however, the magnitude of the impacts would be smaller under this alternative due to the larger number of ACEC designated acres closed to the major surface-disturbing activities depicted in Table 4-5.

Impacts from Alternative D

Under Alternative D, five ACECs representing 28,894 acres would be designated, representing a large increase in the number of ACEC acres when compared to the No Action Alternative. Under this alternative, 28,893 ACEC acreages would be designated as NSO/closed to leasable mineral development and 26,470 acres withdrawn from locatable mineral development; 201 acres would be closed to livestock grazing, and 27,224 acres closed and OHV limited.

Qualitatively, adverse impacts associated with surface-disturbing activities would be the same as those described under the No Action Alternative; however, the magnitude of the impacts would be smaller under this alternative due to the larger number of ACEC designated acres closed to the major surface-disturbing activities depicted in Table 4-5.

4.2.1.2.5 Impacts of Wilderness Study Areas on Soil and Water Resources

Impacts from Management Common to All

All soil and water resources within the four designated WSAs, comprising a total of 7,086 acres, would continue to benefit from additional protection through special management requirements, including a closed designation for all future leases and no reissuing of current leases once expired, which would enhance and preserve its wilderness values, including plant communities within the unit. In addition, new permanent facilities and new surface disturbance would be prohibited, all of which would minimize adverse impacts to soil and water resources, such as increased soil erosion and compaction, decreased soil productivity, increased runoff and potential contaminant delivery to water bodies.

Impacts from the No Action Alternative

Under the No Action Alternative, the four WSAs would remain under their current designation and managed accordingly under prescriptions outlined in the Carlsbad RMP (BLM 1988) as amended, such as closed to all future leasing or NSO designation, closed to salables, withdrawn from locatables, OHV limited, closed to or excluded from renewable energy and designated as Visual Resource Management (VRM) Class I, and also as a ROW avoidance area. These management prescriptions would continue to minimize adverse impacts to soil and water through restrictions on surface-disturbing activities.

Alternatives A, B, and C

If the WSA designation is removed, the four previously designated WSAs would be managed as closed to leasable and salable development and recommended for withdrawal from locatable development. Adverse impacts under these three alternatives would be comparable to those under the No Action Alternative and as described under management common to all.

Alternative D

Under Alternative D, adverse impacts resulting from loss of WSA designation would be greater than those found under the other alternatives because management prescriptions would be less stringent for surface-disturbing activities. Unlike the other four alternatives, leasable mineral development would be open with major constraints, salable mineral development would be open with moderate constraints and the areas would be open for locatable development. In addition, the proposed VRM class on these lands would be Class III.

Adverse impacts, as those described under management common to all alternatives, would be greater under Alternative D compared to the No Action Alternative and also compared to Alternatives A through C.

4.2.1.2.6 Impacts of Wild and Scenic Rivers on Soil and Water Resources

Impacts from Management Common to All Action Alternatives

Under Management Common to All Action Alternatives, the Black River would be recommended as suitable for inclusion in the NWSRS and would be given the same management prescriptions as other WSR areas, including a VRM Class II classification. Beneficial impacts to water and soil resources would occur, as the WSR designation would limit surface-disturbing activities that would potentially result in adverse impacts, such as decreased soil productivity and water quality, increased bare ground, increased soil compaction and erosion, and alterations in stream hydrology.

Impacts from the No Action Alternative

Under the No Action Alternative, the Black River would not be managed as part of the National Wild and Scenic River System (NWSRS) but since it was determined to be eligible as a WSR (see Appendix N) it would be managed to protect its eligibility until a suitability determination is made as part of this RMP process. The Black River would be managed with the following management prescriptions: designation as VRM Class III, closed to salable and recommended for withdrawal from locatable mineral development, with leasables open with major constraints (NSO). All ROW construction would continue to be designated under “avoidance” within WSR areas and all renewable energy development would be precluded.

The Delaware River would also not be managed as part of the NWSRS, but since it was determined to be eligible as a WSR (see Appendix N) it would be managed to protect its eligibility until a suitability determination is made as part of this RMP process. The Delaware River would be managed with various prescriptions, such as classifying certain segments of the river under VRM Class II and IV objectives, excluding areas adjacent to the river to renewables development and mineral development (open with major constraints) and designations as a ROW ”avoidance area.” The No Action Alternative mineral and renewable energy prescriptions would protect the soils in the two river segments by reducing or eliminating surface disturbance.

Impacts from Alternative A

Under Alternative A, the Black River would be recommended as suitable for inclusion in the NWSRS and would be managed with the following prescriptions: VRM Class II, travel limited to designated routes, closed to leasable and salable mineral development, withdrawn from locatable mineral development, and excluded from both ROW development and renewable energy projects.

Also, under this alternative the Delaware River (one segment comprising 8.22 miles) would be recommended as suitable for designation in the NWSRS and would be managed under same prescriptions above for the Black River. All of these prescriptions would minimize surface disturbance and, therefore, reduce adverse impacts to soil and water resources.

Compared to the No Action Alternative which does not designate either the Black or the Delaware River in the NWSRS, the magnitude of adverse impacts to soil and water resources would be smaller under this alternative.

Impacts from Alternatives B and C

Under both of these alternatives, proposed management concerning the Black River would be the same as those under Alternative A, resulting in minimized surface disturbance and potential adverse impacts to soil and water resources. The Delaware River (Segment 1) would not be recommended as suitable for inclusion in the NWSRS and would be managed with prescriptions, including designation as VRM Class III, OHV limited, and various portions open to leasables with standard lease terms and conditions (1.0 miles) and open with major constraints (7.5 miles). Locatable and salable mineral development would be open in some areas but closed or recommended for withdrawal in others.

Compared to the No Action Alternative, which does not designate the Black River in the NWSRS and would keep the Delaware River open to locatable mineral development, the magnitude of adverse impacts to soil and water resources would be smaller under these alternatives.

Impacts from Alternative D

Under Alternative D, management prescriptions in relation to the Black River would be the same as those under Alternatives A, B, and C with the exception of the allowance of leasable development open with major constraints on WSR areas. Proposed management of the Delaware River segment would be the same as under alternatives B and C.

Compared to the No Action Alternative, which does not designate the Black River in the NWSRS and would keep the Delaware River open to locatable mineral development, the magnitude of adverse impacts to soil and water resources would be smaller under this alternative.

4.2.1.2.7 Impacts of Lands with Wilderness Characteristics Actions on Soils and Water Resources

Those soil and water resources located within lands with wilderness characteristics units that are managed to protect wilderness characteristics would receive beneficial impacts as a result of additional management prescriptions aimed at protecting wilderness characteristics and further minimizing surface disturbances. The greater the number of acres managed in this manner, the greater the benefit to soil and water resources. When units are managed to emphasize multiple uses while applying some protective management (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics, there would be some long-term benefits to soil and water resources, but it would depend on the prescriptions for the individual units. See Section 4.2.9 Lands with Wilderness Characteristics for details. For this reason, the greater the number of acres managed to protect wilderness characteristics, the greater the protection afforded to soil and water resources. Where lands with wilderness characteristics units are managed to emphasize other multiple uses as a priority over protecting wilderness characteristics, ground-disturbing activities such as minerals development may still be allowed and would offer less protection to soil and water resources.

The acreages designated as lands with wilderness characteristics and their management vary by alternative and are represented in Table 4-6.

Table 4-6. Acres within Lands with Wilderness Characteristics by Alternative

Management Level	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Protects wilderness characteristics	*N/A	66,666	47,611	5,119	1,221
Emphasizes other multiple uses while applying some protective management	*N/A	0	18,964	30,595	0
Emphasizes other multiple uses	*N/A	0	0	30,862	65,446

* There are currently no units managed as lands with wilderness characteristics.

Impacts from the No Action Alternative

Under the No Action Alternative, soil and water resources would not receive any beneficial impacts because no lands are currently designated as lands with wilderness characteristics and, therefore, no soil and water resources would benefit from management prescriptions, as described above, specific to designated lands with wilderness characteristics.

Impacts from Alternative A

Under Alternative A, 66,666 acres would be managed to protect wilderness characteristics. Associated management prescriptions would benefit soil and water resources by closing all lands with wilderness characteristics acres to future leases, withdrawing all acres from locatables and salables, excluding ROWs, and designating travel as OHV limited. Beneficial impacts resulting from these management prescriptions would include decreased erosion, sedimentation, and potential for noxious weed invasion.

Compared to the No Action Alternative, which designates no lands with wilderness characteristics and does not propose any new management prescriptions, the magnitude of beneficial impacts to soil and water resources is much greater under Alternative A.

Impacts from Alternative B

Under Alternative B, 47,611 acres would be managed to protect wilderness characteristics and 18,964 acres would be managed to emphasize other multiple uses while applying some protective management, and zero acres would be managed to emphasize other multiple uses.

Compared to the No Action Alternative, which designates no lands with wilderness characteristics and does not propose any new management prescriptions, the magnitude of beneficial impacts to soil and water resources is much greater under Alternative B.

Impacts from Alternative C

Under Alternative C, 5,119 acres would be managed to protect wilderness characteristics, 30,595 acres would be managed to emphasize other multiple uses while applying some protective management, and zero acres would be managed to emphasize other multiple uses.

Compared to the No Action Alternative, which designates no lands with wilderness characteristics and does not propose any new management prescriptions, the magnitude of beneficial impacts to soil and water resources is much greater under Alternative C.

Impacts from Alternative D

Under Alternative D, 1,221 acres would be managed to protect wilderness characteristics, zero acres would be managed to emphasize other multiple uses while applying some protective management, and 65,446 acres would be managed to emphasize other multiple uses.

Compared to the No Action Alternative, which would not manage any lands to protect wilderness characteristics and does not propose any new management prescriptions, the magnitude of beneficial impacts to soil and water resources is slightly greater under Alternative D.

4.2.1.2.8 Impacts of Leasable, Salable, and Locatable Minerals Actions on Soil and Water Resources

Minerals management actions would include the fluid leasable minerals oil and gas; the solid leasable mineral potash; locatable minerals gypsum, copper, gold, uranium, etc.; and salable minerals sand, gravel, rock, etc. Surface-disturbing activities associated with mineral development and exploration can adversely impact soil and water resources in various ways, including loss of vegetative cover and soil productivity, increased soil compaction and erosion, sediment loading, and alterations in surface and stream hydrology. In addition, noxious weed infestations resulting from reclamation-limited soils would degrade soil productivity and potentially cause additional alterations in surface water hydrology. Mitigation plans and BMPs used during the implementation phase of surface-disturbing activities associated with mineral development would reduce the potential for adverse impacts, as those previously described.

The number of acres of surface disturbance expected to occur across the planning area as a result of mineral development varies by each alternative and is presented in Table 4-7. These new surface disturbances would have an adverse impact on soil and water resources through soil disturbance, potential contamination of streams, rivers, and other water bodies and additional impacts as those listed above. Subsurface disturbances would primarily result from the hydraulic fracturing wells and open pit mines. Hydraulic fracturing wells have the potential to contaminate groundwater resources through spills and accidental discharges.

The best impact indicator for minerals actions would be the total number of acres that are closed to further development and the number of wells predicted across the planning area. The greater the number of disturbed acres and wells, the greater the potential for negative impacts to soils and water resources (both surface water and groundwater).

Potential impacts from hydraulic fracturing would be analyzed by looking at the number of predicted wells on BLM-administered lands by alternative and the associated acres of disturbance and the amount of water consumed. The number of predicted wells is based on the percentage of land open to surface disturbance. Hydraulic fracturing has the potential to cause direct and indirect impacts to the groundwater resources during mineral development. Several of the processes used in mineral extraction require the use of hydraulic fracturing fluids or high concentration brine fluids that when managed improperly have the potential to be directly or indirectly discharged into the groundwater or surface water resources. Another potential direct impact of hydraulic fracturing is with the large amount of water resources needed during the process in an area already experiencing declining surface waters and aquifer levels. However, 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 reduce the impact on groundwater availability. The BLM has management actions in place to mitigate the risks associated with hydraulic fracturing and ensure that it is a transparent process.

Potential impacts to water resources from oil and gas drilling and production conducted by hydraulic fracturing 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 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 EPA 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." (EPA 2016)

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% 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.

When hydraulic fracturing of oil and gas wells drilled to access federal fluid minerals or for accessing private fluid minerals from federal surface lands is properly implemented, it does not represent a significant adverse impact to human health and the environment. BLM Onshore Order No. 2 (53 *Federal Register* 46798) and New Mexico Administrative Code 19.15.16.10 are operational rules and contain specific requirements for casing and cementing and well integrity.

In addition to the vertical separation of the upper extent of fractures and freshwater aquifers, the BLM (BLM Onshore Order No. 2) and the New Mexico Oil Conservation Division (New Mexico Administrative Code 19.15.16.10) require the proper casing and cementing of wellbores to isolate aquifers penetrated by a wellbore. The depth of casings is based on a geological review of the formations, aquifers, and groundwater. Cement is 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.

The CFO RMP also includes several fluid minerals lease stipulations that would help prevent potential impacts to groundwater and other water resources. These stipulations can be found in Appendix C, and include the following stipulations:

- C-3 (Controlled Surface Use Stipulation – Domestic Freshwater Wells and Monitoring Wells)
- C-3A (0.25-mile buffer around riparian areas, perennial springs, and seeps prohibiting placement of oil, tank bottoms, or other hydrocarbons, salt water, or any toxic substances)
- C-4 (Controlled Surface Use Stipulation – Riparian-wetland and Aquatic Areas)
- C-8 (Lease Notice – Potential Cave or Karst Occurrence Area)
- C-34 (Controlled Surface Use Stipulation – City of Carlsbad Capitan Water Supply Field)
- C-37 (Controlled Surface Use Stipulation – Recharge Areas for the Capitan Aquifer West of the Pecos River)

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. Potential impacts associated with hydraulic fracturing would be analyzed in more site-specific detail at the APD stage.

Surface disturbance from the various minerals management actions would have similar impacts to soil and water resources, and all are analyzed as one category of impact: by analysis of management action acreages for the three mineral categories: 1) leasable, 2) salable, and 3) locatable (Table 4-7–Table 4-10). Note the differences in total acreages across all alternatives are small, so overall there would not be much difference in the impacts of minerals management actions on soils and water resources across the various alternatives.

The potential for induced seismicity resulting from underground injection of waste water and hydraulic fracturing is another concern. Currently, the 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. 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).

Table 4-7. Number of Predicted Wells, Total Predicted Surface Disturbance, and Total Predicted Water Use by Alternative on BLM-administered Lands

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Number of predicted wells on **BLM-administered lands only**	5,874	4,465	3,538	5,832	6,044
Total predicted surface disturbance/acres on **BLM-administered lands after reclamation**	8,636	6,565	5,202	8,575	8,887
Total predicted water use from wells on BLM-administered lands (acre-feet)	***38,811***	***29,503***	***23,379***	***38,538***	***39,937***

Table 4-8. Acreage Opened and Closed to Leasable Mineral Management Decisions by Alternative for BLM Lands

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
BLM Surface Lands					
Open with standard terms and conditions	1,598,870	1,142,802	1,089,481	1,750,774	1,997,681
Open with moderate constraints (CSU)	956,410	799,649	449,759	786,381	631,634
Open with major constraints (NSO)	54,602	80,394	162,013	158,401	70,142
Closed	174,391	761,404	1,082,972	88,502	84,687
Total	***2,784,273***	***2,784,248***	***2,784,224***	***2,784,058***	***2,784,145***
% of planning area surface lands proposed as closed	***6.3%***	***27.3%***	***38.9 %***	***3.2%***	***3.0%***

Table 4-9. Acreage Opened and Closed to Salable Mineral Management Decisions by Alternative for BLM Lands

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
BLM Surface Lands					
Open	2,637,465	1,160,064	1,121,118	1,784,431	2,028,324
Open with special terms and conditions	–	1,062,192	726,270	752,286	602,621
Closed	146,568	561,995	936,799	247,323	153,174
Total	***2,784,033***	***2,784,251***	***2,784,186***	***2,784,041***	***2,784,119***
% of planning area surface lands proposed as closed	***5.3%***	***20.2%***	***33.6%***	***8.9%***	***5.5%***

Table 4-10. Acreage Opened and Closed to Locatable Mineral Management Decisions by Alternative for BLM Lands

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
BLM Surface Lands					
Open to mineral entry	2,751,856	2,403,114	2,110,098	2,651,855	2,661,705
Recommended (or previously recommended for withdrawal)	32,374	380,990	673,996	132,249	122,444
Total*	***2,784,229***	***2,784,105***	***2,784,094***	***2,784,104***	***2,784,149***
% of planning area surface lands recommended for withdrawal	***1.2%***	***13.7%***	***24.2%***	***4.8%***	***4.4%***

*Total may not sum correctly due to rounding

Impacts from the No Action Alternative

Under the No Action Alternative, approximately 5,874 wells and 8,636 acres of surface disturbance are predicted after reclamation and 38,811 of water use in acre-feet (see Table 4-7). Approximately 6.3% of the total planning area would be closed to leasable development, 5.3% to salable development, and approximately 1.2 % withdrawn from mineral development.

Adverse impacts to soil and water resources, as those described above, would be expected to continue if the No Action Alternative is adopted.

Impacts from Alternative A

Under Alternative A, 4,465 wells and approximately 6,565 acres of surface disturbance are predicted on all BLM-administered lands after reclamation. Total predicted water use would be 29,503 acre-feet. A total of 27.3% of the entire planning area would be closed to leasable mineral development, 20.2% closed to salable, and 13.7% recommended for withdrawal from locatables (see Table 4-9).

Compared to the No Action Alternative, surface disturbance would decrease by 2,071 acres and predicted water use by 9,308 acre-feet under Alternative A. Therefore, the magnitude of adverse impacts (as those described above) to soil and water resources would be greater under the No Action Alternative than under Alternative A.

Impacts from Alternative B

Under Alternative B, 3,538 wells and approximately 5,202 acres of surface disturbance are predicted on BLM-administered lands. Total predicted water use would be 23,379 acre-feet. Approximately 38.9% of the entire planning area would be closed to leasable mineral development, 33.6% closed to salable, and 24.2% recommended for withdrawal from locatables.

Compared to the No Action Alternative, surface disturbance would decrease by 3,434 acres and predicted water use by 15,432 acre-feet under Alternative B. Therefore, the magnitude of adverse impacts (as those described above) to soil and water resources would be greater under the No Action Alternative than under Alternative B.

Impacts from Alternative C

Under Alternative C, 5,832 wells and approximately 8,575 acres of surface disturbance are predicted on BLM-administered lands. Total predicted water use would be 38,538 acre-feet. A total of 3.2% of the entire planning area would be closed to leasable mineral development, 8.9% closed to salable, and 4.8% recommended for withdrawal from locatables.

Compared to the No Action Alternative, surface disturbance would decrease by 61 acres and predicted water use by 273 acre-feet under Alternative C. Therefore, the magnitude of adverse impacts (as those described above) to soil and water resources would be slightly greater under the No Action Alternative than under Alternative C.

Impacts from Alternative D

Under Alternative D, 6,044 wells and approximately 8,887 acres of surface disturbance are predicted on BLM-administered lands. Total predicted water use would be 39,937 acre-feet. Only 3.0% of the entire planning area would be closed to leasable mineral development, 5.5% closed to salables, and 4.4% recommended for withdraw from locatables.

When compared to the No Action Alternative, surface disturbance would be 251 acres greater under Alternative D. Predicted water use is also slightly greater (an increase of 1,126 acre-feet) under this alternative compared to the No Action Alternative; therefore, the magnitude of adverse impacts to soil and water resources would be greater under Alternative D compared to the No Action Alternative.

4.2.1.2.9 *Impacts of Renewable Energy on Soil and Water Resources*

Adverse impacts to soil and water resources would potentially occur in those areas where renewable energy projects that include surface-disturbing activities are allowed. Solar projects would result in direct removal of vegetation created by solar panels. This would have adverse impacts on soil resources, such as erosion and decreased soil productivity. Additionally, some solar projects would require substantial water resources, which would impact water availability for other resources, as well as potentially degrading water quality. Desert aquifers, springs, seeps, and other water bodies would be adversely impacted as water is extracted to meet the needs of cooling and cleaning solar systems. Wind energy, comprising the placement of wind turbines, would also result in surface disturbances that would adversely impact soil and water resources. Impacts associated with surface-disturbing activities would include direct soil compaction, erosion, decreased soil productivity, potential contaminant delivery to water bodies, and alterations in stream hydrology.

Impacts from Management Common to All

Adoption of programmatic policies and BMPs in both the Solar Energy Development Programmatic EIS Record of Decision (ROD) (BLM 2012a) and decisions from the Final Wind Energy Development Programmatic EIS (BLM 2005) when implemented would also potentially minimize adverse impacts to soil and water resources across the planning area.

Impacts from Management Common to All Action Alternatives

All action alternatives encourage the placement of wind development projects in areas where transmission corridors are already located and where transmission systems are already in place.

As a result, adverse impacts to soil and water resources, as those described at the beginning of this section, would be greatly minimized.

Impacts from the No Action Alternative

Under the No Action Alternative, the BLM would exclude 1,819,929 acres from geothermal and solar development projects and 7,056 acres from wind development projects. Restrictions on the location of solar or wind energy sites would continue to be implemented on specific sites across the planning area, with the majority of the planning area excluded for solar development, as identified by the Solar Energy Development Programmatic EIS ROD (BLM 2012a). Those sites restricted from wind development projects include WSAs, WSRs, VRM Class I and II areas, and areas with known karst occurrences (for complete list of restrictions, see Chapter 2, Alternatives Matrix). Wind energy development would be restricted in designated SMAs to protect sensitive soils. In addition, applications to permit either solar or wind energy sites on public land within the planning area would be considered only if the applicant can demonstrate no negative impacts on avian and bat species. All of these management prescriptions would benefit soil and water resources by minimizing surface disturbance and its associated adverse impacts, as those described above.

Impacts from Alternative A

Under Alternative A, the BLM would close or exclude approximately 624,734 acres from wind development, approximately 768,020 acres from solar, and 995,285 acres from geothermal development. Solar, wind, and geothermal development would be excluded in areas with sensitive soils, not only in SMAs as is the case under the No Action Alternative.

Compared to the No Action Alternative, the magnitude of beneficial impacts to soil and water resources would be potentially greater because all sensitive soils would be protected, and wind development would be prohibited on a substantially larger number of acres under this alternative. Though the No Action Alternative prohibits solar development projects on a larger number of acres, the Solar Energy Development Programmatic EIS ROD (BLM 2012a) states most of the planning area would not be suitable to support solar development, thus greater number of acres closed to solar development is irrelevant.

Impacts from Alternative B

Under Alternative B, the BLM would exclude approximately 912,860 acres from wind development. Approximately 833,305 acres would be excluded from solar and 1,372,791 acres would be closed to geothermal development. Solar, wind, and geothermal development would be excluded in all areas with sensitive soils.

Compared to the No Action Alternative, the magnitude of beneficial impacts to soil and water resources would be potentially greater because all sensitive soils would be protected, and wind development would be prohibited on a substantially larger number of acres under this alternative.

Impacts from Alternatives C and D

Under Alternative C, the BLM would exclude approximately 206,184 acres from wind development. Approximately 734,636 acres would be excluded from solar and 608,850 acres would be closed to geothermal development.

Under Alternative D, 73,143 acres would be excluded from wind development. Under Alternative D, approximately 630,302 acres would be excluded from solar and 464,187 acres would be closed to geothermal development. Wind and geothermal development would be avoided in areas with sensitive soils while solar development would be excluded.

Compared to the No Action Alternative, the magnitude of beneficial impacts to soil and water resources would be potentially greater because all sensitive soils would be avoided, and wind development would be prohibited on a substantially larger number of acres under this alternative.

4.2.1.2.10 Impacts of Visual Resources on Soil and Water Resources

VRM class designations have specific management objectives that, depending on the class designated, could beneficially impact soil and water resources. The objectives defined for VRM Class I and II include the preservation or retention of the existing character of the landscape and, therefore, minimize and at times prohibit surface-disturbing activities. Those impacts to soil and water resources associated with mineral development, ROW construction and maintenance, and other land use authorizations and road and trail construction would be minimized, and in some cases prohibited, within these VRM Class I and II designations.

Various impacts on soil and water resources associated with ground-disturbing activities include alterations to stream hydrology and subsurface drainage patterns, disruptions in surface vegetative communities resulting in decreased soil productivity, soil compaction, sediment loading, and an increased potential for contamination of groundwater.

The number of acres designated as VRM Class I and II vary across the alternatives and are depicted in Table 4-11.

Table 4-11. Visual Resource Management Decisions (acres) by Alternative

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Total	***50,671***	***273,710***	***357,802***	***67,962***	***48,263***

Impacts from the No Action Alternative

Under the No Action Alternative, 50,671 acres would be designated under either VRM Class I or II (see Table 4-11). Soil and water resources would benefit from additional management prescriptions that would prohibit or minimize ground-disturbing activities within these designated acres.

Impacts from Alternative A

Under Alternative A, 273,710 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impacts would be much greater under this alternative because there is a substantially greater number of acres under the VRM Class I and II designations.

Impacts from Alternative B

Under Alternative B, 357,802 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impacts would be much greater under this alternative because there is a substantially greater number of acres under the VRM Class I and II designations.

Impacts from Alternative C

Under Alternative C, 67,962 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be greater under this alternative due to the increase in the number of acres under the VRM Class I and II designations.

Impacts from Alternative D

Under Alternative D, 48,263 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be greater under this alternative due to the increase in the number of acres under the VRM Class I and II designations.

4.2.1.2.11 Impacts of Wildland Fire and Fuels Management Actions on Soil and Water Resources

Soil conditions are critical to overall ecosystem productivity. Impacts from wildland fire and fuels management on soils and water resources would be largely associated with wildland fire and prescribed fire use, as well as hazardous fuels reduction treatments. Wildland fire can protect, maintain, and enhance resources, but at the same time has the potential to alter the physical, chemical, and biological characteristics of soil due to the transfer of heat. These impacts can in turn increase erodibility through the breakdown soil structure, reduction of soil moisture retention ability and capacity, and the reduction of infiltration and percolation, leading to the development of hydrophobic (i.e., water-repellent) soils (Neary et al. 2008).

Soil conditions also influence the overall hydrological processes that affect watershed conditions, including surface and groundwater, and quality of these water sources. Vegetation cover is the primary component preventing erosion of surface soils (Neary and Folliott 2008). Wildland fire and prescribed fire use result in the loss of vegetation, thereby increasing soil erosion from wind and/or water and potentially leading to the deposition of eroded sediment into streams and other water bodies.

Non-fire treatment methods (mechanical removal, chemical and biological treatments, manual removal, seeding) would facilitate restoration and lessen the potential for future catastrophic wildfire. This in turn would reduce future impacts to soil and water resources resulting from soil alteration and loss of vegetative cover. Mechanical treatments to reduce fuels would also result in a loss of vegetation, but to a lesser degree than fire use because mechanical extraction often leaves the understory intact and does not alter soil characteristics like heat transfer during fire events. Chemical and biological treatments would retain vegetation cover and minimize erosion; however, the chemicals could migrate into water bodies through runoff or wind erosion. Emergency stabilization, rehabilitation, and restoration efforts would be implemented following wildland fire and prescribed fire use for erosion control and revegetation, which would minimize impacts to water resources.

4.2.1.2.12 Impacts of Vegetative Management Actions on Soil and Water Resources

Aside from impacts from mechanical and chemical methods, and wildland fire use described above, other vegetation management actions, common to all alternatives, that would impact soil and water resources include restoration efforts to improve or maintain the vegetative communities. Removal of woody vegetation could result in short-term adverse impacts from soil erosion; however, increased grass cover would be beneficial in the long term. Overall, these management actions—including site-specific seed mixtures, planting of trees and shrubs, and improvement of the surface vegetative community—would benefit soils and water resources by enhancing soil stability against water and wind erosion, and improving the physical function of soils.

4.2.2 Karst Resources

This section addresses the impacts to karst resources from management actions discussed in Chapter 2. Existing conditions concerning karst resources across the planning area are described in Section 3.2.3.

Actions that disturb or degrade karst resources or disrupt the habitat of flora or fauna that utilize caves and other karst features are considered adverse. Actions that avoid or prevent adverse impacts are considered beneficial. Risks to karst resources would result from any activities associated with surface and/or subsurface disturbance, particularly those within critical karst resource zones and zones of high karst potential occurrence. As stated in Section 3.2.3, Cave/Karst Resources, the planning area contains approximately 1 million acres of karst terrain and has documented over a thousand karst features to date. The high probability of encountering karst features makes early detection and prevention of utmost importance in protecting karst resources.

4.2.2.1 Analysis Methods

The analyses of impacts to karst resources under the alternatives are a result of the review of various publications relevant to the karst topography of the planning area, a review of documents associated with current karst resource management across BLM-administered lands, resource monitoring and resource projects and observations conducted by field office staff, and also through coordination with BLM team members.

4.2.2.1.1 Indicators

Section 3.2.3, Cave/Karst Resources, identifies several indicators by which the condition of karst resources may be determined: quality and quantity of associated groundwater, health of associated riparian zones, data on human visitation to recreational caves numbers and health of cave-associated biological communities. Although data associated with each of these potential indicators have been collected and recorded by the BLM and/or other sources, these data are not comprehensive. Therefore, the following quantitative indicator was used for the analysis of management impacts:

- Number of acres impacted by management actions resulting in surface and/or subsurface disturbances across karst landscapes.

4.2.2.1.2 Methods and Assumptions

Management actions associated with the following resources and land uses may result in impacts to karst resources and are discussed in detail below: karst resources, cultural and paleontological resources, wildland fire management, land use authorizations, mineral development, livestock grazing, lands with wilderness characteristics, vegetation, soils and noxious weeds, fish and wildlife, recreation, riparian and other water sources, special designations, visual resources and renewable energy. Actions associated with the following resources do not impact karst because they do not include surface- or subsurface-disturbing activities: air resources, health and safety, land tenure, and special status species.

The assumptions considered for analysis include the following:

- Oil and gas development would increase across karst landscapes over the next 20 years. Given the vast amount of karst topography across the planning area, currently unknown caves and other subsurface voids are very likely to be detected and/or encountered across critical karst resource zones and zones of high and medium karst potential occurrence. As such, the karst potential map boundaries may be adjusted accordingly.
- Newly discovered caves across the planning area would be managed as “significant,” as defined by the Federal Cave Resources Protection Act (FCRPA) of 1988, until further examination is conducted to determine whether significance designation is warranted.
- Visitation to caves not requiring an entry permit would most likely increase over the next 20 years as populations grow and more people are introduced to recreational caving. As a result, adverse impacts to karst resources would potentially increase.
- Speleological research is expected to increase particularly in the microbiological and paleoclimate fields. This is due to recent discoveries and the role that extreme cave environments play in those fields.

4.2.2.2 Direct and Indirect Impacts

Both direct and indirect impacts to karst resources occur primarily as the result of surface- and subsurface-disturbing activities over karst landscapes. Of immediate concern is the potential associated with mineral development for contamination and degradation of groundwater, seeps, springs, and freshwater aquifers, some of which, like the Capitan Aquifer, serve as a major source of drinking water and are recharged through the expedited movement of surface water through karst features (potential impacts to karst resources associated with oil and gas leases and salable and locatable minerals are discussed in greater detail below in the Minerals section 4.3.1).

Surface disturbances associated with other activities such as ROW construction and livestock grazing may also have direct impacts of varying magnitude to karst resources, including alterations in surface drainage routes as a result of soil compaction and excessive sedimentation. This can act as a plug to natural small sinkholes and other drainage features. Other direct impacts may include contamination of the subsurface environment from spills, ruptured or leaking pipes. Indirect impacts to the subsurface environment may also result. These would include potential disruptions of airflow and water flow patterns within caves and other underground voids, as well as disturbances to faunal communities, including rare, cave-adapted species that have very specific temperature and humidity requirements (U.S. Fish and Wildlife Service [USFWS] 2011).

4.2.2.2.1 Impacts of Karst Resource Actions on Karst Resources

Chapter 2 identifies management actions specifically designed to protect karst resources from surface and subsurface disturbances, primarily related to mineral development activities. Preventative measures listed in Chapter 2, including prescriptions addressing early karst feature detection and avoidance, are important for reducing the risk of subsurface impacts, such as migration of pollutants through the karst system and subsequent groundwater contamination, alteration of subsurface drainage patterns, and disruption of cave biological communities. Of particular importance to karst ecosystems are the surface communities surrounding cave entrances. Nutrients are brought into this system either from surface organic material, such as leaf litter, root masses, or through species that obtain their nutrients from the surface but also utilize the cave environment for other food resources, moisture, and shelter. Impacts to surface communities could adversely affect the sensitive balance within the karst ecosystem and indirectly place some species at risk of displacement, including rare, cave-adapted species, some of which are currently undescribed and known only from one locality (Cokendolpher and Polyak 1996; Goodbar 2012).

Karst resources would be at greater risk of adverse impacts, resulting from surface and subsurface disturbances, in areas across the planning area that have a higher frequency of karst development and features present. As discussed in Chapter 3, three categories of karst potential occurrence have been delineated by the CFO across the planning area in order to indicate the likelihood of encountering karst features. These zones of karst potential occurrence are categorized as: high, medium and low. In addition, highly hydrologically important critical karst resource zones have been delineated and occur within zones of high karst potential occurrence. These highly important resource areas assist in the rapid recharge of karst groundwater aquifers from surface runoff and help provide critical drinking water to major communities and springs that support rivers and important riparian habitats. Table 4-12 represents the number of acres within zones of high and medium karst potential occurrence as well as the number of acres designated as critical karst resource zones across the planning area.

Table 4-12. Karst Potential Occurrence and Karst Critical Resource Zones (acres)

Type	Acres	Percent of Planning Area
Critical*	242,231	9
High	628,576	23
Medium	1,006,452	36
Low	1,148,705	41

Note. Karst critical resource zones are all located within zones of high karst potential occurrence.

Impacts from Management Common to All

Management actions common to all alternatives require environmental protection measures for all karst terrain within the planning area. This includes adherence to the BLM's Instructional Memorandum (IM) for guidance in cave closures and decontamination for prevention of the spread of white-nose syndrome and also applicant commitment to management prescriptions outlined in the HB Solution Mining ROD (BLM 2012b). These prescriptions reduce the risk of surface and subsurface disturbances across karst terrain through preventative measures, such as early karst feature detection, and include coordination with the BLM on final layout of all facilities and pipelines within zones of high karst potential occurrence and the requirement that any facilities potentially crossing any major karst features, as defined by BLM staff, will need to be relocated or modified before final construction approval is granted.

Other preventative measures specifically aimed at reducing the risk of adverse impacts to karst resources through early feature detection include compilation of data by BLM staff on already drilled wells to categorize, for example, lost-circulation zones and lowest likely depth at which caves or other karst features may be encountered. In addition, a map depicting high, medium, and low zones of karst potential occurrence, as well as critical karst resource zones integral to groundwater recharge, will serve as a reference for evaluating locations of proposed activities. Required karst field surveys, an essential component of accurate karst feature identification (Stafford 2008), and thorough review of BLM records of karst features in the area of interest will contribute to greater precision in feature detection and, therefore, minimize the potential for surface and subsurface disturbances in areas with karst resources present.

Under all of the alternatives, if a karst feature is detected, avoidance will be considered the primary method for mitigating potential impacts. Avoidance will be accomplished through the relocation or modification of the proposed project.

Karst resources throughout the planning area will continue to be managed under stipulations and COAs required for all mineral exploration, production, and reclamation within BLM-administered lands (see Appendix O for Practices for Oil and Gas Drilling and Operations in Cave and Karst Areas and Appendix C for Fluid Mineral Lease Stipulations). Additionally, the following current cave management plans will continue to be followed; McKittrick Hill Cave Management Plan, Fence Canyon Cave Management Plan, KFFC Cave Management Plan, Yellowjacket Cave Management Plan, Lonesome Ridge Management Plan, Chosa Draw ACEC Management Plan, Dark Canyon ACEC/SMA Management Plan, Manhole Cave Management Plan, Lost Cave Management Plan, and the Boyd's Cave Management Plan.

Impacts from Management Common to All Action Alternatives

All action alternatives require the development of a karst resources management plan for those significant caves that are not covered by other activity or ACEC plans. There are currently more than 500 caves designated as significant across BLM-administered lands within the planning area. Through the development of a broad-based plan covering all caves, scientific, educational, and aesthetic resources that may be unique to these caves would be recognized and considered when compiling management objectives and prescriptions. Additionally, all action alternatives would require a 984-foot buffer around all known karst features. Compared to the No Action Alternative, these buffer zones would qualitatively increase beneficial impacts under all action alternatives because the buffer around all know karst features would increase by 328 feet.

Under Management Common To All Action Alternatives, the risk of potential impacts associated with drilling activities, such as migration of drilling fluids, oil, gas, and brine into cave systems, and contamination and degradation of groundwater and important recharge areas, would be reduced through the requirement of four-string casings of a high-grade steel cemented externally all the way to the surface on all projects within critical karst resource zones and three-string casings in zones of high karst potential occurrence. See Appendix L – Implementation Level Decisions.

Impacts from the No Action Alternative

The 1997 Carlsbad RMP Amendment included a management prescription stating “surface disturbance will not be allowed within up to 656 feet of known cave entrances, passages or aspects of significant caves, or significant karst features” (BLM 1997:API-3). This wording left room for interpretation that was not consistent with the original intent and, therefore resulted in surface disturbances inside the 656-foot buffer around some karst features across the planning area. As a result, the No Action Alternative for this revised RMP will reflect the original intent of the 656-foot surface buffer management prescription, which prohibits all surface-disturbing activities within the entire 656-foot buffer surrounding karst features across the planning area.

Under the No Action Alternative, a 656-foot buffer would be placed around all known karst features, including cave entrances, passages, or aspects of significant caves. All surface-disturbing activities would be prohibited within this buffer, thereby reducing the risk of disturbances to the subsurface karst environment. There are approximately 1,000 documented karst features across the planning area, each of which is subject to the 656-foot surface disturbance buffer under the No Action Alternative.

The 656-foot surface disturbance buffer would also provide beneficial impacts to cave fauna by protecting a portion of the surrounding surface community. As mentioned previously, this is particularly important for cave ecosystems because all nutrient input within these systems is a result of the plants and animals inhabiting the surface.

Under this alternative, in zones of medium karst potential occurrence, the requirement of a third-party karst field survey would be at the discretion of the BLM. Although professional karst surveys are not required, a general site examination is conducted by BLM personnel. Though not a specific karst survey, these field examinations do result in the recording of any karst features encountered. Nonetheless, karst features that are in fact present within the area of interest may go undetected due to the absence of specific karst field surveys, resulting in greater risk to karst resources.

Impacts from Alternatives A and B

Under Alternatives A and B, BLM would work to attain no net loss of BLM lands within high and medium karst occurrence zones due to BLM-authorized activities. To attain no net loss, the BLM would avoid, minimize, rectify, reduce, or eliminate impacts over time, and compensate for remaining unavoidable impacts. Compensatory site mitigation would go to areas such as NSO, ACECs, and sensitive groundwater recharge areas. Compared to the No Action Alternative, which has no similar compensatory site mitigation for high and medium karst occurrence zones, beneficial impacts to karst resources would be greater under Alternatives A and B.

Impacts from Alternative C

Under Alternative C, BLM would work to attain no net loss of BLM lands within high karst occurrence zones due to BLM-authorized activities. To attain no net loss, the BLM would minimize, rectify, reduce, or eliminate impacts over time, and compensate for remaining unavoidable impacts. Compensatory site mitigation would go to areas such as NSO, ACECs, and sensitive groundwater recharge areas.

Compared to the No Action Alternative, which has no similar compensatory site mitigation for high karst occurrence zones, beneficial impacts to karst resources would be greater under Alternative C.

Impacts from Alternative D

Under Alternative D, BLM would work to attain no net loss of BLM lands in karst ACECs due to BLM-authorized activities. To attain no net loss, the BLM would minimize, rectify, reduce, or eliminate impacts over time, and compensate for remaining unavoidable impacts. Compensatory site mitigation would go to areas such as NSO, ACECs, and sensitive groundwater recharge areas. Compared to the No Action Alternative, which has no similar compensatory site mitigation for lands in karst ACECs, beneficial impacts to karst resources would be greater under Alternative D.

4.2.2.2.2 Impacts of Fish and Wildlife Actions on Karst Resources

Fish and wildlife management actions would indirectly benefit karst resources if the presence of species habitat occurs in caves or other karst features and/or is within areas containing karst features, particularly across the zones of critical and high karst potential occurrence. Actions associated with fish and other wildlife that utilize water would provide additional indirect benefits to karst resources through improved water quality management prescriptions.

Impacts from Management Common to All

Karst resources would potentially benefit from any management common to all actions if karst features were present near floodplains, wetlands, and/or river systems that were actively managed for preservation, protection, and restoration purposes, as required by Executive Orders (EOs) 11988 and 11990 and BLM policy.

Stipulations contained in Appendix C provide for a 1,312-foot surface disturbance buffer around all caves with active bat roosts. For those caves, this would contribute to a greater protection of the surface community and, subsequently, the subsurface environment compared to the standard cave-karst buffers.

In addition, those karst features that fall within Phantom Banks Heronries and other areas managed specifically for habitat improvement projects would benefit from minimized surface disturbance and subsequent impacts to the subsurface environment. Karst features may also receive some benefits from a 1,312-foot buffer prohibiting surface-disturbing activity if located near trees with active raptors nests.

Impacts from Management Common to All Action Alternatives

There are no proposed fish and wildlife decisions under Management Common to All Action Alternatives that would impact karst resources because none of the actions address surface-disturbing activities with the exception of seasonal surface-disturbing restrictions around active heronries.

4.2.2.2.3 Impacts of Lands with Wilderness Characteristics Actions on Karst Resources

Those karst resources located within lands managed to protect wilderness characteristics would receive beneficial impacts as a result of additional management prescriptions aimed at further minimizing surface disturbances. The greater the number of acres managed to protect lands with wilderness characteristics, the greater the benefit to karst resources, particularly in those lands with wilderness characteristics that occur across zones of high and medium karst potential occurrence. Those sections designated as critical karst resource zones contain hydrologically important karst features and occur within zones of high karst potential occurrence.

When lands with wilderness characteristic units are managed to emphasize multiple uses while applying some protective management (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics, there would be some long-term benefits to karst resources, but it would depend on the prescriptions for the individual units. See Section 4.2.9 Lands with Wilderness Characteristics for details. For this reason, the greater the number of acres managed to protect wilderness characteristics, the greater the protections afforded to karst resources. Where lands with wilderness characteristics units are managed to emphasize other multiple uses as a priority over protecting wilderness characteristics, ground-disturbing activities such as minerals development may still be allowed and would offer less protection to karst resources.

The acreages of zones with high and medium karst potential occurrence and also critical karst resource zones within proposed lands with wilderness characteristics vary by each alternative and are represented in Table 4-13.

Table 4-13. Number of Acres of High and Medium Karst Potential Occurrence and Acres of Critical Resource Zones within Lands Managed to Protect Wilderness Characteristics under Each Alternative

Karst Potential Occurrence	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
High	*N/A	13,391	13,300	5,119	1,221
Medium	*N/A	53,169	34,206	0	0
Critical karst resource zones	*N/A	3,134	3,043	5,119	1,221

*There would be no units managed as lands with wilderness characteristics under the No Action Alternative.

Impacts from Management Common to All

There are no decisions listed under management common to all.

Impacts from Management Common to All Action Alternatives

Beneficial impacts to karst resources from Management Common to All Action Alternatives would include a reduction in erosion and compaction, and less likely occurrence of contamination and alterations to surface drainage basins and water infiltration routes. Karst resources occurring on lands managed to protect wilderness characteristics would receive indirect positive impacts as a result of applicable management prescriptions, including closure to leasing or NSO stipulations; restrictions on the construction of new roads, structures, and facilities not related to the preservation and enhancement of wilderness characteristics; and vehicular use limited to designated routes only. All management prescriptions would beneficially impact karst resources.

Impacts from the No Action Alternative

Under the No Action Alternative, karst resources would not receive any beneficial impacts, because no lands would be managed as lands with wilderness characteristics and, therefore, no karst resources would benefit from management prescriptions, as described above, specific to designated lands with wilderness characteristics.

Impacts from Alternative A

Under this alternative, 13,391 acres in the high karst potential occurrence zone would be protected under lands with wilderness characteristics management prescriptions. A total of 3,134 of these acres is designated as a critical karst resource zone. Additionally, 53,169 acres in medium karst potential occurrence zone would be protected. A total of 66,666 acres would benefit from management prescriptions described above compared to the 0 acres classified under lands with wilderness characteristics proposed in the No Action Alternative.

Impacts from Alternative B

Under Alternative B, a total of 13,300 acres in high karst potential occurrence zone would be protected under lands with wilderness characteristics management prescriptions. A total of 3,043 of these acres is designated as a critical karst resource zone. An additional 34,206 acres in medium karst potential occurrence would be protected. Approximately 47,611 acres would benefit from management prescriptions described above compared to the 0 acres classified under lands with wilderness characteristics proposed in the No Action Alternative. An additional 18,964 acres would be managed to emphasize other multiple uses while applying some protective management.

Impacts from Alternative C

Under Alternative C, 5,119 acres in the high karst potential occurrence zone, all of which fall within critical karst resource zones, would be protected under lands with wilderness characteristics management prescriptions. Zero acres in medium karst potential occurrence would be protected. Approximately 5,119 acres would benefit from management prescriptions described above compared to the 0 acres classified under lands with wilderness characteristics proposed in the No Action Alternative. Approximately 30,595 acres would be managed to emphasize other multiple uses while applying some protective management, and 30,862 acres would be managed to emphasize other multiple uses. Alternative C would offer more protections to karst resources as compared to the No Action Alternative but less than Alternatives A and B.

Impacts from Alternative D

Alternative D would manage 1,221 acres to protect wilderness characteristics, the least number of acres for lands with wilderness characteristics designation within critical, high, and medium karst potential occurrence zones and, therefore, would be the least beneficial to karst resources after the No Action Alternative. Zero acres would be managed to emphasize other multiple uses while applying some protective management, and 65,446 acres would be managed to emphasize other multiple uses. Alternative D would offer the least amount of protections to karst resources as compared to the No Action Alternative.

4.2.2.2.4 Impacts of Paleontological and Cultural Resources Actions on Karst Resources

Beneficial indirect impacts to karst resources would occur if the presence of paleontological or cultural resources occurred within caves or other areas containing karst features that lead to restrictions on surface disturbance. Most of the caves containing paleontological resources across the planning area are gated, which greatly negates the potential for adverse impacts to cave resources as a result of illegal entry.

Boyd's Cave, an important cultural resource considered sacred to the Mescalero Tribe and tribal members, is designated under the Cave Resources ACEC and is further discussed in the Special Designations section below (Section 4.4).

Impacts from Management Common to All

There are no management common to all decisions for paleontological or cultural resources.

Impacts from Management Common to All Action Alternatives

Karst features that fall within the boundaries of archeological districts would benefit from restrictions on the use of surface-disturbing equipment, such as bulldozers and road graders, within these areas. The prohibition of this machinery would reduce the risk of impact to the subsurface environment and minimize disturbances to the surrounding surface community, an integral component in the health of karst ecosystems.

Impacts from the No Action and Action Alternatives

There are no impacts to karst resources from paleontological and cultural proposed decisions listed in all the alternatives.

4.2.2.2.5 Impacts of Vegetative Communities Actions on Karst Resources

Vegetative management actions would indirectly benefit karst resources through the restoration and enhancement of the surface vegetative community around karst features, particularly across zones of critical and high karst potential. A healthy surface vegetative community would beneficially impact karst resources by providing a surface buffer against potential disturbances in temperature and humidity regimes within the cave environment, as well as providing resources for species that use both the cave and the surface for food and shelter. This would have an indirect beneficial impact on all cave fauna, including rare, cave-adapted species.

Impacts from Management Common to All

Under management common to all alternatives, karst resources would benefit indirectly through the general management objectives to improve vegetative composition, cover, and production in areas that currently do not meet vegetation condition objectives, as defined by the BLM Roswell Field Office and adopted by the CFO.

Impacts from Management Common to All Action Alternatives

There would be no impact to karst resources from the Management Common to All Action Alternatives proposed decisions.

Impacts from the No Action and Action Alternatives

There are no impacts to karst resources from proposed vegetative management decisions listed in all of the alternatives.

4.2.2.2.6 Impacts of Noxious Weeds and Invasive Species Actions on Karst Resources

Management prescriptions for the treatment of non-native and invasive species provide beneficial impacts to the surface communities around karst features. Indirect benefits would occur for cave biota, particularly those species that utilize both the surface and cave environment, through an enhanced and healthy surface plant community.

Impacts from Management Common to All

Those karst features located in areas across the planning area that are also under management prescriptions outlined in the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (BLM 2007b) would receive long-term, indirect benefits through a healthy, more diverse surface plant community absent of non-native, invasive species that can potentially out-compete and displace native plant species.

Impacts from Management Common to All Action Alternatives

All action alternatives contain management decisions that would positively benefit karst resources by requiring a 984-foot buffer around all cave/karst resources that would prohibit the application of herbicides. This would provide an indirect beneficial impact to cave/karst resources through protection of the surface vegetative community which may act as a buffer against drastic alterations in temperature and humidity regimes within the cave environment and also provide nutrients to species that use the cave for shelter and food. Additionally, the 984-foot buffer would reduce the potential for herbicide contamination within the subsurface ecosystem.

BMPs aimed at controlling noxious weeds and other non-native species would provide indirect benefits to karst resources through habitat restoration activities and invasive vegetation monitoring. Species within the cave ecosystem would indirectly benefit from these management actions through the maintenance of healthy surface communities and overall improved rangeland health.

Impacts from the No Action Alternative

Under the No Action Alternative, cave entrances would not necessarily be protected from herbicide application, which would adversely affect plant cover and composition directly around the caves and other karst resources. This would potentially affect the cave ecosystem by altering nutrient inputs that enter the cave through the surface.

Impacts from the Action Alternatives

There are no impacts to karst resources from noxious weeds and invasive species decisions listed in these alternatives.

4.2.2.2.7 Impacts of Soil Resources Actions on Karst Resources

Karst resources would benefit from soil management objectives across the planning area that maintain or enhance stability and physical function of soils, particularly in karst-dense gypsum soils. In addition, the surface communities surrounding karst features would benefit through special reclamation procedures of disturbed sites, including special site-specific seed mixtures, the planting of trees and shrubs, erosion control, and land treatments. Karst resources would benefit indirectly from the enhanced surface community, particularly those found in areas with special soil management prescriptions across zones of critical and high karst potential occurrence.

Impacts from Management Common to All

Management common to all decisions would beneficially impact karst resources, as all include BMPs designed specifically to prevent soil erosion and runoff. Some of these would include special site-specific seed mixtures, the removal of caliche and other surface materials, soil amendments, soil treatments, and the planting of trees and shrubs. Runoff from disturbed and destabilized soils would potentially alter surface water infiltration routes into karst features. This would indirectly impact water sources that are important to karst formation. In addition, cave fauna would be potentially affected through disruptions in moisture and humidity requirements.

Impacts from Management Common to All Action Alternatives

There are no proposed decisions for soils under Management Common to All Action Alternatives.

Impacts from the No Action Alternative

Under the No Action Alternative, karst resources would potentially receive adverse impacts as a result of management stipulations that do not place explicit limits on the percentage or acreage on allowable surface disturbance on an oil and gas lease.

In addition, projects may be modified, moved, or mitigated for soil erosion if located on unsuitable areas, defined under this alternative as areas with slopes with grades of 30% or greater.

Impacts from Alternative A

Under Alternative A, future development of ROWs for pipelines, roads, and power lines would be avoided on gypsum soils. This would reduce the risk of both surface and subsurface impacts to karst resources within the karst-dense and hydrologically important gypsum soils.

Additionally, surface disturbance stipulations would be in effect within the entire Southern Gypsum Soil Area (SGSA). Under this alternative, those karst features located within the SGSA would benefit from additional surface protection, as surface disturbances associated with oil and gas leases would not be permitted to exceed 3% of the entire lease acreage or a maximum of 7 acres (whichever is greater). This is of particular importance on these karst-dense and hydrologically important gypsum soils, as they are highly susceptible to erosion and have many exposed karst features that serve as recharge for groundwater.

As in the No Action Alternative, surface disturbances are minimized; however, under Alternative A the magnitude of beneficial impacts is greater because it sets specific requirements for the amount of allowable surface disturbance and prohibits surface occupancy in any areas with slopes at 10% or greater, as opposed to the No Action Alternative, which does not prohibit any surface occupancy. The magnitude of beneficial impacts to karst resources is greatest under this alternative.

Impacts from Alternative B

Under Alternative B, surface disturbances would be limited by stipulations only within specific soil mapping units of the SGSA. As in the No Action Alternative, surface disturbances are minimized; however, under Alternative B the magnitude of beneficial impacts is greater because it sets specific requirements for the amount of allowable surface disturbance within specific soil units and prohibits surface occupancy in any areas with slopes with grades 20% or greater, as opposed to the No Action Alternative which does not prohibit any surface occupancy.

Impacts from Alternative C

Alternative C does not set a percentage or acreage limit on allowable surface disturbance within oil and gas leases, although it does require the use of directional drilling and restrict all new well infrastructure to existing disturbed corridors when applicable. As with Alternative B, Alternative C proposes NSO stipulations in areas with slopes with grades greater than 20%, with the additional requirement of an engineered plan for areas with slopes with grades greater than 10%.

These proposed decisions would provide greater beneficial impacts to karst resources compared to the No Action Alternative, but the magnitude of beneficial impacts would be less here than under Alternatives A and B.

Impacts from Alternative D

Compared to all the other alternatives, Alternative D would have the greatest potential adverse impact to karst resources, with no cap on allowable surface disturbance, no requirements to utilize directional drilling, and a management prescription that would provide the least amount of protection against erosion (avoidance of slopes with grades greater than 30%).

4.2.2.2.8 Impacts of Wildland Fire and Fuels Management Actions on Karst Resources

The surface community provides an important source of nutrients to the cave ecosystem through the input of organic materials washed into the cave and by species that may feed on the surface but also spend a substantial amount of time in the cave for other food sources and shelter (e.g., trogloxenes). As a result, wildland fire and fuels management actions could potentially result in short-term, adverse impacts to karst resources due to initial removal of surface vegetation. These adverse effects would be most prominent in areas of high karst potential designated for saltcedar (*Tamarix* sp.) eradication and/or under prescribed burn management plans. However, these shot-term adverse impacts could ultimately be replaced by long-term beneficial impacts after the surface vegetation regenerates by potentially increasing the nutrient input from the surface community into the cave ecosystem for utilization by trogloxenes and other cave inhabitants.

Impacts from Management Common to All

Management common to all decisions would provide long-term, indirect benefits to karst resources through restoration and enhancement of native plant communities. This would contribute to the overall health of the karst ecosystem through an enhanced vegetative and animal surface community.

Impacts from Management Common to All Action Alternatives

Those karst resources located in saltcedar and other invasive species treatment areas would indirectly benefit from prescribed fire management and fuel loading reduction.

Impacts from the No Action and Action Alternatives

There are no impacts to karst resources from wildland fires and fuels management decisions listed in these alternatives.

4.2.2.2.9 Impacts of Livestock Grazing Actions on Karst Resources

Livestock grazing proposed decisions would potentially impact karst resources if features are located within areas open to grazing, particularly across zones of high and medium karst potential occurrence.

One potential indirect impact would be from fecal contamination of surface water runoff and, consequently, wells, aquifers, and springs (Pasquarell and Boyer 1995), some of which are important municipal and agricultural water sources. Karst resources within the gypsum karst terrain would be particularly affected due to specific soils characteristics that make these areas more susceptible to contamination from surface sources. In areas where cattle congregate, grazing would contribute to excessive soil compaction and degradation of surface vegetative community. This would potentially impact karst resources in close proximity through alterations in surface to subsurface drainage patterns and also in surface plant and animal communities, both of which influence important biotic and abiotic processes within caves and other karst features.

Those areas open to grazing within zones of high and medium karst potential occurrence would have a greater risk of adverse impacts than those areas across low karst potential occurrence zones. Table 4-14 below shows the number of acres open to livestock grazing on BLM-administered lands across areas of high and medium karst potential occurrence by each alternative. Critical karst resource zones, which occur within sections of high karst potential occurrence, are also represented in the table. These resource areas contain hydrologically important karst features that provide rapid recharge of karst groundwater aquifers from surface runoff and serve an integral function in providing critical drinking water supplies to major communities, ranching operations, and springs that support rivers and important riparian habitats.

Table 4-14. Livestock Grazing Management Decisions-Number of Acres Open across Areas of High and Medium Karst Potential Occurrence by Alternative

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Acres open across high karst potential occurrence	573,955	464,401	469,457	572,174	574,929
Acres open across medium karst potential occurrence	781,620	428,926	744,700	781,996	783,755
Acres open across critical karst resource zones	209,431	156,177	163,511	209,623	210,846

Impacts from Management Common to All Alternatives

Under impacts from management common to all action alternatives, potential adverse impacts to karst resources associated with grazing would include decreased surface vegetation, which could result in soil destabilization and increased erosion, as well as increased potential for fecal contamination of karst aquifer.

Impacts from Management Common to All Action Alternatives

There are no proposed decisions listed under Management Common to All Action Alternatives for grazing.

Impacts from the No Action Alternative

Under the No Action Alternative, 1,355,575 acres would be open to grazing across areas of high and medium karst potential occurrence. Approximately 209,431 of these acres occur within critical karst resource zones. Almost the entire acreages of zones of high and medium karst potential occurrence, as well as the majority of designated critical resource zones would be open to livestock grazing under this alternative (see Table 4-14).

Impacts from Alternative A

Under Alternative A, 893,327 acres within areas of high and medium karst potential occurrence would be open to livestock grazing. A total of 156,177 of these acres occur within critical karst resource zones; a difference of 54,209 acres compared to the No Action Alternative. The risk of adverse impacts to karst resources would be smaller under this alternative compared to the No Action Alternative.

Impacts from Alternative B

Under Alternative B, approximately 1,214,157 acres within areas of high and medium karst potential occurrence would be open to livestock grazing. A total of 163,511 of these acres occur within critical karst resource zones. With less acres open to livestock grazing within zones of high and medium karst potential occurrence and less acres open within critical karst resource zones, the risk of adverse impacts to karst resources would be smaller under this alternative compared to the No Action Alternative.

Impacts from Alternative C

Under Alternative C, 1,354,170 acres within zones of high and medium karst potential occurrence would be open to livestock grazing. Approximately 209,623 of these acres occur within critical karst resource zones. Almost the entire acreages of areas of high and medium karst potential occurrence, as well as the majority of designated critical resource zones would be open to livestock grazing under this alternative (see Table 4-14). Risk of adverse impacts would be slightly less under this alternative compared to the No Action Alternative.

Impacts from Alternative D

Under Alternative D, 1,358,684 acres within areas of high and medium karst potential occurrence would be open to livestock grazing. Approximately 210,846 of these acres occur within critical karst resource area. Almost the entire acreages of areas of high and medium karst potential occurrence, as well as the majority of designated critical karst resource zones would be open to livestock grazing under this alternative (see Table 4-14). Risk of adverse impacts would be comparable compared to the No Action Alternative.

4.2.2.2.10 Impacts of Recreation Actions on Karst Resources

Recreational management decisions would potentially have both beneficial and adverse impacts to karst resources. As discussed in Section 3.2.3, Cave/Karst Resources, increased visitation to caves has resulted in impacts to karst resources. The impacts associated with increased visitation to caves would include trampling and degradation of unique and/or fragile speleothems and damage to cave ecosystems. A greater influx of nutrients in the form of food items and trash left by visitors in the cave could potentially result in an imbalance among faunal trophic relationships by attracting a greater number of surface predators into the cave environment (Krejca and Myers 2005). This could indirectly reduce species diversity within the cave. Microbial communities would also be adversely impacted through excessive cave visitation. The closure of some areas to recreational activities that also include karst features would minimize potential damage to karst resources.

Impacts from Management Common to All Alternatives

Impacts to karst resources from the proposed decisions, listed under the management common to all alternatives, would potentially include: decreased erosion associated with the confinement of OHV use to established roads and trails, increased native vegetation associated with restoration efforts on SMRA's, and other special management areas, while adverse impacts would include increased erosion along designated trails within high or medium karst potential occurrence areas associated with increased use.

Impacts from Management Common to All Action Alternatives

Under the Management Common to All Action Alternatives, the Pecos River Equestrian ERMA, the La Cueva Trails SRMA, and the Black River SRMA would be designated. All of these occur across mostly karst-dense landscapes, particularly the Black River SRMA, which is located within critical karst resource zones. Potential direct and indirect adverse impacts to karst resources could occur as a result of increased recreational activities within these areas, as described above.

In addition, the Cave Resources SRMA designation would be converted to an ACEC designation. ACEC designations highlight areas where special management attention is needed to protect, and prevent irreparable damage to important and relevant values, such as historical, cultural, and scenic values, fish, or wildlife resources or other natural systems or processes (BLM 1988). As is the case with SRMAs, recreation is not the primary focus under ACEC designation. Please see the Special Designations section 4.4 for more detail on the Cave Resources ACEC.

Impacts from the No Action Alternative

Under the No Action Alternative, the Cave Resources SRMA, covering 8,626 acres, would remain designated as would the Pecos River Corridor (5,627 acres) and Hackberry Lake (53,560 acres) SRMAs. Karst resources located within the nine units of the Cave Resources SRMA would receive some beneficial impacts through surface protection from mineral development and other land uses, while continuing to serve an important educational and recreational role for the public. There would also be beneficial impacts from the no surface occupancy restriction of the Pecos River Corridor SRMA (5,627 acres) to leasable mineral development and the closure to solid mineral leasing and mineral material disposal.

Impacts from the Action Alternatives

There would be no impact to karst resources as a result of proposed recreational decisions listed specifically under Alternatives A through D. Currently, there are approximately 20 gated caves that are frequented by visitors and require permits issued through the CFO for entry. All other ungated caves across the planning area are open to the public; therefore, illegal entry is not a significant issue. Visitation to ungated caves, irrespective of whether particular proposed SRMAs or ERMAs are designated, is not expected to increase.

4.2.2.2.11 Impacts of Travel Management Actions on Karst Resources

Adverse impacts from travel management to karst resources would be minimized if areas designated as closed or limited to OHV use contained caves and other karst features in which entry was not permitted. Potential indirect adverse impacts would include alteration of surface water infiltration and drainage around karst features as a result of soil compaction and erosion and damage to surface vegetative community around cave entrances that would negatively affect cave species.

As stated in Section 3.3.4, Travel and Transportation Management, open areas are those parts of the planning area where vehicle travel is permitted both on and off roads if the vehicle is operated responsibly in a manner unlikely to cause significant undue damage to the environment. Closed areas do not allow any OHV use, except in conjunction with BLM activities. Limited areas allow OHV use, but restrict that use to existing designated roads or ways.

Travel management decisions would have beneficial impacts to karst resources where travel is restricted to existing roads and trails or closed to all motorized travel. Table 4-15 summarizes those portions of the planning area designated as medium and high karst occurrence potential that are OHV limited and closed.

Table 4-15. High and Medium Karst Potential Occurrence (acres) and Travel on BLM-administered Lands by Alternative

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
High, OHV limited	567,738	567,600	567,600	568,495	568,495
High, travel-closed	9,092	9,233	9,233	8,338	8,338
Medium, OHV limited	783,439	783,772	783,772	783,769	783,769
Medium, travel-closed	545	217	217	217	217
Total	***1,360,814***	***1,360,822***	***1,360,822***	***1,360,819***	***1,360,819***

Impacts from Management Common to All

There would be no significant impact to karst resources from proposed decisions listed under management common to all alternatives because they do not address surface or subsurface damage. Additionally, all alternatives propose a comparable acreage of high and medium karst potential that is designated as closed or OHV limited.

To note, the construction, maintenance, rehabilitation, abandonment, and closure of all roads subject to BLM jurisdiction would be conducted according to the BLM's Road Policy, Standards and Procedures (BLM 1997, Road). Additional policy and guidance for construction, maintenance, rehabilitation, abandonment, and closure of roads can be found in BLM Manual 9113-1 (BLM 2011a), BLM Manual 9113-2 Roads Design Handbook (BLM 2011b), BLM Manual 9115 Roads National Inventory and Condition Assessment and Guidance & Instructions Handbook (BLM 2012b), and Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – the Gold Book (BLM 2007b).

Impacts from Management Common to All Action Alternatives

There would be no significant impact to karst resources from proposed decisions listed under Management Common to All Action Alternatives because they do not address surface or subsurface damage.

4.2.2.2.12 Impacts of Land Use Authorization Actions on Cave / Karst Resources

Impacts to karst resources from development activities, such as ROWs for roads, pipelines, power lines, easements, and utility/transportation systems, would potentially increase if placed in zones of high karst potential occurrence. Indirect impacts would include excessive sedimentation and erosion, degradation of water quality, and alteration of water drainage and infiltration routes as a result of surface-disturbing activities. Direct impacts to the surface plant and animal communities through the removal of vegetation and cover would indirectly impact the cave ecosystem, as the surface community is the primary source of nutrients to the cave system.

Impacts from Management Common to All Alternatives

Management common to all decisions, such as the requirement of site-specific analysis for ROW approval, the placement of facilities on existing structures when possible, and conditions of ROW grants contingent upon the sensitivity of affected resources, would provide a direct beneficial impact to karst resources through additional protection from surface-disturbing activities associated with ROW development. Under this alternative, those karst resources within the Cave Resources SRMA would still receive some beneficial impacts from the continued designation of 8,626 acres as ROW avoidance or exclusion areas.

Additionally, under all of the alternatives, approximately 19,596 acres in areas of high karst potential occurrence and 30,517 acres in medium karst potential occurrence would be dedicated to the development of ROW corridors. Adverse impacts to karst resources, as those described above, would be expected to occur within these areas with high and medium karst occurrence potential.

Impacts from Management Common to All Action Alternatives

There are no decisions listed under Management Common to All Action Alternatives. All cave/karst features, however, would continue to receive beneficial impacts from ROW avoidance or exclusion because there will be a 984-foot buffer around them under all the action alternatives.

Impacts from the No Action Alternative

Under this alternative, terms and conditions of ROW grants would depend on the sensitivity of the affected resources and existing laws and regulations already established to protect them.

Impacts from Alternative A

Under Alternative A, all future ROWs for pipelines, roads, sites and power line development would avoid gypsum soils within the planning areas. This would reduce the risk of both surface and subsurface impacts to karst resources within the karst-dense and hydrologically important gypsum soils.

This alternative proposes the requirement of third-party compliance monitoring on all new ROW construction and reclamation activities throughout the planning area. Compared to the No Action Alternative, which does not require compliance monitoring, the potential risk of adverse impacts as a result of negligence and non-compliance with ROW development stipulations would be reduced.

Stipulations under Alternative A would reduce potential risks resulting from leakage, spills, and subsequent contamination by requiring leak detection and automatic shut-off systems on all hydrocarbon and salt water pipelines/storage facilities located across both critical resource zones and zones of high karst potential occurrence. The No Action Alternative does not propose any similar stipulations and, therefore, poses greater risks of leakage, spills, and contamination to the subsurface karst environment in comparison with Alternative A.

Impacts from Alternative B

Under Alternative B, gypsum soils within the planning areas would be avoided for all future ROWs for pipelines, roads, sites, and power line development.

This alternative proposes the requirement of third-party compliance monitoring on all new ROW construction and reclamation activities throughout zones of high karst potential occurrence. Compared to the No Action Alternative, which does not require compliance monitoring, the potential risk of adverse impacts as a result of negligence and non-compliance with ROW development stipulations would be reduced.

Stipulations under Alternative B would reduce potential risks resulting from leakage, spills, and subsequent contamination by requiring leak detection and automatic shut-off systems on all hydrocarbon and salt water pipelines/storage facilities located across both critical resource zones and zones of high karst potential occurrence. The No Action Alternative does not propose any similar stipulations and, therefore, poses greater risks of leakage, spills, and contamination to the subsurface karst environment in comparison with Alternative B.

Impacts from Alternative C

Under Alternative C, gypsum soils within the planning areas would be avoided for all future ROWs for pipelines, roads, sites and power line development.

Under this alternative, third-party compliance monitoring would be required only in situations where operators have a documented history of non-compliance. Qualitatively, the impact as described under Alternative A would be the same; however, the potential for adverse impacts is greater due to reduced monitoring of ROW development activities.

Stipulations under Alternative C would reduce potential risks from leakage, spills, and subsequent contamination by requiring leak detection and automatic shut-off systems on all hydrocarbon and salt water pipelines/storage facilities located across both critical resource zones and zones of high karst potential occurrence. The No Action Alternative does not propose any similar stipulations and, therefore, poses greater risks of leakage, spills, and contamination to the subsurface karst environment in comparison with Alternative C.

Impacts from Alternative D

The potential for adverse impacts would be greatest under Alternative D, which would not require compliance monitoring in relation to ROW construction and reclamation activities across the planning area.

Under Alternative D, leak detection and shut-off systems would not be required, thereby increasing the chances of greater contamination if leaks or spills should occur. Under this alternative, the magnitude of impacts would be the same as those under the No Action Alternative, which also does not require leak detection or shut-off systems.

4.2.2.2.13 Impacts of Water/Riparian Actions on Karst Resources

The integral relationship between karst landscapes and water increases the potential for adverse or beneficial impacts of any water-related management action under all the alternatives. Caves, sinkholes, fissures, and other karst features serve as natural conduits; water travels through these features without much filtration and quickly reaches aquifers, wells, springs, and other water sources, some of which provide water to critical riparian areas and also serve as water sources for municipal, agricultural, and industrial uses. The health of a riparian system may also give valuable information on the health of the associated karst features. All management actions that protect and minimize impacts to riparian areas, surface water, and groundwater will also provide indirect benefits to karst resources.

Protecting these areas interconnected to karst features through surface disturbance buffers reduces the risk of contaminants reaching the karst system, thereby minimizing risks to karst resources, including cave faunal and microbial communities.

Impacts from Management Common to All

Management common to all would provide beneficial impacts to karst resources through intensive management to assure water and vegetative quality. Karst resources associated with additional seeps, springs, or other water sources identified on public lands would receive indirect beneficial impacts through their incorporation into riparian habitat management plans (HMPs) and also through no surface disturbance stipulations in riparian areas (unless for riparian enhancement projects).

Also, of particular benefit would be the prohibition of saltwater injection wells above the Capitan Formation and the requirement of four-strand casings within formations hydrologically connected to the Capitan Reef Aquifer. These measures would reduce the risk of contamination into the karst environment and also reduce the risk of groundwater contamination. This is particularly important along the Capitan Formation, which contains numerous karst recharge features.

Annual biological surveys required for the assessment of riparian health would also beneficially impact karst resources by providing data on the health of associated karst features.

Impacts from Management Common to All Action Alternatives

Karst resources located within playas would benefit from additional minimization of surface disturbance, as occupation and surface disturbance would not be allowed within 984 feet of a highly productive or moderately productive playa.

Stipulations on seeps and springs management would be carried forward and would indirectly benefit karst resources through additional protections, including NSO stipulations on future oil and gas leases, avoidance of future ROW actions through riparian habitat areas, withdrawal from mining claim location and closure to mineral material disposal and mineral leasing, restrictions on surface-disturbing activities such as plant collecting and camping, and designation as closed to OHV use.

A 984-foot surface disturbance buffer would be placed around all springs, seeps, and downstream riparian areas. Beneficial impacts would be the same as described under the No Action Alternative.

Impacts from the No Action Alternative

Under the No Action Alternative, stipulations on seeps and springs management would be carried forward and would indirectly benefit karst resources through additional protections, including NSO stipulations on future oil and gas leases, avoidance of future ROW actions through riparian habitat areas, withdrawal from mining claim location and closure to mineral material disposal and mineral leasing, restrictions on surface-disturbing activities such plant collecting and camping, and designation as closed to OHV use.

In addition, this alternative retains the 656-foot surface disturbance buffer around all springs, seeps, and downstream riparian areas.

Impacts from Alternatives A and B

Under Alternative A, a 984-foot surface disturbance buffer would be placed around spring headwaters, seeps, and downstream riparian areas. Qualitatively, beneficial impacts would be the same as described under the No Action Alternative and the magnitude of benefits to karst resources would be similar.

Impacts from Alternative C

Under Alternative C, a 984-foot surface disturbance buffer would be placed around all springs, seeps, and downstream riparian areas and motorized and mechanized travel would only be allowed for BLM administrative use. Beneficial impacts would be slightly greater than under the No Action Alternative.

Impacts from Alternative D

Under Alternative D, a 984-foot surface disturbance would be placed around all springs, seeps, and downstream riparian areas. Beneficial impacts would be the same as described under the No Action Alternative.

4.2.2.2.14 Impacts of Renewable Energy on Karst Resources

Impacts from Management Common to All

All management common to all decisions would potentially provide some beneficial impacts to karst features that also occur on LPC and/or dunes sagebrush lizard (*Sceloporus arenicolus*; DSL) habitat, as all applications to permit either solar or wind energy sites across the planning area would require the demonstration that proposed projects would not adversely impact these species' habitats.

Adoption of programmatic policies and BMPs in both the Solar Energy Development Programmatic EIS ROD (BLM 2012a) and the Wind Energy Development Programmatic EIS ROD (BLM 2005) would also potentially minimize adverse impacts to karst resources across the planning area.

Impacts from Management Common to All Action Alternatives

Impacts from Management Decisions Common to All Action Alternatives would include the exclusion of wind and solar, and closure to geothermal development in areas that are within known karst areas. In addition, all action alternatives encourage the placement of wind development projects in areas where transmission corridors are already located and where transmission systems are already in place.

As a result, adverse impacts to karst resources, including surface disturbance near karst features as a result of new access roads and construction, would be greatly minimized.

Impacts from the No Action Alternative

Under the No Action Alternative, the BLM would close and exclude 1,819,929 acres from geothermal and solar development projects and 7,056 acres from wind development projects. Restrictions on the location of solar or wind energy sites would continue to be implemented on specific sites across the planning area, with the majority of the planning area excluded for solar development, as identified by the Solar Energy Development Programmatic EIS ROD (BLM 2012a). Those sites restricted from wind development projects include WSAs, WSRs, VRM Class I and II areas, and areas with known karst occurrences (for complete list of restrictions, see Chapter 2, Alternatives Matrix). Wind energy development would be restricted in designated SMAs to protect sensitive soils. In addition, applications to permit either solar or wind energy sites on public land within the planning area would be considered only if the applicant can demonstrate no negative impacts on avian and bat species. All of these management prescriptions would benefit karst resources by minimizing surface disturbance and its associated adverse impacts.

Impacts from the Action Alternatives

There are no renewable energy decisions specific to any of the action alternatives that would significantly impact karst resources.

4.2.2.2.15 Impacts of Minerals Development Actions on Karst Resources

There are many aspects of mineral development that would adversely impact karst resources. Adverse impacts from contamination are a primary concern, as drilling fluids, produced saltwater, oil and/or gas, cuttings, and cement could quickly enter groundwater, and subsequently aquifers, springs, and other resurgences through karst features that serve as natural conduits to these water sources.

Cementing operations may plug or alter groundwater flow, potentially reducing the water quantity at springs and water wells. Production facilities such as transfer stations and pipelines may fail and allow contaminants to enter caves and freshwater systems. Downhole casing and cementing failures can allow migration of fluids and/or gas between formations and aquifers. Contamination would also indirectly result in adverse impacts to cave fauna, including rare, cave-adapted species.

Blasting, heavy vibrations, an increase in impermeable cover due to pipeline, road and utilities construction, could adversely impact karst resources through alterations in the surface and/or subsurface drainage systems. Excessive siltation and sedimentation can affect surface water infiltration and plug downstream sinkholes, and other karst features, resulting in adverse impacts to groundwater quality and to the cave ecosystem. Indirect impacts would include potential disruptions in recharge processes and moisture regimes within the karst system. As a result, subsidence or sudden surface collapse could potentially occur. Cave fauna would also be indirectly impacted through displacement or extermination. Activities associated with mineral development could also contribute to changes in airflow patterns within the karst environment and alterations in the surface communities (vegetative and animal) surrounding karst features. This could indirectly impact the cave ecosystem, as well as speleothem formations within the caves.

Risks to karst resources would be reduced by a management emphasis on detection, avoidance, and mitigation. Stipulations and COAs specific to oil and gas development across karst landscapes would help to further minimize impacts associated with mineral exploration, production, and reclamation (see Chapter 2).

Mineral development across high and medium karst potential occurrence zones would pose the greatest threat to karst resources, as karst feature densities are higher within these karst landscapes. Areas designated as critical karst resource zones, which contain important recharge features, would also be potentially impacted from surface- and subsurface-disturbing activities associated with mineral development.

Table 4-16. Number of Predicted Wells and Total Predicted Surface Disturbance within Areas of High and Medium Karst Potential Occurrence on BLM Surface Lands by Alternative

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Number of predicted wells on **high* karst potential occurrence acreage within BLM-administered lands only** (based on % of land open to surface disturbance)	1,351	1,027	814	1,341	1,390
Number of predicted wells on **medium karst potential occurrence acreage within BLM-administered lands only** (based on % of land open to surface disturbance)	2,115	1,607	1,274	2,100	2,176
Total # of Predicted Wells	***3,466***	***2,634***	***2,087***	***3,441***	***3,566***
Total predicted surface disturbance/acres on **high karst[1] potential acreage within BLM-administered lands only**	2,648	2,013	1,595	2,630	2,725
Total predicted surface disturbance/acres on **medium karst potential acreage within BLM-administered lands only**	4,145	3,151	2,497	4,116	4,266
Total Predicted Surface Disturbance Acreage	**6,794**	**5,164**	**4,092**	**6,746**	**6,991**

*Karst critical resource zones are all located within zones of high karst potential occurrence.

Fluid and Solid Leasables

The number of acres closed or withdrawn from fluid and solid leasable mineral development varies across alternatives. Karst resources would benefit when located within open with major constraints or closed leasing categories because these areas would be excluded from surface disturbance. Table 4-17 shows the number of acres both open with major constraints and closed to mineral development across areas of high and medium karst potential by each alternative.

Table 4-17. Acres Closed and Open with Major Constraints to Leasable Mineral Management Decisions by Alternative within Areas of High and Medium Karst Potential Occurrence

Karst Potential Occurrence	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
High – closed	33,263	144,826	100,494	35,285	31,476
High – avoid (open with major constraints)	16,257	37,763	104,636	36,559	37,191
Medium – closed	16,514	436,718	464,776	292	292
Medium – avoid (open with major constraints)	19,808	36,719	36,204	31,660	27,279
Total	***85,842***	***656,026***	***706,110***	***103,796***	***96,238***

Impacts from Management Common to All

Management common to all alternatives would include several prescriptions in place to minimize and mitigate for surface disturbance, all of which would reduce the risk of adverse impacts to karst resources. Some of these include a requirement to revegetate disturbed areas post-construction; the utilization of reclamation activities that would enhance reclamation pits, roads, and pads for maximum surface protection; and a management protection emphasis on those features designated as significant (including newly discovered features that would be considered significant until further examination deems otherwise).

Potential adverse impacts to karst resources as a result of drilling would be minimized through careful review of karst features, as well as on-site field surveys to determine the presence of unrecorded karst features across areas of interest. Depending on findings, drill operations may be relocated as necessary.

The ROD for the Dark Canyon EIS (BLM 1994) would continue to guide oil and gas resources in a portion of Dark Canyon. Karst resources within this portion of the planning area would receive beneficial impacts as a result of management prescriptions already in place, including closure of 8,320 surface acres to future oil and gas leasing and an NSO stipulation for existing leases or portions of existing leases within the cave protection zone. Directional drilling, however, would still be allowed from outside the cave protection zone. This would adversely impact karst resources if undetected voids with no surface expression were encountered.

Impacts from Management Common to All Action Alternatives

Impacts from Management Common to All Action Alternatives would provide beneficial impacts to karst resources through additional stipulations for oil and gas development across karst landscapes. Newly proposed COAs would apply to all development projects and would include prescriptions addressing hydraulic fracturing pond requirements, four-string casing in specific areas, the requirements of erosion control and reclamation plans in zones of critical and high karst potential occurrence, and the presence of third-party compliance monitors on projects that may have specific risks or environmental concerns. In addition, monitors would be required on projects with operators with a history of non-compliance. All new management prescriptions would provide additional means of minimizing adverse impacts to karst resources, including the requirement of third-party karst surveys in high karst potential occurrence zones. The requirement of a third-party karst survey within medium karst potential occurrence zones will be at the discretion of the BLM. These requirements do not apply exclusively to geophysical exploration, but all activities that may cause disturbance to the surface. Proposed Management Common to All Action Alternatives would minimize surface disturbances and other impacts to karst resources through these various COAs and stipulations.

Impacts from the No Action Alternative

Under the No Action Alternative, 6,794 acres of surface disturbance and 3,466 wells are predicted within areas of high and medium karst potential occurrence across BLM surface lands within the planning area (see Table 4-16). A total of 85,842 acres would be designated as avoidance areas or closed to leasable mineral development (see Table 4-17). Adverse impacts associated with surface disturbance, as those described above, would continue within those areas open to leasable mineral development.

If the No Action Alternative is adopted, management decisions for karst resources as described in the 1997 RMP would remain intact. This alternative does not propose management prescriptions or stipulations on many aspects of mineral development, such as restrictions on locations of earthen hydraulic fracturing ponds and hydraulic fracturing water containment and testing, requirements for tank battery liners and secondary containment areas, and a completion deadline on all interim reclamation projects. Adverse impacts to karst resources would have a greater potential of occurring under this alternative compared to the action alternatives.

Impacts from Alternative A

Under Alternative A, a total of 656,026 acres would be designated as avoidance areas or closed to leasable mineral development across karst landscapes on BLM surface lands (see Table 4-17). This represents a substantial increase in the number of acres closed or avoided compared to the No Action Alternative.

Additionally, approximately 5,164 acres of surface disturbance and 2,634 new wells are predicted within areas of high and medium karst potential occurrence across BLM surface lands within the planning area (see Table 4-16). Adverse impacts associated with surface disturbance, as those described above, would continue within these areas, however; compared to the No Action Alternative, this alternative presents a 24% decrease in both the number of predicted acres of surface disturbance and in the number of predicted wells.

Many stipulations and COAs for oil and gas development through critical karst resource zones and zones of high karst potential occurrence would be required under this alternative, including closed loop systems for drilling, caps on number of acres allotted for surface disturbance per lease, and the requirement of leak detection and automatic shut-off systems for wells and hydrocarbon and salt water pipelines/storage facilities. Compared to the No Action Alternative, which has less stringent management prescriptions and stipulations, the magnitude of adverse impact would be smaller under Alternative A.

Impacts from Alternative B

Under Alternative B, stipulations and COAs for all aspects of oil and gas development across karst landscape would be the most stringent. A total of 706,110 acres would be designated as avoidance areas or closed to leasable mineral development across karst landscapes on BLM surface lands (see Table 4-17). This represents a substantial increase in the number of acres closed or avoided compared to the No Action Alternative.

Under this alternative, 4,092 acres of surface disturbance and 2,087 wells are predicted across high and medium karst potential occurrence zones. Compared to the No Action Alternative, Alternative B represents a 40% decrease in both the number of predicted acres of surface disturbance and number of predicted wells.

Many stipulations and COAs for oil and gas development through critical and high karst potential occurrence zones would be required under this alternative, including closed loop systems for drilling, caps on number of acres allotted for surface disturbance per lease, and the requirement of leak detection and automatic shut-off systems for wells and hydrocarbon and salt water pipelines/storage facilities. Compared to the No Action Alternative, which has less stringent management prescriptions and stipulations, the magnitude of adverse impact would be smaller under Alternative B.

Impacts from Alternative C

Under Alternative C, many stipulations and COAs for oil and gas development through critical and high karst potential occurrence zones would be required under this alternative, including closed loop systems for drilling, caps on number of acres allotted for surface disturbance per lease, and the requirement of leak detection and automatic shut-off systems for wells and hydrocarbon and salt water pipelines/storage facilities.

Additionally, a total of 103,796 acres would be designated as avoidance areas or closed to leasable mineral development across karst landscapes on BLM surface lands (see Table 4-17). This represents a moderately substantial increase in the number of acres closed or avoided compared to the No Action Alternative.

Under this alternative, 6,746 acres of surface disturbance and 3,441 wells are predicted across high and medium karst potential occurrence zones. Compared to the No Action Alternative, Alternative C represents a small decrease in both the number of predicted acres of surface disturbance and number of predicted wells.

Impacts from Alternative D

Under Alternative D, management prescriptions and stipulations would include allowing hydraulic fracturing ponds on a case-by-case basis; disposal of produced water would also be allowed, as is the case under the No Action Alternative, however; they would be prohibited in critical karst resource zones and high karst potential occurrence zones. Leak detection systems would not be required under this alternative.

Under Alternative D, a total of 96,238 acres would be designated as avoidance areas or closed to leasable mineral development across karst landscapes on BLM surface lands (see Table 4-17). This represents a slight increase in the number of acres closed or avoided compared to the No Action Alternative.

Also, 6,991 acres of surface disturbance and 3,566 wells are predicted across high and medium karst potential occurrence zones. Compared to the No Action Alternative, Alternative D represents a slight increase in both the number of predicted acres of surface disturbance and number of predicted wells. Adverse impacts to karst resources would be slightly greater under Alternative D.

Salable and Locatable Minerals

The number of acres closed (or open with special terms and conditions) to salable mineral development or withdrawn from locatable mineral development varies across alternatives. Karst resources would benefit when located within these closed or withdrawn areas. Table 4-18 and Table 4-19 depict these areas across the alternatives.

Table 4-18. Acreage Closed or Open with Special Terms and Conditions to Salable Mineral Management Decisions by Alternative in High and Medium Karst Potential Occurrence Areas

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
High – closed or open with special terms and conditions to mineral entry (i.e., avoidance area)	64,757	266,484	287,026	168,806	90,210
Medium – closed or open with special terms and conditions to mineral entry (i.e., avoidance area)	22,020	528,337	546,452	218,818	153,502
Total	***86,777***	***794, 821***	***833,478***	***387,624***	***243,712***

Table 4-19. Acreage Open and Recommended for Withdrawal to Locatable Mineral Management Decisions by Alternative in High and Medium Karst Potential Occurrence Areas

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
High – open to mineral entry	608,561	475,789	447,481	575,006	578,702
Medium – open to mineral entry	997,112	921,657	932,436	988,587	992,501
Total	***1,605,673***	***1,297,446***	***1,379,917***	***1,563,593***	***1,571,203***
High – recommended (or previously recommended for withdrawal)	20, 007	152,782	181,084	53,564	49,881
Medium – recommended (or previously recommended for withdrawal)	9,469	84,821	74,041	17,881	13,970
Total	***29,476***	***237,603***	***255,125***	***71,445***	***63,851***

Impacts from Management Common to All

There are no proposed salable mineral decisions listed under management common to all that would significantly impact karst resources because they would not result in surface or subsurface disturbances.

Under locatable decisions, all karst landscape would be available for location of mining claims unless withdrawn. Although karst resources would potentially be impacted from any surface-disturbing activities associated with locatable mineral development, specific stipulations and COAs applied to activities conducted within karst landscape would be in effect and would minimize adverse impacts.

Impacts from Management Common to All Action Alternatives

There are no proposed decisions for salable or locatable minerals under Management Common to All Action Alternatives that would significantly impact karst resources because they do not result in surface or subsurface disturbances.

Impacts from the No Action Alternative

Under the No Action Alternative, approximately 86,777 acres across areas of high and medium karst potential occurrence would be closed or open with special terms and conditions to salables mineral development. Approximately 29,476 acres across high and medium karst potential occurrence areas would be recommended for withdrawal from locatable minerals development (see Table 4-18 and Table 4-19). Adverse impacts to karst resources would continue within remaining areas open to surface-disturbing activities associated with mineral development. Potential adverse impacts to karst resources are described at the beginning of this section.

Impacts from Alternative A

Under Alternative A, approximately 794,821 acres across areas of high and medium karst potential occurrence would be closed or open with special terms and conditions to salables mineral development, while approximately 237,603 acres across high and medium karst potential occurrence areas would be recommended for withdrawal from locatables mineral development withdrawal (see Table 4-18 and Table 4-19).

Compared to the No Action Alternative, Alternative A represents a substantial increase in the number of acres closed or open with moderate constraints to salable mineral development and also a substantial increase in the number of acres recommended for withdrawal from locatables mineral development (see Table 4-18 and Table 4-19). The magnitude for adverse impacts to karst resources would, therefore, be greater under the No Action Alternative when compared to Alternative A.

Impacts from Alternative B

Under Alternative B, approximately 833,478 acres across areas of high and medium karst potential occurrence would be closed or open with special terms and conditions to salables mineral development, while approximately 255,125 acres across high and medium karst potential occurrence areas would be recommended for withdrawal from locatables mineral development (see Table 4-18 and Table 4-19).

Compared to the No Action Alternative, Alternative B represents a substantial increase in the number of acres closed or open with moderate constraints to salables mineral development and also a substantial increase in the number of acres recommended for withdrawal from locatables mineral development (see Table 4-18 and Table 4-19). The magnitude for adverse impacts to karst resources would, therefore, be greater under the No Action Alternative when compared to Alternative B.

Impacts from Alternative C

Under Alternative C, approximately 387,624 acres across areas of high and medium karst potential occurrence would be closed or open with special terms and conditions to salables mineral development, while approximately 71,455 acres across high and medium karst potential occurrence areas would be recommended for withdrawal from locatables mineral development (see Table 4-18 and Table 4-19).

Compared to the No Action Alternative, Alternative C represents a substantial increase in the number of acres closed or open with moderate constraints to salable mineral development and also a substantial increase in the number of acres recommended for withdrawal from locatables mineral development (see Table 4-18 and Table 4-19). The magnitude for adverse impacts to karst resources would, therefore, be greater under the No Action Alternative when compared to Alternative C.

Impacts from Alternative D

Under Alternative D, approximately 243,712 acres across areas of high and medium karst potential occurrence would be closed or open with special terms and conditions to salables mineral development, while approximately 63,851 acres across high and medium karst potential occurrence areas would be recommended for withdrawal from locatables mineral development.

Compared to the No Action Alternative, Alternative D represents a substantial increase in the number of acres closed or open with moderate constraints to salable mineral development and also a substantial increase in the number of acres recommended for withdrawal from locatables mineral development (see Table 4-18 and Table 4-19). The magnitude for adverse impacts to karst resources would, therefore, be greater under the No Action Alternative when compared to Alternative D.

4.2.2.2.16 Impacts of Special Designation Actions on Karst Resources

Special designations would provide beneficial impacts to karst resources if they impart restrictions on surface- and subsurface-disturbing activities within their boundaries. Restrictions on surface- and subsurface-disturbing activities associated with various land use activities would minimize potential impacts to karst resources located within these special designation areas.

Areas of Critical Environmental Concern

Impacts to karst resources within the proposed Cave Resources ACEC as a result of mineral development would depend on the number of acres within this designation that are closed to these activities and associated surface disturbance. The number of acres closed, designated as NSO or recommended for withdrawal varies between the No Action Alternative and the action alternatives and is shown in Table 4-20.

Table 4-20. Approximate Acres Open with Major Constraints (NSO), Closed or Recommended for Withdrawal to Mineral Development across the Cave Resources ACEC by Alternative

Cave Resources ACEC (19,625 acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Leasables – acres open with major constraints (NSO)/closed	–	6,128	6,112	6,153	8,538
Salables – acres closed	10,520	19,625	19,625	19,610	17,200
Locatables – acres recommended for withdrawal	9,141	19,625	19,625	18,827	17,201

Impacts from Management Common to All Alternatives

There are no proposed special designation decisions listed under management common to all alternatives; however, all alternatives provide management prescriptions to minimize risks to karst resources within the special designations proposed. While all the alternatives provide some level of protection to karst resources within special designations, the magnitude of that protection varies across alternatives and is discussed below.

Impacts from Management Common to All Action Alternatives

Under Management Common to All Action Alternatives, approximately 19,625 acres would be designated under the Cave Resources ACEC (see Table 4-20). Long-term protection for karst resources from various land uses would be maintained and risk of impacts would be reduced through management prescriptions such as closure to all future oil and gas leasing on some of the units within this ACEC, requiring the installation of erosion control and leak detection methods on all surface use plans, limited OHV designations, and NSO around heavily concentrated karst areas or within 984 feet of surface waters or defined features that feed into a cave system and designating ROW exclusion where pre-existing access rights do not exist.

Lonesome Ridge, another proposed ACEC under all action alternatives, contains relevant and important karst features, including six known significant caves. Karst features within this ACEC would benefit from special management prescriptions proposed, including future ROW exclusion, exclusion of renewable energy development, and restrictions on surface disturbances.

In addition to the Cave Resources and Lonesome Ridge ACECs, there are three other ACECs containing relevant and important karst features that are proposed for designation. The ACECs designated vary by alternative and are shown in Table 4-21 below.

Table 4-21. Proposed Areas of Critical Environmental Concern with Relevant and Important Karst Features by Alternative

ACECs	Alternative A	Alternative B	Alternative C	Alternative D
Cave Resources	19,625	19,625	19,625	19,625
Lonesome Ridge	2,981	3,021	3,021	3,021
Gypsum Soils	–	65,562	65,554	–
Carlsbad Chihuahuan Desert Rivers	108,474	–	–	–
Seven Rivers Hills	–	1,027	1,027	954
Total acreage of proposed ACECs with relevant and important karst features	***131,080***	***89,235***	***89,227***	***23,600***

Under Management Common to All Action Alternatives, risks to karst resources would be further minimized through the closure of approximately 13,000 acres to salable and locatable mineral leasing. See Table 4-20 for a comparison of acreages open and closed to leasable, salable, and locatable mineral development by alternatives.

Impacts from the No Action Alternative

Under the No Action Alternative, nine karst management units would continue to be managed under current prescriptions. These units would have management prescriptions associated with the designation as a Cave Resources SRMA, including an NSO stipulation on all future oil and gas leases, future ROW avoidance through cave areas, and restrictions on surface disturbances. As Table 4-20 displays, however, there would be only 56% within this unit closed to leasables and salables mineral development and 48% closed to locatables.

Under this alternative, adverse impacts to karst resources would also be minimized through a 656-foot surface disturbance buffer that would be placed around all known cave entrances, passages or aspects of significant caves or significant karst features. Indirect adverse impacts to karst resources within these ACECs would be expected to continue in areas that remain open to surface-disturbing activities.

Impacts from Alternative A

Under Alternative A, management actions propose 131,080 acres containing relevant and important karst features for ACEC designation (see Table 4-21). Additional karst resources in the hydrologically and biologically important gypsum soils would benefit from the designation of the Carlsbad Chihuahuan Desert Rivers ACEC, although karst landscapes in two other proposed ACECs, the equally important Gypsum Soils and Seven Rivers Hills ACECs, would not. Both of these areas play an important role in local groundwater recharge and resurgences, which could increase risks to karst resources under this alternative.

Additionally, 6,128 acres of the proposed Cave Resources ACEC would be open with major constraints (NSO) and 19,625 acres would be closed to leasables mineral development and closed/recommended for withdrawal from salables and locatables. Compared to the No Action Alternative, which represents an 86% decrease in the number of acres with NSO or closed to leasables and salables mineral development and a substantial decrease in the number of recommended acres for withdrawal from locatables development, the magnitude of adverse impacts to karst resources would be smaller under this alternative.

Impacts from Alternative B

Under Alternative B, management actions propose 89,235 acres containing relevant and important karst features for ACEC designation. Alternative B also proposes the designation of the Gypsum Soils ACEC, which would beneficially impact groundwater recharge in the region and also provide additional protection to several significant caves in the gypsum plains region (see Table 4-21).

Additionally, as with Alternative A, this alternative calls for approximately 6,112 acres of the proposed Cave Resources ACEC to be open with major constraints (NSO) or closed to leasables mineral development and 19,625 acres to be closed/recommended for withdrawal from salables and locatables. Compared to the No Action Alternative, the magnitude of adverse impacts would be smaller under this alternative.

Impacts from Alternative C

Under Alternative C, management actions propose 89,227 acres containing relevant and important karst features for ACEC designation. Alternative C also proposes the designation of the Gypsum Soils ACEC (see Table 4-21); beneficial impacts would be similar to those under Alternative B.

Additionally this alternative calls for 6,153 acres of the proposed Cave Resources ACEC to be open with major constraints (NSO) and 19,610 acres NSO or closed to leasables mineral development and all but 798 acres closed/recommended for withdrawal from salables and locatables. Compared to the No Action Alternative, the magnitude of adverse impacts would be similar to those under Alternative A.

Impacts from Alternative D

Under Alternative D, management actions propose 23,600 acres containing relevant and important karst features for ACEC designation. Under this alternative, 19,625 acres of the proposed Cave Resources ACEC would be open with major constraints (NSO) or closed to leasables mineral development.

Approximately 17,200 acres would be closed/recommended for withdrawal from salables/ locatables. Compared to the No Action Alternative, the magnitude of adverse impacts would be identical to those under Alternative A. Compared to the No Action Alternative, the magnitude of adverse impacts would be smaller under this alternative.

4.2.2.2.17 Impacts of Wilderness Study Areas on Karst Resources

Impacts from Management Common to All

All karst resources within the four designated WSAs comprising a total of 7,086 acres, would benefit from additional protection through special management requirements, including a closed designation for all future leases and no reissuing of current leases once expired, which would enhance and preserve its wilderness values, including karst resources within the unit. In addition, new permanent facilities and new surface disturbance would be prohibited, all of which would minimize both direct and indirect adverse impacts to karst resources, such as alterations or obstruction of surface and subsurface drainage patterns and water infiltration, potential subsidence and contamination of groundwater, disruption of subterranean environment which would impact the associated biological community and alterations in surface vegetation community.

Impacts from Management Common to All Action Alternatives

There are no proposed decisions listed under Management Common to All Action Alternatives.

Impacts from the No Action Alternative

Under the No Action Alternative, the four WSAs would remain under their current designation and managed accordingly under prescriptions outlined in the Carlsbad RMP (BLM 1988) as amended, such as closed to all future leasing or NSO designation, closed to salables, withdrawn from locatables, OHV limited, closed to renewable energy and designated as VRM Class I, and also as a ROW avoidance area. These management prescriptions would continue to minimize adverse impacts to karst resources through restrictions on surface-disturbing activities.

Alternatives A, B, and C

If the WSA designation is removed, the four previously designated WSAs would be managed as closed to leasable and salable development and recommended for withdrawal from locatable development. Adverse impacts under these three alternatives would be comparable to those under the No Action Alternative and as described under management common to all.

Alternative D

Under Alternative D, adverse impacts resulting from loss of WSA designation would be greater than those found under the other alternatives because management prescriptions would be less stringent for surface-disturbing activities. Unlike the other four alternatives, leasable mineral development would be open with major constraints, salable mineral development would be open with moderate constraints and the areas would be open for locatable development. In addition, the proposed VRM class on these lands would be Class III.

Adverse impacts, as those described under management common to all alternatives, would be greater under Alternative D compared to the No Action Alternative and also compared to Alternatives A through C.

4.2.2.2.18 Impacts of Wild and Scenic Rivers on Karst Resources

Impacts from Management Common to All

There are no proposed management decisions common to all alternatives that would significantly impact karst resources.

Impacts from Management Common to All Action Alternatives

Under Management Common to All Action Alternatives, the Black River would be recommended as suitable for inclusion in the NWSRS and would be given the same management prescriptions as other WSR areas, including a VRM Class II classification. Beneficial impacts to karst resources would result, as the area is located in a critical karst resource zone and WSR designation would limit surface-disturbing activities that would potentially result in adverse impacts to these karst resources, such as subsurface contamination and alterations in surface drainage patterns.

4.2.2.2.19 Impacts of Backcountry Byways Actions on Karst Resources

Impacts from Management Common to All

There are no proposed management decisions common to all alternatives that would significantly impact karst resources.

Impacts from Management Common to All Action Alternatives

There are no proposed decisions listed under Management Common to All Action Alternatives that would significantly impact karst resources.

Impacts from the No Action and Action Alternatives

Under the No Action Alternative and Alternatives C and D, the Dark Canyon Road Loop would not be proposed for designation as a BLM Backcountry Byways and would be open to leasable, salable, and locatable mineral development; therefore, karst resources within this area would not benefit from additional protective management prescriptions.

Under Alternatives A and B, the Dark Canyon Road Loop would be designated as a BLM Backcountry Byway. Management prescriptions would include open to leasables with moderate constraints, open to salable with special terms and stipulations, excluded from all renewables development, and designated as OHV limited. Karst resources within a 2-mile buffer of the Dark Canyon Road Loop would benefit from VRM Class II management on both sides of the road. Other stipulations under this VRM class would include an open status on locatables as well as ROWs, as long as they are compatible with VRM Class II restrictions under site specific analysis.

Under Alternative C, the Dark Canyon Road Loop would not be designated as a BLM Backcountry Byway. This alternative would be less beneficial to karst resources, as the buffer proposed would only cover 0.25 mile on both sides of the road as opposed to the 2-mile buffer proposed by Alternatives A and B. All other management prescriptions, however, would be the same as under Alternatives A and B, with the exception of salable mineral development. The loop would be open to salable, locatables, and ROWs as long as those permitted uses are shown to be compatible with the VRM class under a site-specific analysis.

Alternative D would minimize risks to karst resources with a proposed VRM management of Class III within a 1-mile buffer on both sides of the Dark Canyon Road. Because of VRM Class II prescriptions, Alternatives A and B would be the most beneficial to karst resources.

4.2.2.2.20 Impacts of Visual Resources on Karst Resources

VRM class designations have specific management objectives which, depending on the class designated, could beneficially impact karst resources. The objectives defined for VRM Class I and II include the preservation or retention of the existing character of the landscape and, therefore, minimize and at times prohibit surface-disturbing activities. Those impacts to karst resources associated with mineral development, ROW construction and maintenance and other land use authorizations and road and trail construction would be minimized within these VRM Class I and II designations. The number of acres designated as VRM Class I and II vary across the alternatives and is depicted below.

Table 4-22. VRM Class I and Class II Management Decisions (Acres) by Alternative

VRM Class	No Action	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Total	***50,671***	***273,710***	***357,802***	***67,962***	***48,263***

Impacts from Management Common to All

There are no proposed management decisions common to all alternatives that would significantly impact karst resources.

Impacts from Management Common to All Action Alternatives

There are no proposed Management Decisions Common to All Action Alternatives that would significantly impact karst resources.

Impacts from the No Action Alternative

Under the No Action Alternative, a total of 50,671 acres would be designated under either VRM Class I or II (see Table 4-22). Karst resources would benefit from additional management prescriptions that would prohibit or minimize ground-disturbing activities within these designated acres. Various impacts on karst resources associated with ground-disturbing activities include alterations to surface and subsurface drainage patterns, disruptions in surface vegetative communities, which can cause indirect adverse effects to subsurface faunal communities, an increased potential for contamination of groundwater and excessive sedimentation loading and subsequent plugging of potentially important karst recharge features.

Impacts from Alternative A

Under Alternative A, a total of 273,710 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative: however, the magnitude of beneficial impacts would be much greater under this alternative because there is a substantially greater number of acres under the VRM Class I and II designation.

Impacts from Alternative B

Under Alternative B, a total of 357,802 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative: however, the magnitude of beneficial impacts would be much greater under this alternative because there is a substantially greater number of acres under the VRM Class I and II designation.

Impacts from Alternative C

Under Alternative C, a total of 67,962 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative: however, the magnitude of beneficial impact would be greater under this alternative because there is a substantial increase in the number of acres under the VRM Class I and II designation.

Impacts from Alternative D

Under Alternative D, a total of 48,263 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be greater under this alternative because of the slight increase (5.4%) in the number of acres under the VRM Class I and II designation.

4.2.3 Vegetative Communities

4.2.3.1 Upland Vegetation including Noxious Weeds

This section analyzes and discusses impacts to upland vegetation and noxious weeds from management actions discussed in Chapter 2. Upland vegetation is characterized by the general Major Land Resource Area (MLRA) descriptions found in Chapter 3. Existing conditions concerning noxious weeds and other exotic invasive plants are also described in Section 3.2.4.

Actions that physically disturb, degrade, or change the composition of vegetation communities through surface disturbances are considered adverse because they negatively affect the long-term functioning condition of these communities (Allen 1995; Castillo et al. 1997). Surface disturbance would impact vegetation resources to varying degrees, depending on such factors as vegetation type, the type of soils, watershed conditions, topography, location, and the type of surface disturbance and plant reproductive characteristics. Management actions that reduce or curtail surface disturbance and associated adverse impacts to upland vegetation would be considered beneficial.

Actions that increase the risk for the spread of noxious weeds and other exotic invasive plants are considered adverse. Actions that prevent or decrease the risk of spread of noxious weeds and other exotic invasive plants are considered beneficial. The spread of noxious weeds and other invasive plants can be caused by actions such as overland movement of vehicles, livestock, equipment, recreational activities, etc. Soil disturbance facilitates the establishment and spread of noxious weeds, many of which prefer disturbed sites for colonization (Allen 1995; Jacobs et al. 1998; Monsen et al. 2004). Actions that can prevent or decrease the spread of noxious weeds and other exotic invasive plants include avoidance of surface disturbance, vegetation treatments for noxious weeds, and vegetation restoration using native plants.

Climate change has become a serious environmental factor over the past few decades, with increasing temperatures and decreasing precipitation. Climate change toward warming and drying conditions across the American Southwest, including the planning area, is predicted to continue to intensify for the foreseeable future. The climate of the New Mexico already is changing due to global warming and is predicted to become progressively warmer and drier over the foreseeable future (for example, by the U.S. Bureau of Reclamation). Climate change as predicted will have significant impact to upland vegetation communities, causing shifts in vegetation communities upward in elevation, and plant species adapted to relatively cool and moist conditions die out and would be replaced by species adapted to warmer and drier conditions. Such trends have already been documented in forests and woodlands of the Southwest (Allen et al. 2010).

Climate change will likely reduce the efficacy of brush control herbicide treatments over the life of this RMP; grasses may decline because of climate change alone, and shrub control may not be effective at increasing perennial grasses. Shrub control treatment effectiveness will vary across landscapes, soil types, vegetation communities and microclimates in different ways than it has historically. Climate change will likely affect grazing management over the life of this RMP as grass forage and stock water availability decline.

Climate change, including increasing temperatures and decreasing precipitation and changing weather patterns across the Southwest, is likely to have significant effects on most management actions relative to riparian, wetland and upland vegetation resources, especially vegetation, grazing, wildland fire, and travel management. Over the next 20 years, climate change alone already has altered and will continue to alter trends in vegetation composition away from historic climax community composition, and cause shifts in historic vegetation climax communities to communities dominated by more xeric and warmer temperature adapted species (e.g., desert grassland to desert scrub, piñon/juniper woodland to juniper savanna).

4.2.3.1.1 Analysis Methods

Indicators

The following indicator was used for the analysis of management impacts to upland vegetation and noxious weeds:

- Number of acres of surface disturbance resulting from management actions (including mineral development, livestock grazing, and OHVs) across upland vegetation communities, including changes to species composition, vertical structure, and/or successional or seral stages of upland vegetation communities. Such surface disturbance would impact vegetation resources to varying degrees, depending on the amount, location, and type of surface disturbance. Number of acres of surface disturbance associated with various management actions is also used as an indicator for the potential establishment and spread of noxious weeds.

Methods and Assumptions

Management actions associated with the following resources and land uses may result in impacts to upland vegetation resources and are discussed in detail below: karst resources, wildland fire management, land use authorizations, mineral development, livestock grazing, lands with wilderness characteristics, upland vegetation including noxious weeds, fish and wildlife, special status species, soils, recreation, riparian areas, special designations, visual resources, renewable energy, and travel management.

Actions associated with the following resources would not impact upland vegetation because they do not include surface-disturbing activities and are, therefore, not discussed: air resources, paleontological and cultural resources, health and safety, and land tenure.

The following assumptions were used for the analysis of management action impacts on upland vegetation and noxious weeds management:

- Mineral development, and associated surface disturbances, is expected to increase across the planning area over the next 20 years (Engler et al. 2012).
- The degree of impact attributed to any one disturbance or series of disturbances would be greatly influenced by several factors, including existing plant community and specific species composition, location in the watershed, the type, time, and degree of disturbance, precipitation, and mitigating actions applied to the disturbance.
- Both quantitative and qualitative data show overall rangeland health and vegetative communities to be stable and, in some instances, improving. These trends, in part a result of the Restore New Mexico Project, are assumed to continue across the planning area.
- Noxious weeds are those plant species formally listed by the state of New Mexico and separated by classes and are regulated. The term noxious weeds used here also includes other exotic invasive plant species that are not formally listed as noxious weeds, but are ecologically similar. Most are not listed and regulated as noxious weeds because they are already so widespread that regulatory control is not practical. Examples include Russian thistle (*Salsola tragus*), kochia (*Bassia* [formerly *Kochia*] *scoparius*), Lehmann lovegrass (*Eragrostis lehmanniana*), and puncture vine (*Tribulus terrestris*). The environmental impacts of other exotic invasive weeds may be as severe or as worse as some listed noxious weeds.

4.2.3.1.2 Direct and Indirect Impacts

Impacts on upland vegetation, including noxious weeds, would include all management actions that physically disturb or change the composition of vegetation communities and their functioning condition in the planning area. The impacts of management actions on vegetation communities vary, depending on such factors as the type of soils, watershed conditions, wildland fire management, topography, vegetation type, climatic conditions, and plant reproductive characteristics. Impacts to vegetation diversity and species composition would be based on likely changes relative to movement toward the desired plant community (DPC).

Impacts on vegetation communities would result from two categories of management actions: those designed to improve vegetation resources for their ecological values and those directed at other resources but that also indirectly impact vegetation. Direct impacts on vegetation include crushing, trampling, or removing rooted vegetation, resulting in a reduction in plant abundance and diversity, vigor, structure, and/or function of vegetation habitat.

Surface-disturbing activities from management actions would impact the relative abundance and distribution of species within plant communities, as well as facilitate the colonization of bare and disturbed ground by noxious weeds. As stated in Section 3.2.4, within the planning area, invasive plant infestations begin as small patches in disturbed areas such as pipeline and utility corridors, roads, oil and gas locations, undeveloped vehicle trails, range improvement projects, and mining operations.

Other indirect impacts from surface disturbance on vegetation include soil compaction, erosion and sedimentation, changes in hydrology, loss of pollinators and pollinator habitat, and an increased likelihood for weed invasion. Together, these impacts would probably lead to reduced vegetation health and vigor, reduced plant cover, lower plant diversity, habitat fragmentation, and an increased presence of noxious, invasive weed species.

Impacts from Upland Vegetation Management/Noxious Weed Management Actions on Upland Vegetation/Noxious Weeds Management

Vegetation management, including the treatment of noxious weeds, would include the use of herbicides, mechanical techniques (e.g., root plowing), and prescribed fire to reduce shrub cover in treated areas. In general, vegetation treatments have the potential to impact most plant species in similar ways. All vegetation treatments are intended to kill or injure target plants, which may vary in intensity and extent, while providing long-term beneficial impacts to non-target vegetation, including the movement of plant communities towards the DPC and attaining other ecological objectives.

Impacts from Management Common to All

Upland vegetation management actions common to all of the alternatives are composed of several management prescriptions that include the judicious use of herbicides, per the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (BLM 2007b); the continued implementation of rangeland restoration and vegetation treatments for achievement of multi-use management goals; the site-specific use of chemical, mechanical, and prescribed burns to combat woody brush and noxious weeds encroachment; and the rehabilitation of well pads, roads, and ROWs. Additionally, all trees that provide habitat for a migratory bird or a threatened or endangered species would be protected from disturbances, including vegetation treatments.

Impacts to upland vegetation as a result of vegetation treatments would vary, depending on the various biotic and abiotic factors previously discussed and would also depend on which particular vegetation treatment method (mechanical, chemical, or prescribed burn) is applied. Vegetative response to treatments would also be contingent upon the MLRA and associated vegetative communities.

Approximately 67% of the planning area falls within the Southern Desertic Basins, Plains, and Mountains MLRA (see Section 3.2.4.1.1); however, treatments, both chemical and mechanical, have been demonstrated to be ineffective and result in adverse impacts to vegetation communities in desertified landscapes (Schlesinger et al. 1990; Whitford 2002) of southern New Mexico, particularly in regard to the targeting of mesquite (*Prosopis* sp.) (Archer 1994).

Adverse impacts in these landscapes would include alterations in species composition and the temporary removal of woody vegetation, causing increased soil erosion and the potential spread of invasive weedy species, such as Russian thistle. Beneficial impacts of this increased grass cover include reduced raindrop impact, decreased water and wind erosion potential, and increased infiltration. In addition, under all of the alternatives, the BLM would manage appropriately for the vegetative habitat requirements of federally listed species, including the LPC and DSL.

Management prescriptions for these species would include identifying and targeting those areas that are currently designated as unsuitable habitat but have the potential to become suitable habitat. In these parts of the planning area, management prescriptions would be implemented to attain appropriate habitat requirements, reduce fragmentation, enhance connectivity, and move towards the DPC. Also, herbicide treatments would not be implemented in shinnery oak (*Quercus havardii*) communities on dunes that provide potential DSL habitat, which would impart additional beneficial impacts to upland vegetation by helping to maintain natural shinnery oak vegetation communities across the planning area. All of these actions would provide beneficial and enhancement-related impacts to upland vegetation and noxious weed management through management activities focusing on native plant species and their biotic communities, through vegetation restoration and reclamation activities and through the reduction of invasive species establishment and movement towards the DPC. As a result, upland vegetation composition, cover, and production would improve.

Noxious weed and invasive plant management actions common to all would include compliance with EO 13112 and BLM Manual 1745 in restoration, rehabilitation, and reclamation efforts, which would allow non-native plant species to be used in reseeding activities only if native species are not readily available in sufficient quantities or are incapable of maintaining or achieving the properly functioning conditions of biological health. Seed mixes used in these actions would use the closest locally adapted selections, varieties, or cultivars of native species available to improve success of the seeding effort. Operators would also be required to provide an annual report summarizing their noxious weed treatments, as well as provide seed tags prior to seeding disturbed areas. The BLM would follow the management prescriptions provided for in the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (BLM 2007b).

All of these actions would benefit upland vegetation by reducing the potential spread of noxious weeds and invasive species and also by favoring DPC species in upland areas.

Impacts from Management Common to All Action Alternatives

Management Common to All Action Alternatives also includes COAs, BMPs, and other management prescriptions for operators that specifically address the proper methods for minimizing the spread of noxious weeds. The eradication of any non-native noxious weed species that occur as a result of new surface disturbance would be the responsibility of the operator (see Appendix O for a full list of COAs and BMPs addressing noxious weeds). In addition, all action alternatives would include the requirement that any surface-disturbing activity have a plan in place for the control of noxious weeds and invasive species. This would provide beneficial impacts to upland vegetation by minimizing the spread of these noxious and invasive species and reducing competition with native species.

Placement of surface-disturbing activities in established Lehmann lovegrass stands would be avoided. Lehmann lovegrass occurs in low elevation desert grasslands, so impact levels would apply mostly to the Southern Desert Foothills, Southern Plains, and Southern Desertic Basins-Plains and Mountains MLRAs. Prohibiting surface disturbances in areas with Lehmann lovegrass would beneficially impact upland vegetation, as this introduced species is known to be prolific in disturbed areas and would reduce composition and diversity of competing native grasses.

Other Management Prescriptions Common to All Action Alternatives address wildlife stipulations that would prohibit the use of aerial and ground-spraying of herbicide within 100 feet of cave entrances and the use of mechanical or aerial herbicide treatments within 656 feet of active nests (specifically, those nests in mesquite, catclaw acacia (*Acacia greggii*), riparian, and piñon-juniper vegetative communities). Also, the mechanical treatment of saltcedar would be prohibited in known southwestern willow flycatcher (*Empidonax traillii extimus*) occupied habitat. These wildlife stipulations would result in negligible impacts to upland vegetation because the areas targeted would be relatively small and would not affect overall rangeland health and DPC objectives across the planning area.

In addition, all action alternatives would protect any known special status plant species with a 656-foot buffer from any noxious weed treatments. This action would protect special status plant species from direct adverse impacts of noxious weed treatments, but adverse indirect impacts may also occur as a result of permitting noxious weeds to persist in the immediate proximity (within 656 feet) of special status plants. Indirect adverse impacts, such as increased competition for resources between special status plants and noxious weeds, promotion of additional dispersal of noxious weed seeds into the surrounding landscape, and an increased risk of wildfire, may occur.

Impacts from the No Action Alternative

Under the No Action Alternative, current trends and management activities for vegetation, including noxious weeds management, would continue. This would include the steady increase of noxious weeds, particularly African rue (*Peganum harmala*) and Malta starthistle (*Centaurea melitensis*), across the planning area (see Section 3.2.4.3.1).

Under this alternative, specific sections across the planning area designated for vegetation treatments, including herbicide application, prescribed burns, and mechanical removal, would be solely determined by BLM resource specialists. As a result, impacts to upland vegetation would be more variable, as no specific guidelines for initiating vegetation treatments would be outlined.

Management actions under the No Action Alternative would continue to allow planned surface disturbances in areas of Lehmann lovegrass prevalence, thereby facilitating further growth and expansion of this species. As a result, Lehmann lovegrass stands, which are prolific in disturbed areas (Uchytil 1992), may continue to increase along areas with surface disturbance. This would adversely impact native upland vegetation through displacement and by out-competing them for resources.

Additionally, this alternative has no special restrictions or buffers on herbicide application within areas populated by special status plant species. This would potentially impact any special status plants found in areas treated for noxious weeds by reducing abundance and occurrence localities of these special status species. Other adverse impacts would be expected due to the current trends observed in the spread of noxious weeds across the planning area (see Section 3.2.4.3.1) and lack of updated environmental provisions.

Impacts from Alternative A

Under Alternative A, there would be no establishment of fence buffers during vegetation treatments. This would result in less treated acres, which would equate to less acreage meeting the Standards and Guidelines (BLM 2001a). Vegetation treatments would be implemented in areas where targeted woody species have surpassed specific thresholds (see Chapter 2, Alternatives Matrix for woody species list and their various threshold levels). In addition, there would not be established buffers on herbicide treatments around snake dens. Impacts to upland vegetation would vary depending on the various biotic and abiotic factors previously addressed above and also on which particular vegetation treatment method is applied and would be similar to those impacts described above under Direct and Indirect Impacts.

Under Alternative A, those riparian areas of the Delaware, Black, and Pecos Rivers (and also perennial springs and seeps) would be prioritized for monitoring after vegetation treatments are conducted. This would provide beneficial impacts to vegetation through the maintenance of native plant communities in these areas. Compared to the No Action Alternative, which calls for no prioritization in the monitoring of treated areas, Alternative A would provide greater beneficial impacts by minimizing the spread of noxious weeds across the planning area.

Impacts from Alternative B

Under Alternative B, there would be no establishment of fence buffers during vegetation treatments. Impacts from this management action would be the same as those discussed in Alternative A. Additionally, Alternative B would not reduce brush control actions by target species thresholds and would, therefore, impact fewer acres of target shrub species with lower occurrences or cover than under the No Action Alternative.

Alternative B would also require that no herbicide treatments be applied within 100 feet of known snake dens. Piñon-juniper stands with known bat occupancy would be targeted for treatment at higher than 12 percent vegetative cover. Specific types of impacts would be the same as those described in text under Direct and Indirect Impacts above. Compared to the No Action Alternative, the magnitude of adverse impacts would be less under this alternative due to the additional vegetation management prescriptions.

Under noxious weeds management, the impacts from Alternative B would be the same as those described under Alternative A, because noxious weeds management actions would be the same. Compared to the No Action Alternative, which calls for no prioritization in the monitoring of treated areas, Alternative B would provide greater beneficial impacts to upland vegetation.

Impacts from Alternative C

Under Alternative C, brush control actions would be limited to areas where primary target species would surpass thresholds to achieve DPC, and 20-foot buffers would be established around treatment boundary areas to create fire breaks. Also, no herbicide treatments would be allowed within 100 feet of known special status snake species dens. Specific types of direct and indirect impacts from vegetation treatments would be the same as those described in text under Direct and Indirect Impacts. Compared to the No Action Alternative, the magnitude of adverse impacts would be less under this alternative due to the additional vegetation management prescriptions aimed at achieving DPC.

Impacts from Alternative D

Under Alternative D, impacts to upland vegetation from vegetation treatment would be the same as those under the No Action Alternative because both alternatives would leave the areas designated for treatment up to the discretion of the resource specialist. Vegetation treatments would be buffered 20 feet at treatment boundaries and pasture fences to create natural fire breaks. Specific types of direct and indirect impacts from vegetation treatments would be the same as those described in text under Direct and Indirect Impacts.

Impacts of Soil Resources Actions on Upland Vegetation/Noxious Weeds Management

Upland vegetation and weed management would benefit from soil management objectives across the planning area that maintain or enhance stability and physical function of soils and restrict surface-disturbing activities. In addition, vegetation communities would benefit through special reclamation procedures of disturbed sites, including special site-specific seed mixtures, the planting of trees and shrubs, erosion control, and land treatments. Upland vegetation resources and noxious weeds management would benefit indirectly from the enhanced surface community, which in turn would also reduce the likelihood of noxious weed invasion.

Impacts from Management Common to All

Management common to all decisions would beneficially impact upland vegetation resources and noxious weed management, as all include BMPs designed specifically to prevent soil erosion and runoff. Some of these would include special site-specific seed mixtures, the removal of caliche and other surface materials, soil amendments, soil treatments, and the planting of trees and shrubs.

Impacts from Management Common to All Action Alternatives

There are no proposed decisions listed under Management Common to All Action Alternatives.

Impacts from the No Action Alternative

Under the No Action Alternative, upland vegetation resources and noxious weed management would potentially receive adverse impacts as a result of management stipulations that suggest minimizing erosion and soil loss but do not place precise limits on number of acres or allowable percentage of surface disturbance within oil and gas leases.

In addition, projects may be modified, moved, or mitigated for soil erosion if located on unsuitable areas, defined under this alternative as areas with slopes of 30% or greater.

Impacts from Alternative A

Under Alternative A, surface disturbance stipulations would be in effect within the entire SGSA. Under this alternative, those vegetation communities located within the SGSA would benefit from additional surface protection, as surface disturbances associated with oil and gas leases would not be permitted to exceed 3% of the entire lease acreage or a maximum of 7 acres (whichever is greater).

As with management under the No Action Alternative, surface disturbances are minimized; however, under Alternative A the magnitude of beneficial impacts is greater because it sets specific requirements for the amount of allowable surface disturbance and prohibits surface occupancy in any areas with slopes at 10% or greater, as opposed to the No Action Alternative, which does not prohibit any surface occupancy. The magnitude of beneficial impacts to upland vegetation resources and noxious weeds management is greatest under this alternative.

Impacts from Alternative B

Under Alternative B, surface disturbances would be limited by stipulations only within specific soil mapping units of the SGSA. As in the No Action Alternative, surface disturbances are minimized; however, under Alternative B the magnitude of beneficial impacts is greater because it sets specific requirements for the amount of allowable surface disturbance within specific soil units and prohibits surface occupancy in any areas with slopes at 20% or greater, as opposed to the No Action Alternative which does not prohibit any surface occupancy.

Impacts from Alternative C

Alternative C does not set a percentage or acreage limit on allowable surface disturbance within oil and gas leases, although it does require the use of directional drilling and restrict all new well infrastructure to existing disturbed corridors when applicable. As with Alternative B, Alternative C proposes NSO stipulations in areas with slopes greater than 20% with the additional requirement of an engineered plan for areas with slopes greater than 10%.

These proposed decisions would provide greater beneficial impacts to upland vegetation resources and noxious weeds management compared to the No Action Alternative, but the magnitude of beneficial impacts would be less here than under Alternatives A and B.

Impacts from Alternative D

Compared to all the other alternatives, Alternative D would have the greatest potential adverse impact to upland vegetation resources and noxious weeds management, with no cap on allowable surface disturbance, no requirements to use directional drilling, and a management prescription that would provide the least amount of protection against erosion (avoidance of slopes greater than 30%).

Impacts of Karst Resources Management Actions on Upland Vegetation/Noxious Weeds Management

Karst resource management actions would impact vegetation in circumstances where surface disturbance buffers have been placed around karst features. These actions would directly benefit vegetation communities by protecting them from surface-disturbing activities associated with mineral development and other land uses. Beneficial impacts would include maintaining community composition and plant diversity, minimizing soil compaction and erosion and decreasing the likelihood of noxious weed invasion. The proposed 984-foot surface disturbance buffer proposed for all the action alternatives (Alternatives A–D) as noted in Appendix L would have more direct benefits than under the No Action Alternative where a 656-foot surface disturbance buffer is proposed.

Impacts from Management Common to All

There are no management actions common to all alternatives that would impact upland vegetation/ noxious weeds management because actions listed here mainly address karst detection guidelines, the classification of karst resources across the planning area, and guidance in addressing white nose syndrome.

Impacts from Management Common to All Action Alternatives

All action alternatives would provide for a 984-foot buffer around all known karst features, within which all surface-disturbing activities would be prohibited. This would result in greater protection of the surface vegetation community. Qualitatively, the nature of the impacts to vegetation is the same as those under the No Action Alternative; however, the magnitude of adverse impacts to vegetation would be smaller due to a larger surface disturbance buffer.

There are no other management actions common to all action alternatives that would impact upland vegetation/noxious weed management because the actions listed here pertain to the development of resource management plans for caves and karst resources across the planning area and casing requirements.

Impacts from the No Action Alternative

Under the No Action Alternative, vegetation would benefit from a 656-foot surface disturbance buffer placed around all known cave entrances, passages, or aspects of significant caves or features. This would help to maintain vegetation diversity and abundance within surrounding plant communities.

Impacts of Special Status Species Management Actions on Upland Vegetation/ Noxious Weeds Management

Objectives listed under special status species management include the protection and enhancement of endangered, threatened, and sensitive species habitat. The preclusion of surface-disturbing activities in special status species terrestrial habitats would benefit vegetation communities by minimizing impacts to vegetation abundance and diversity and decreasing the likelihood of erosion and weed invasion, among others.

Impacts from Management Common to All

Under management common to all alternatives, several management prescriptions are proposed that would benefit vegetation and noxious weed management, including the proper use of herbicides as indicated in the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (BLM 2007b), the adjustment of buffering distances on a case-by-case basis, the preclusion of surface disturbances within 656 feet of active raptor nests, and the prohibition of all surface-disturbing activities on public land with known prairie dog (*Cynomys* sp.) towns. All of these prescriptions would benefit vegetation by placing limitations on surface-disturbing activities.

Impacts from Management Common to All Action Alternatives

Under Management Common to All Action Alternatives, activities are not permitted in threatened, endangered, or sensitive species habitat that would jeopardize their continued existence. For terrestrial species, this would include impacts to habitat resulting from surface-disturbing activities. These prescriptions for protecting habitat would benefit vegetation by maintaining plant community abundance and diversity and minimizing soil erosion, compaction, and likelihood of noxious weed invasion.

Impacts from the No Action Alternative

Under the No Action Alternative, wildlife habitat management prescriptions outlined in the 1988 RMP would continue across the planning area. These include management efforts to restore and/or reclaim habitat in previously developed areas. Habitat restoration would benefit vegetation, as efforts would be made to return species composition to historical settings and would also assist in restoring connectivity between isolated habitat blocks. This would favor greater native plant diversity and abundance and also minimize adverse impacts to vegetation, such as fragmentation, soil erosion, and compaction,

Impacts from Alternative A

Under Alternative A, vegetation treatments adjacent to special status plant species and habitats would be prioritized. Impacts would vary depending on prioritization criteria and implementation. The treatment of noxious and invasive species would ultimately provide beneficial impacts to native species in treatment areas that may have previously been out-competed by noxious and invasive species.

This alternative would provide greater beneficial impacts compared to the No Action Alternative, which does not provide any guidance on vegetation treatments adjacent to special status plant species and habitats.

Impacts from Alternatives B, C, and D

Impacts under Alternatives B, C, and D would be exactly the same because proposed management prescriptions are identical. Under these three alternatives, proposed management calls for the avoidance of vegetation treatments adjacent to special status plant species. Impacts to vegetation would vary and depend on the characteristics and plant community composition within these adjacent areas. Vegetation in those adjacent areas with prevalent noxious and invasive weeds would receive adverse impacts as plant diversity and native plant abundance would decrease.

Compared to the No Action Alternative, which provides no guidance on vegetation treatments adjacent to special status plant species, impacts may vary and would be contingent upon decisions made by BLM land managers.

Impacts from Riparian/Water Resource Actions on Upland Vegetation/Noxious Weed Management

The goals and objectives of riparian management actions include the restoration of degraded riparian vegetation communities in order to move riparian areas towards proper functioning condition (PFC), all of which would favor greater plant species abundance, diversity, and ecosystem functionality. This would provide indirect beneficial impacts to upland vegetation by reducing the likelihood of noxious weeds invasion and contributing to greater long-term landscape stability and movement towards DPC.

Impacts from Management Common to All

Under management actions common to all alternatives, all surface disturbances, with the exception of riparian enhancement projects, are prohibited in riparian areas and annual biological surveys would be conducted to assess riparian health. The 1997 stipulations on springs would remove livestock, OHVs, and minerals activities from riparian areas, greatly reducing the potential for spread of noxious weeds.

These management actions would reduce adverse impacts to riparian areas and associated vegetation and also reduce the presence and spread of noxious weeds, especially saltcedar. This would provide indirect beneficial impacts to upland vegetation and noxious weeds management as those described above.

Impacts from Management Common to All Action Alternatives

Under management common to all action alternatives, restoration of riparian areas would be prioritized on an as needed basis, resulting in better management and reduced direct adverse impacts to riparian vegetation. This would reduce adverse impacts from noxious weeds, especially saltcedar, and contribute to an indirect increased shift towards DPC for upland vegetation.

Proposed riparian management actions under the action alternatives mainly address the restoration of riparian areas and the restriction of surface-disturbing activities around playas, seeps, and spring headwaters. Buffers placed around springs and playas would provide indirect beneficial impacts to upland vegetation.

Impacts from the No Action Alternative

Under the No Action Alternative, current riparian/wetlands management would continue. Standard conditions used for determining feasibility of saltcedar management, such as location and density of saltcedar stands, available budget and staff to conduct treatments and management objectives, would remain intact under this alternative. Additionally, all stipulations on springs and seeps recorded in the 1997 Amendment to the RMP, including avoidance of future ROW actions, removal of livestock, and implementation of a 656-foot surface disturbance buffer around springs, seeps, and downstream from riparian areas would be carried forward, thus minimizing the spread of noxious weeds.

Impacts from Alternative A

Under Alternative A, restoration of riparian areas would be prioritized on an as needed basis, which would result in better management and would reduce indirect adverse impacts to upland vegetation and noxious weeds management compared to the No Action Alternative. Restoration actions would result in less presence and spread of noxious weeds, especially saltcedar.

Alternative A would protect moderately and highly productive playas and riparian vegetation around and on playas with a 656-foot surface disturbance/occupancy buffer and a 0.25-mile buffer for certain oil, gas, and minerals activities (see Minerals Actions section, above). Low productivity playas would have 328-foot buffers. Such actions would limit the spread of noxious weeds within the vegetation of playas by removing the direct impacts of surface-disturbing activities within playas. Alternative A would also include planting of native vegetation in riparian areas. There would also be a 984-foot surface disturbance buffer for seeps and spring headwaters, further reducing the spread of noxious weeds in riparian areas.

The magnitude of beneficial impacts would be greater under this alternative, compared to the No Action Alternative, which does not provide management stipulations for playas and only requires a 656-foot surface disturbance buffer around seeps and springs. The potential for noxious weeds to spread and colonize would be reduced under this alternative.

Impacts from Alternative B

Under Alternative B, riparian restoration and seeps, springs, and playa buffers would be the same as Alternative A, except that riparian restoration would be prioritized for the Delaware River, springs, the Pecos River, and the Black River, in that order. Grazing would not be allowed in the Black River Management Area, riparian spring areas, within 656 feet of the banks of the Black River on public land outside the Black River Management Area. Dormant season grazing use would be allowed along the Delaware River. Restrictions on OHV use and livestock grazing in springs and seeps would be the same as those described under the No Action Alternative. These actions would help reduce the spread of noxious weeds near playas, seeps, and springs by reducing surface disturbance and would also contribute to DPCs in these areas.

The magnitude of beneficial would be greater under this alternative, compared to the No Action Alternative, which does not provide management stipulations for playas and only requires a 656-foot surface disturbance buffer around seeps and springs.

Impacts from Alternative C

Alternative C would prioritize riparian restoration on an as needed basis like Alternative A. Alternative C would also provide a 656-foot surface disturbance buffer to all playas instead of making the buffer size dependent upon the productivity level of the playa. There would also be an approximately 984-foot surface disturbance buffer for seeps or spring headwaters. Because of the limitations on surface disturbance, all of these management actions would reduce the risk of the spread of noxious weeds in these areas. Seasonal livestock grazing would still be allowed in the Delaware and Pecos River riparian areas if the riparian area associated with the allotment is at PFC.

The magnitude of beneficial impacts would be greater under this alternative, compared to the No Action Alternative, which does not provide management stipulations for playas and only requires a 656-foot surface disturbance buffer around seeps and spring headwaters. Qualitatively, this would be the same impact as described under the No Action Alternative because, in the case of the buffers around seeps and springs, the same type of management action would apply. However, the magnitude of adverse impacts would be smaller due to the greater surface disturbance buffer size.

Impacts from Alternative D

Alternative D would prioritize the establishment of native riparian plants. It would have the same livestock grazing-related protection for riparian areas, as well as the same springs and seeps protections, as those described under Alternative A. Thus, these management actions would have the same impacts as those described under Alternative A.

Unlike the No Action Alternative, however, Alternative D proposes a 656-foot surface disturbance buffer around all playas. This would result in greater beneficial impacts compared to the No Action Alternative, such as minimizing the potential spread of noxious weeds.

Impacts of Wildland Fire and Fuels Management Actions on Upland Vegetation/ Noxious Weeds Management

Impacts from wildland fire management actions may result in a wide range of both direct and indirect impacts to upland vegetation depending on various factors, including departure from historic fire regime reference conditions, type of fire management activity (suppression, management of wildfire to meet resource objectives, prescribed fire) and vegetation type and structure. Prescribed burns would have short-term adverse impacts on upland vegetation by potentially reducing native plant species diversity and thinning out non-target DPC species. Long-term benefits, however, would accrue as the once native or desirable non-native vegetation becomes re-established. Other beneficial long-term impacts would include a more varied habitat structure, multiple age-classes, and openings for forb species recruitment.

Impacts from Management Common to All

Management actions common to all alternatives would include planning and coordination among agencies to restore 19,500 acres to within their historic fire regime reference conditions and to reduce the amount of fuels and also aid in the thinning of trees in overgrown forests. Tree thinning and prescribed burns would be used to manage forests and woodlands. Implementation-level NEPA actions and an approved burn plan would be required before any prescribed fire takes place. Updates to the Fire Management Plan (FMP) would be applied annually or as needed to ensure wildfire suppression priorities and RMP decisions are being effectively implemented.

Impacts from wildland fire management actions would generally be beneficial to upland vegetation communities given that past wildfire suppression has led to overgrown stands of trees and excessive fire fuels over the past century, resulting in high-severity and environmentally catastrophic wildfires. Use of prescribed fire and tree thinning in coniferous forests and woodlands have beneficial impacts to upland vegetation communities in vegetation types where wildfire historically was an important ecological factor maintaining native plant communities, where forests and woodlands are now overgrown from a century of fire suppression, and where native plant species are fire adapted (Allen et al. 2001; Fulé et al. 2001; Troendle et al. 2010). Direct impacts to upland vegetation would include the reduction of conifer forest stand densities, which would be beneficial to the remaining trees and other upland vegetation. Tree thinning would reduce competition among remaining trees for soil, water, and other resources. Remaining stands should be healthier and more resistant and resilient to drought and wildfire impacts. Forest thinning also would enhance other vegetation by opening habitat and resources for herbaceous understory vegetation and increasing the canopy cover, density, and species diversity of understory vegetation.

Additionally, all equipment would be washed prior to entering treatment areas to reduce the potential spread of noxious weeds. Emergency stabilization and rehabilitation actions following wildfires would enhance post-wildfire vegetation recovery. Overall, wildfire management actions would increase the potential for forested upland vegetation communities to trend toward and achieve DPC status.

Impacts from Management Common to All Action Alternatives

All action alternatives would include provisions for working with federal, state, and local partners to identify high priority areas for fuels treatments to reduce high-severity wildfire risk. Fire suppression activities in all SMAs would be managed in accordance with OHV designations. Restrictions on OHV use would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants All action alternatives would protect riparian areas and floodplains by prohibiting the use of applied management prescriptions (prescribed fire included) to take vegetation down to soil or completely consume the vegetation. This would beneficially impact upland vegetation by minimizing soil erosion and sedimentation but may create more long-term adverse impacts if non-native, invasive riparian species, such as saltcedar, are allowed to spread.

Additionally, all action alternatives would avoid prescribed fire within either 0.5 or 1 mile of known bat roosts, which would increase the threat of high-severity wildfire and its impact in these areas.

Impacts from the No Action Alternative

Under the No Action Alternative, current fire management strategies would continue in the planning area. Within the planning area approximately 19,500 acres per year would be treated with prescribed fire. The amount of area to be treated may vary depending on annual rainfall. See the 2004 *Resource Management Plan Amendment for Fire and Fuels Management on Public Land in New Mexico and Texas* (BLM 2004a). Impacts affecting the potential spread of noxious weeds would be the same as those described under Impacts from management common to all except that prescribed fire would not be used to manage saltcedar in riparian areas. By prohibiting prescribed fire as a management tool for saltcedar in riparian areas, the spread of this species would be minimized.

Impacts from Alternative A

Under Alternative A, prescribed fire would not be permitted within 1 mile of known occupied bat roosts from March through August. This would result in smaller areas being treated with prescribed fire and would have indirect adverse effects on upland vegetation communities, as those described at the beginning of this section. A reduction in use of prescribed fire for fuels reduction would have indirect adverse effects on the spread of noxious weeds by increasing the probability of high-severity wildfire.

Compared to the No Action Alternative, which has no restrictions on prescribed burns within areas with occupied bat roosts, the magnitude of beneficial impacts to upland vegetation would be greater than under Alternative A because a greater number of acres would be open for prescribed burn treatments, which would ultimately impart long-term benefits to upland vegetation, as those described at the beginning of this section.

Impacts from Alternative B

Under Alternative B, prescribed fire would not be permitted within 1 mile of known occupied bat roosts from March through August. This would result in smaller areas being treated with prescribed fire and would have indirect adverse effects on upland vegetation communities. This would impart long-term benefits to upland vegetation, as those described at the beginning of this section.

Compared to the No Action Alternative, which has no restrictions on prescribed burns within areas with occupied bat roosts, the magnitude of beneficial impacts to upland vegetation would be greater than under Alternative B because a greater number of acres would be open for prescribed burn treatments. This would impart long-term benefits to upland vegetation, as those described in Impacts from Management Common to All. Wildland fire and fuels management would have the same impacts to the spread of noxious weeds as those described under Alternative A, because the management actions would be the same.

Impacts from Alternative C

Under Alternative C, prescribed fire would not be permitted within 0.5 mile of known occupied bat roosts from March through August. This would result in smaller areas being treated with prescribed fire and would have indirect adverse effects on upland vegetation communities, as described under Impacts from

Management Common to All. Wildland fire and fuels management would have the same impacts to the spread of noxious weeds as those described under Alternative A, because the management actions would be the same.

Compared to the No Action Alternative, which has no restrictions on prescribed burns within areas with occupied bat roosts, the magnitude of beneficial impacts to upland vegetation would be greater than under Alternative C because a greater number of acres would be open for prescribed burn treatments. This would impart long-term benefits to upland vegetation, as described at the beginning of this section.

Impacts from Alternative D

Under Alternative D, prescribed fire would not be permitted within 0.5 mile of known occupied bat roosts from March through August. This would result in smaller areas being treated with prescribed fire and would have indirect adverse effects on upland vegetation communities, as described under Impacts from Management Common to All. Wildland fire and fuels management would have the same impacts to the spread of noxious weeds as those described under Alternative A, because the management actions would be the same.

Compared to the No Action Alternative, which has no restrictions on prescribed burns within areas with occupied bat roosts, the magnitude of beneficial impacts to upland vegetation would be greater than under Alternative D because a greater number of acres would be open for prescribed burn treatments. This would impart similar long-term benefits to upland vegetation as those described at the beginning of this section.

Impacts of Livestock Grazing Actions on Upland Vegetation/Noxious Weeds Management

Domestic livestock grazing may result in adverse impacts to native vegetation communities in arid and semiarid environments of the Southwest (Pieper 1994; Jones 2000) if livestock stocking rates, rotation schemes and utilization levels are not properly managed. Despite proper management, adverse impacts may still occur, though to a lesser degree. Direct adverse impacts could include the selective removal of preferred plant species (generally perennial grasses), soil compaction and increased erosion, contamination of adjacent water bodies, trampling of vegetation, and the potential spread of noxious weeds and other invasive species through equipment, feed products, and on livestock themselves. Indirect adverse impacts may include reduced vegetation cover and increased soil exposure changes in species community diversity and composition, where species that are not preferred by livestock have a competitive advantage over those species preferred by livestock. In addition, those species that are better adapted to trampling and soil compaction would be favored over those species that are not.

Livestock grazing impacts may be minimized by adjusting the densities and movement of livestock to coincide with the optimal grazing tolerance, including species composition and seasonal status of particular plant communities. Grazing management actions that reduce grazing would be the most beneficial to upland vegetation communities. Adaptive grazing management prescriptions may lessen the adverse impacts to upland vegetation communities. Goals of livestock grazing management are to achieve meeting the Standards and Guidelines (BLM 2001a), and to trend upland vegetation communities toward DPC. Grazing intensity would not exceed 45% utilization of total annual plant production.

The number of acres open and closed to livestock grazing varies by alternatives and is presented in Table 4-23.

Table 4-23. Management Acreages Open and Closed to Livestock Grazing by Alternatives

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,086,107	1,598,198	1,937,725	2,083,232	2,087,759
Closed	5,226	493,120	153,583	8,115	3,594

Impacts from Management Common to All

Livestock grazing management actions common to all alternatives would include restrictions such as utilization levels not exceeding 45%, fences, exclosures, rest periods, changes in seasons of use, and changes in stocking rates, all of which would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. Management actions would also include the use of consultation, coordination, range survey data, and resource monitoring when making livestock use adjustments, all of which could help identify and reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. Other management actions that could help identify and reduce the potential for impacts to upland vegetation include allotment-specific objectives, interdisciplinary development and review of proposed actions, and reduction in livestock concentrations in special status species habitat. Vegetation treatments would also be conducted as part of rangeland improvements, which would reduce the spread of noxious weeds and invasive plants in upland vegetation.

Impacts from Management Common to All Action Alternatives

All action alternatives would avoid placing livestock infrastructure in archaeological districts. Fences may be allowed to cross segments of archaeological districts in areas where previous disturbance has occurred after consultation with the New Mexico State Historic Preservation Office (SHPO). Reduced livestock grazing would minimize trampling and direct loss of vegetation, decrease the potential for soil erosion and compaction, and reduce the spread of noxious weeds and invasive plants in these areas. Other grazing management action impacts to upland vegetation and noxious weeds common to all action alternatives would be the same as those described above.

Impacts from the No Action Alternative

Under the No Action Alternative, current management would continue, including the authorization of approximately 350,000 AUMs to 200 permittees and approximately 18,000 AUMs to 62 lessees. These numbers would be supported by quantitative field monitoring, and any future increase or decrease in authorized numbers would need to be backed with similar data. The types of direct and indirect impacts that would be expected would be the same as those described above.

As shown in Table 4-23, under the No Action Alternative, approximately 2,089,107 acres would remain open and 5,226 acres would remain closed to livestock grazing. Thus, upland vegetation on these acres open to livestock grazing would potentially receive adverse impacts as those described above.

Impacts from Alternative A

Alternative A would reduce the total number of acres open to livestock grazing and authorized AUMs would also be reduced by a 10%, which would reduce the direct and indirect adverse impacts to upland vegetation caused by grazing activities. The types of direct and indirect impacts that would be expected would be the same as those described above.

As shown in Table 4-23, Alternative A would have approximately 1,598,198 acres open to livestock grazing and 493,120 acres closed to livestock grazing. This represents a substantial increase in the number of acres closed to grazing, compared to the No Action Alternative. Thus, the magnitude of adverse impacts to upland vegetation from livestock grazing under Alternative A would be smaller than those impacts under the No Action Alternative due to the greater number of acres closed to grazing.

Increased vegetation from restoration efforts, as well as any suspended or inactive AUMs, would be allocated to watershed and wildlife use. This would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. Livestock use would also be deferred in pastures following vegetation treatments until certain monitoring criterion are met, which would also help reduce impacts to upland vegetation, such as trampling and loss of vegetation, soil compaction, increased soil erosion, and the spread of noxious weeds and invasive plants, during the period that grazing is deferred.

Impacts from Alternative B

Compared to the No Action Alternative, Alternative B would reduce the total number of acres open to livestock grazing, which could reduce the direct and indirect adverse impacts to upland vegetation caused by grazing activities. However, Alternative B would authorize the same number of AUMs and have the same monitoring requirements as the No Action Alternative. The types of direct and indirect impacts that would be expected would be the same as those described above.

As shown in Table 4-23, under Alternative B, approximately 1,937,725 acres would be open to livestock grazing and 153,583 acres would be closed. This represents a substantial increase in the number of acres closed to grazing, compared to the No Action Alternative. Thus, the magnitude of adverse impacts to upland vegetation from livestock grazing under Alternative B would be smaller than those impacts under the No Action Alternative due to the greater number of acres closed to grazing.

Increased vegetation from restoration efforts would be allocated to watershed and wildlife use in the LPC, DSL, and aplomado falcon areas. Vegetation would go to livestock use in all other areas. All increased forage/cover would be allocated to watershed and wildlife resources. Half of any suspended or inactive AUMs would also be retired and dedicated to watershed health. Any areas of upland vegetation, areas that are dedicated to watershed or wildlife use, and areas retired from livestock use would be less prone to impacts such as crushing and the spread of noxious weeds and invasive plants. Livestock use would also be deferred for a minimum of two growing seasons following treatments, and longer if the BLM determines that additional rest is needed from monitoring results. Reduced livestock grazing during this period would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Impacts from Alternative C

Compared to the No Action Alternative, Alternative C would reduce the total number of acres open to livestock grazing, which could reduce the direct and indirect adverse impacts to upland vegetation caused by grazing activities. However, Alternative C would authorize the same number of AUMs and have the same monitoring requirements as the No Action Alternative. The types of direct and indirect adverse impacts that would be expected would be the same as those described above.

As shown in Table 4-23, under Alternative C, approximately 2,083,232 acres would be open to livestock grazing and 8,115 acres would be closed. This represents an increase in the number of acres closed to grazing, compared to the No Action Alternative. Thus, the magnitude of adverse impacts to upland vegetation from livestock grazing under Alternative C would be smaller than those impacts under the No Action Alternative due to the greater number of acres closed to grazing.

A total of 16,660 AUMs that are currently inactive or in suspension would be made available to the authorized permittee when resource conditions and vegetation monitoring show that the AUMs can be supported. Retired AUMs would be made available to any applicant who meets the mandatory qualifications and base property requirements set by federal regulations. Allowing livestock grazing in these areas would increase the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

All increased forage/cover would be allocated to watershed and wildlife resources, which would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. Livestock use would be deferred for a minimum of two growing seasons following all treatments. However, if monitoring criteria is met then the pasture could be grazed sooner. The potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants would be reduced while livestock use is deferred, but would be increased when grazing commences.

Impacts from Alternative D

Alternative D would increase the total number of acres open to livestock grazing, which could increase the direct and indirect adverse impacts to upland vegetation caused by grazing activities. However, Alternative D would authorize the same number of AUMs and have the same monitoring requirements as the No Action Alternative. The types of direct and indirect adverse impacts that would be expected would be the same as those described above.

As shown in Table 4-23, under Alternative, approximately 2,087,759 acres would be open to livestock grazing and 3,594 acres would be closed. This represents a slight increase in the number of acres closed to grazing, compared to the No Action Alternative. Thus, the magnitude of adverse impacts to upland vegetation from livestock grazing under Alternative C would be smaller than those impacts under the No Action Alternative due to the greater number of acres closed to grazing.

A total of 16,660 AUMS that are currently inactive or in suspension would be made available to the authorized permittee when resource conditions and vegetation monitoring show that these AUMs can be supported. Retired AUMs would be made available to any applicant who meets the mandatory qualifications and base property requirements set by federal regulations. All increased vegetation from restoration efforts would be allocated to livestock. Allowing livestock grazing in these areas would increase the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

All increased forage/cover would be allocated to watershed and wildlife resources, which would also reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. Livestock use would be deferred for one growing season after vegetation treatments, which would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants during this time.

Impacts of Land Use Authorization Actions on Upland Vegetation/Noxious Weeds Management

Land use authorizations generally include a number of activities and features, such as access roads, transmission lines and pipelines, and their ROWs that would result in surface disturbances and vehicle and equipment transportation, both of which could contribute to adverse impacts to vegetation and the spread of noxious weeds. Potential impacts would include direct loss of vegetation and topsoil, reduced plant diversity, habitat fragmentation, soil compaction, and increased erosion and increased likelihood of noxious weed invasion. Additional impacts to soils and native vegetation would be perpetuated over time by maintenance activities for those features, although mitigation and BMPs in place would help alleviate adverse impacts.

Those areas that are classified as ROW avoidance, exclusion, or open areas would minimize surface disturbances and, therefore, beneficially impact vegetation. The number of acres under each of these categories varies across the alternatives and is depicted in Table 4-24.

Table 4-24. Right-of-way Avoidance, Exclusion, and Open by Alternatives (acres)

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Avoid	30,965	629,149	413,654	313,619	270,360
Exclude	7,056	662,038	918,701	165,378	69,540
Open	2,051,927	798,544	757,380	1,610,692	1,749,782
Total	***2,089,949***	***2,089,731***	***2,089,735***	***2,089,689***	***2,089,682***

Impacts from Management Common to All

Under management common to all alternatives, minor ROWs would be considered in exclusion and avoidance zones on a case-by-case basis. Impacts to vegetation would vary depending on areas under consideration and decisions made by land managers. Generally, the fewer the number of acres managed for ROWs, the less potential for adverse impacts to vegetation and the spread of noxious weeds and invasive plants. In addition, ROWs would be granted only after site-specific analysis and terms and conditions of ROW grants would depend on the sensitivity of the affected resources and applicable laws and regulations established to protect them.

New surface disturbance in dune complexes would not be authorized within DSL habitat. Exceptions to this requirement would be considered based on the proposed surface use and proposed mitigations. By reducing surface-disturbing activities in DSL habitat, plant community composition would remain intact and the potential for the spread of noxious weeds and invasive plants would be reduced.

Whenever possible, facilities would be confined to existing alignments, minimizing width requirements and maximizing multiple occupancy, thereby reducing additional surface disturbance and associated impacts to vegetation and also minimizing the spread of noxious weeds and invasive species.

Impacts from Management Common to All Action Alternatives

Under management common to the action alternatives, all projects for which allocations for land use authorizations are not specified as avoidance or exclusion would be open to consideration of granting ROWs subject to site-specific analysis and stipulations applied at the project level. The degree of impact on vegetation and noxious weed management would vary, depending on the project, its location, and the plant composition of the area.

Additionally, under all of the action alternatives permanent pipelines greater than 4 inches in diameter or greater than 125 pounds per square inch (psi) would be buried with exceptions made for pipeline burial in particular soil types (limestone hills, shallow sites) that would be deemed impractical.

Impacts from the No Action Alternative

Under the No Action Alternative, current management pertaining to land use authorizations would continue, as specified in the guidelines in Appendix 2 of the 1997 Carlsbad RMP Amendment. Approximately 184,201 acres, encompassing six ROW corridors, would remain designated for major new utility and transportation facility alignments across the planning area. A total of 30,965 acres, primarily within SMAs, would remain designated as “avoidance” areas. Approximately 7,056 acres would be designated as exclusion and approximately 2,051,927 acres would remain open (see Table 4-24). Adverse impacts to upland vegetation and noxious weed management, as those described at the beginning of this section, would continue as ROW applications are granted. Mitigation and remediation actions in place, however, would help minimize these impacts.

Under this alternative, any pipelines greater than 4 inches in diameter and any lines with a pressure greater than 125 psi would be buried. The decision to bury pipelines less than 4 inches in diameter would be made on a case-by-case basis. Additionally, terms and conditions of ROW grants would depend on the sensitivity of the affected resources and existing laws and regulations already established to protect them.

Impacts from Alternative A

This alternative proposes the requirement of third-party compliance monitoring on all new ROW construction and reclamation activities throughout the planning area. Compared to the No Action Alternative, which does not require compliance monitoring, the potential risk of adverse impacts as a result of negligence and non-compliance with ROW development stipulations would be reduced. Also, under Alternative A, 629,149 acres would be designated as avoidance and 662,038 as exclusion. Approximately 798,544 acres would remain open across the planning area (see Table 4-24). Compared to the No Action Alternative, which has 7,056 acres designated as exclusion and proposes a 95% decrease in acres designated as avoidance areas, the magnitude of and potential for adverse impacts to upland vegetation and noxious weed management, as those described above, would be smaller under this alternative. Qualitatively, the impacts would be the same.

Stipulations under Alternative A would reduce potential risks resulting from leakage, spills, and subsequent contamination by requiring leak detection and automatic shut-off systems on all hydrocarbon and saltwater pipelines/storage facilities located across the planning area. The No Action Alternative does not propose any similar stipulations and, therefore, poses greater risks of leakage, spills, and contamination of upland vegetation resources in comparison with Alternative A.

Impacts from Alternative B

This alternative proposes the requirement of third-party compliance monitoring on all new ROW construction and reclamation activities throughout the planning area. Compared to the No Action Alternative, which does not require compliance monitoring, the potential risk of adverse impacts as a result of negligence and non-compliance with ROW development stipulations would be reduced. Also, under Alternative B, 413,654 acres would be designated as avoidance and 918,701 acres as exclusion. Approximately 757,380 acres would remain open across the planning area (see Table 4-24). Compared to the No Action Alternative, which has a much lower exclusion acreage designated and proposes a 92% decrease in acres designated as avoidance areas, the magnitude of and potential for adverse impacts to upland vegetation and noxious weed management, as those described above, would be smaller under this alternative. Qualitatively, the impacts would be the same.

Stipulations under Alternative B would reduce potential risks resulting from leakage, spills, and subsequent contamination by requiring leak detection and automatic shut-off systems on all hydrocarbon and saltwater pipelines/storage facilities. The No Action Alternative does not propose any similar stipulations and, therefore, poses greater risks of leakage, spills, and contamination of upland vegetation resources in comparison with Alternative B.

Impacts from Alternative C

Under this alternative, third-party compliance monitoring would be required only in situations where operators have a documented history of non-compliance. Qualitatively, the impact as described under Alternative A would be the same; however, the potential for adverse impacts is greater due to reduced monitoring of ROW development activities. Also, under Alternative C, 313,619 acres would be designated as avoidance and 165,378 as exclusion. Approximately 1,610,692 acres would remain open across the planning area (see Table 4-24). Compared to the No Action Alternative, which has 7,056 acres designated as exclusion and proposes a 90% decrease in acres designated as avoidance areas, the magnitude of and potential for adverse impacts to upland vegetation and noxious weeds management, as those described above, would be smaller under this alternative. Qualitatively, the impacts would be the same.

Stipulations under Alternative C would reduce potential risks from leakage, spills, and subsequent contamination by requiring leak detection and automatic shut-off systems on all hydrocarbon and saltwater pipelines/storage facilities located across the planning area. The No Action Alternative does not propose any similar stipulations and, therefore, poses greater risks of leakage, spills, and contamination of upland vegetation resources in comparison with Alternative C.

Impacts from Alternative D

Potential for impacts would be greatest under Alternative D, which would not require compliance monitoring in relation to ROW construction and reclamation activities across the planning area. Also, under Alternative D, 270,360 acres would be designated as avoidance and 69,540 as exclusion. Approximately 1,749,782 acres would remain open across the planning area (see Table 4-24). Compared to the No Action Alternative, which has 7,056 acres designated as exclusion and proposes an 88% decrease in acres designated as avoidance areas, the magnitude of and potential for adverse impacts to upland vegetation and noxious weed management, as those described above, would be smaller under this alternative. Qualitatively, the impacts would be the same.

Under Alternative D, leak detection and shut-off systems would not be required, thereby increasing the possibility of greater contamination if leaks or spills should occur. Adverse impacts would be the same as those under the No Action Alternative, which also does not require leak detection or shut-off systems.

Impacts of Travel Management and Recreation Management Actions on Upland Vegetation/Noxious Weeds Management

For ease, travel management and recreation have been combined since the primary impact for both is from OHVs. The use of OHVs on areas designated as open to travel would potentially contribute to the spread of noxious weeds as native vegetation becomes more susceptible to trampling. Increased risk of wildfire associated with human activity also would increase with more recreation (especially campfires) activity in upland areas, resulting in the spread of noxious weeds.

OHVs have adverse impacts on vegetation, and wherever OHVs operate, adverse impacts to vegetation would occur (Webb and Wilshire 1983; Ouren et al. 2007). Increased risk of wildfire associated with human activity also would increase with more recreation (especially campfires) activity in upland areas. Designation of WSAs would close those areas to OHVs and would be beneficial to upland vegetation. Equestrian recreation activities have similar adverse impacts to vegetation, but would be largely limited to trail margins. Direct impacts to upland vegetation would be from OHVs that directly crush and destroy vegetation. Human caused wildfire would directly destroy vegetation, and removal of woody vegetation for campfire fuel would destroy woody vegetation. Equestrian trails would cause adverse impacts to corridor vegetation from trampling and grazing and browsing. Indirect impacts from travel and recreation would primarily be physical impacts to soils and loss of existing plants from OHVs will create disturbance conditions that would favor establishment and spread of invasive weeds. Equestrian activities could spread invasive and noxious weeds from contaminated livestock feed (hay). However, the use of certified weed-free hay would be required in all equestrian-oriented SRMAs and ERMAs.

The majority of OHV activities would be in desert areas with sand dunes and playas in the Southern High Plains MLRAs. The vegetation of those areas is particularly sensitive to impacts and lacks resiliency for recovery. OHV actions would have even more adverse impacts to upland vegetation in those MLRAs than other MLRAs of the planning area. Impacts from campfire and equestrian actions would conversely be greatest in woodland and forested areas of the Arizona/New Mexico Mountains MLRA, and riparian areas of low-elevation MLRAs, but riparian management is addressed in another section below. Table 4-25 provides acreages that would be limited or closed to OHV use across alternatives over the entire planning area.

Table 4-25. Travel Management Allocations (acres) by Alternatives

OHV Restrictions	No Action	Alternative A	Alternative B	Alternative C	Alternative D
OHV limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737

Impacts from Management Common to All

Under management common to all alternatives, RAMPs would be prepared for all designated SRMAs. These plans would address levels and types of management actions necessary to achieve the recreation objectives in the RMP.

Additionally, The Black River SRMA (1,275 acres) would be a ROW exclusion area and would be closed to salable mineral development activities, which would reduce the potential for impacts to upland vegetation because surface disturbance from ROWs and mineral development would not occur. OHV and equestrian use would also not be allowed in the SRMA, which would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

The Conoco Lake SRMA (7 acres) would prohibit firewood collection and allow fires in grills only (subject to fire restrictions), which would help reduce the potential for wildfire in upland areas. The SRMA would also be a ROW exclusion area, which would reduce impacts to upland vegetation caused by ROW-related surface disturbance, The Dunes RMZ would have an NSO stipulation on active dunes and developed areas for future leases, which would reduce impacts to upland vegetation from surface disturbance caused by minerals development. It would also be managed as a ROW exclusion area on dunes and a ROW avoidance area elsewhere. The fewer the acres managed for ROW, the less potential for impacts to upland vegetation from ROW-related surface disturbance.

The Trails RMZ would limit travel to existing routes and expand routes on a case-by-case basis. The fewer the number of trails present, the less potential for adverse impacts to upland vegetation, such as crushing, compaction, and the spread of noxious weeds and invasive plants. The area would be managed as open with moderate constraints for leasable development and open with special terms and conditions for salable development, so the fewer the number of acres managed for mineral exploration and development, the less potential for adverse impacts to upland vegetation from surface disturbances caused by these activities.

Phantom Banks Heronries would be designated as limited to OHV use and a plan would be implemented to protect active heronries through seasonal limitations to designated routes. Emergency OHV limitations may also be imposed in problem areas. Restrictions on OHV access would reduce the potential for the impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Within the planning area, motorized wheeled cross-country travel would be allowed for any military, fire, search and rescue, or law enforcement vehicles used for emergency purposes. Allowing motorized access would increase the potential for adverse impacts to upland vegetation, such as crushing, soil compaction, reduced vegetation health and vigor, and the spread of noxious weeds and invasive plants.

Motorized wheeled cross-country travel for lessees and permittees would be limited to the administration of a BLM lease or permit. Lessees and permittees would not be allowed to drive cross-country for the purposes of hunting, fishing, recreation, or other purposes not directly related to the administration of their federal permit or lease. Restrictions on motorized travel would reduce the potential for adverse impacts to upland vegetation, such as those previously described.

Management actions common to all that would not affect upland vegetation include actions that focus on other resources, such as public safety protections (e.g., OHV flags and signage), NSO on bike trails, VRM objectives, restrictions on weapons, restrictions on swimming, restrictions on fishing, restrictions on pets, sound restrictions, boating restrictions, and protection of cultural and paleontological resources.

Impacts from Management Common to All Action Alternatives

Camping would be prohibited within 900 feet of any natural or human-made water source (excluding the Pecos River). Limiting camping access could help reduce impacts to upland vegetation, such as trampling, crushing and the spread of noxious weeds and invasive plants, where applicable.

Roads would be constructed and maintained per BLM's *Surface Operating Standards and Guidelines for Oil and Gas Development - The Gold Book* (BLM 2007a). Properly constructed and maintained roads would reduce the potential for impacts to upland vegetation from surface disturbance caused by road construction.

Trails would be designated within the Black River SRMA, including extending trails to Ladder Hole from the parking area. These trails would be for non-motorized use only. Increasing the number of trails would increase the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. However, restrictions on motorized use would help limit the potential for impacts to upland vegetation caused by OHVs, such as crushing and the spread of noxious weeds and invasive plants.

Hackberry Lake would be managed as an SRMA. Other uses would be subject to the existing COAs in place to protect the OHV user recreational experience (e.g., burying surface pipelines under existing trails). This alternative would look to create new trails and facilities for the OHV user experience. Increasing the number of OHV trails would increase the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Trails in the La Cueva SRMA (1,565 acres) would be limited to non-motorized use only (43 CFR 8341.1). Restrictions on motorized use would help reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. The SRMA would be designated as open to ROWs under all alternatives but Alternative B where it would be an exclusion area. The fewer the acres managed for ROW, the less potential for impacts to upland vegetation from ROW-related surface disturbance. It would be managed with default mineral allocations. The fewer the acres managed for mineral exploration and development, the less potential for impacts to upland vegetation from surface disturbance caused by these activities. The SRMA would also be open to grazing, which would increase the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Impacts from the No Action Alternative

As shown in Table 4-25, under the No Action Alternative, approximately 2,035,307 would be managed as OHV limited. Approximately 55,966 acres would remain closed. The types of direct and indirect impacts that would be expected in areas of OHV use are described at the beginning of this section.

Management actions regarding campfires, firewood gathering, and equestrian activities would remain unchanged from the 1988 RMP. Thus, impacts to upland vegetation from campfires, firewood gathering, and equestrian activities would be a continuation of the trends under existing conditions. The types of direct and indirect impacts that would be expected from campfires, firewood gathering, and equestrian activities are described at the beginning of this section.

Alkali Lake would be managed as an OHV area (944 acres). Special oil and gas stipulations would remain in place, which would continue to protect OHV trails and camping areas from all development authorizations in the area. Alkali Lake would continue to require special recreation permits for competitive or commercial motorcycle events and management under full fire suppression would also continue.

OHV use would increase the potential for impacts to upland vegetation, such as crushing, compaction and the spread of noxious weeds and invasive plants. It would also be managed with 944 acres open for ROW development. The fewer the acres managed for ROWs, the less potential for impacts to upland vegetation from ROW-related surface disturbance.

Approximately 53,573 acres of the Hackberry Lake SRMA would be managed as limited to existing travel and 53,573 acres of the SRMA would be managed as OHV limited. The fewer the acres open to travel and the more restrictions on trial use, the less potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Pecos River Corridor would be managed as an SRMA and surface disturbance would be restricted throughout the SRMA to reduce erosion and minimize impacts to upland habitat. Reducing surface disturbance would reduce the potential for the impacts to upland vegetation. Approximately 122 acres around the Red Bluff Reservoir would be closed to OHV use, and the remaining 4,809 acres would be managed as OHV limited. Restricting OHV use would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

West Wells Dune (624 acres) would not be managed as an ERMA but would be managed with entire acreage open for ROW development. The fewer the acres managed for ROWs, the less potential for impacts to upland vegetation caused by ROW-related surface disturbance.

Dispersed use would be allowed in the Pecos River ERMA (11,207 acres), but no developed trails would be allowed. Likewise, dispersed use would be allowed in the Hay Hollow area (12,913 acres), but no trails would be developed. The fewer the number of trails present, the less potential for adverse impacts to upland vegetation, such as crushing, compaction, and the spread of noxious weeds and invasive plants.

Impacts from Alternative A

Under Alternative A, approximately 2,039,299 acres would be OHV limited and 52,028 acres would be closed (see Table 4-25). The magnitude of adverse impacts would be similar to the No Action Alternative. The types of direct and indirect impacts that would be expected in areas of OHV use are described at the beginning of this section.

Restrictions on campfires and firewood gathering would be applied in riparian areas. Thus, upland vegetation and noxious weeds management would continue to experience direct and indirect adverse impacts from these activities. Equestrian activities would not be permitted in riparian areas on the Pecos, Delaware, and Black Rivers, as well as on perennial springs and seeps. Thus, upland vegetation would continue to experience direct and indirect adverse impacts from equestrian activities. The types of direct and indirect impacts that would be expected from campfires, firewood gathering, and equestrian activities are described under Impacts from Management Common to All above.

Alkali Lake (318 acres) would be managed as an SRMA and would be a ROW exclusion area on dunes and a ROW avoidance area elsewhere. The fewer the acres managed for ROW, the less potential for the spread of noxious weeds and impacts to upland vegetation from ROW-related surface disturbance. Special oil and gas stipulations would be applied to protect approved OHV trails and camping areas to all development authorizations within the area. The fewer the acres managed for mineral exploration and development, the less potential for spread of noxious weeds and impacts to upland vegetation from surface disturbance caused by these activities.

The Pecos River Corridor SRMA (9,136 acres) would be managed to provide recreation opportunities on public land parcels with an emphasis on natural and scenic qualities. Travel in the SRMA would be limited to existing routes, which would help limit impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. The SRMA would be managed as open with major constraints for fluid leasables and closed to locatable and salable development. The more restrictions on mineral exploration and development, the less potential for adverse impacts to upland vegetation from surface disturbance caused by these activities. The SRMA would be prioritized for brush control and weed treatments, which would help protect upland vegetation from the spread of noxious weeds and invasive plants.

Under Alternative A, West Well Dunes management would be the same as under the No Action Alternative in relation to mineral development and ROW construction. Travel in the area would be limited to existing trails/dunes, which would help limit the impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Square Lake (2,975 acres) would be managed as an ERMA and would provide for limited OHV play experiences on open dunes while restricting travel to designated routes between dunes. The ERMA would be closed to camping during the LPC breeding season (March 1–June 15, 3:00–9:00 a.m.). Restricting camping activities would reduce the potential for impacts to upland vegetation where applicable during this period, such as crushing and the spread of noxious weeds and invasive plants. OHVs would be limited to designated routes between dunes, which would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. Approximately 2,973 acres would be open with moderate constraints to leasable and salable mineral development. Approximately 2,973 acres would be open for locatable mineral development under this alternative. The more acres managed for mineral exploration and development, the greater potential for impacts to upland vegetation from surface disturbance caused by these activities.

The Pecos River Equestrian Trail and Hay Hollow Equestrian ERMAs would be managed the same as is described under the No Action Alternative.

Impacts from Alternative B

Under Alternative B, approximately 2,049,391 acres would be OHV limited and 41,936 acres would be closed (see Table 4-25). Thus, Alternative B would have similar impacts to upland vegetation from OHV use compared to the No Action Alternative. The types of direct and indirect impacts that would be expected in areas of OHV use are at the beginning of this section.

Restrictions on campfires and firewood gathering would be applied in certain riparian areas. Thus, upland vegetation would continue to experience direct and indirect adverse impacts from these activities. Equestrian activities would be restricted to existing trails in riparian areas on the Pecos and Delaware Rivers, as well as perennial springs and seeps. The Black River would be closed to equestrian activities. Thus, upland vegetation would continue to experience direct and indirect adverse impacts from equestrian activities. The types of direct and indirect impacts that would be expected from campfires, firewood gathering, and equestrian activities are described under Impacts from Management Common to All above.

Alkali Lake would be managed as SRMA, with the same prescriptions as Alternative A.

Square Lake (2,975 acres) and West Well Dunes (624 acres) would be managed as ERMAs. Travel in the ERMA would be limited to designated trails/dunes and trails would be expanded on case-by-case basis. Restrictions on travel would reduce the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. Entire acreage of West Well Dunes would be closed to leasable and salable mineral development, and 624 acres would be withdrawn to locatable mineral development. It would be closed entirely to ROW development. The fewer the acres managed for ROW and mineral development, the less potential for impacts to upland vegetation from surface disturbance caused by these activities.

The Pecos River Equestrian Trail would be managed as an ERMA. Certified weed-free hay would be required in the ERMA, which would reduce the potential for impacts to upland vegetation from the spread of noxious weeds and invasive plants. The ERMA would be a ROW avoidance area. The fewer the acres managed for ROWs, the less potential for impacts to upland vegetation from ROW-related surface disturbance. New trails would be designated/constructed in combination with existing trails, excluding the Delaware River portion of the ERMA. An increased number of trails would increase the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. No motorized or mechanized use would be allowed on single-track portions of the equestrian trail. The more restrictions on motorized and mechanized travel, the less potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Hay Hollow equestrian trail (12,913 acres) would be managed as an ERMA, with potential trail and facility development. The use of certified weed-free hay would be required in the ERMA, which would reduce the potential for impacts to upland vegetation from the spread of noxious weeds and invasive plants. The ERMA would be open to grazing, which would increase the potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants. Approximately 5,617 acres would be open with standard terms to leasable, salable and locatable mineral development. The fewer the acres managed for mineral exploration and development, the less potential for impacts to upland vegetation from surface disturbance caused by these activities. COAs for ROWs would also be applied to the ERMA, though entire acreage would be open to ROW development. The more restrictions on ROWs in place, the less potential for impacts to upland vegetation from ROW-related surface disturbance.

Impacts from Alternative C

Under Alternative C, approximately 2,052,582 acres would be OHV limited and 38,738 acres would be closed. This is the least amount of acreage that would be closed under all the alternatives except for Alternative D, which proposes to close 38,737 acres to OHV use (see Table 4-25). Thus, Alternative C would have more impacts to upland vegetation from OHV use than the No Action Alternative. The types of direct and indirect impacts that would be expected in areas of OHV use are described at the beginning of this section.

Impacts to upland vegetation from campfires and firewood gathering would be the same as those under Alternative B, because the management actions would be the same.

Any ROWs proposed in the EMRA would have to adhere to COAs for ROWs (see Appendix O). The fewer the acres managed for ROWs, the less potential for impacts to upland vegetation from ROW-related surface disturbance.

West Well Dunes and the Pecos River Equestrian Trail would be managed as ERMAs with the same prescriptions described under Alternative B.

The Hay Hollow Equestrian ERMA would be managed the same as is described under the No Action Alternative.

Square Lake (5,285 acres) would be managed as an ERMA with the same prescriptions as described under Alternative A.

Impacts from Alternative D

Under Alternative D, approximately 2,052,584 acres would be managed as OHV limited and 38,737 acres as closed, which is the least amount of acreage closed under all the alternatives (see Table 4-25). Thus, Alternative D would have more impacts to upland vegetation from OHV use than the No Action Alternative. The types of direct and indirect impacts that would be expected in areas of OHV use are described at the beginning of this section.

Impacts to upland vegetation from campfires, firewood gathering, and equestrian activities would be the same as those described under Alternative B, because the management actions would be the same.

Pecos River Equestrian Trail ERMA would designate/construct new trail in combination with using existing trails, with no motorized or mechanized use allowed on single-track portions of the equestrian trail. The more restrictions on motorized and mechanized travel near riparian areas, the less potential for impacts to upland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

West Well Dunes (624 acres) would be managed as an ERMA with the same prescriptions described under Alternative B.

Impacts of Special Designations on Upland Vegetation/Noxious Weeds Management

Special designations would provide beneficial impacts to upland vegetation resources and noxious weed management if they impart restrictions on surface-disturbing activities within their boundaries. Restrictions on surface-disturbing activities associated with various land use activities, such as mineral development, livestock grazing, and OHV use, would minimize the potential spread of noxious weeds and other adverse impacts to vegetation resources located within these special designation areas.

Impacts of Areas of Critical Environmental Concern Management Actions on Upland Vegetation/Noxious Weeds Management

ACECs are managed to protect relevant and important values and would benefit upland vegetation communities when there are surface disturbance restrictions in place, for example restrictions on mineral development, livestock grazing and/or OHV use. These surface-disturbing activities would impact upland vegetation by potentially affecting the relative abundance and relative distribution of species within plant communities and reducing the overall vegetative cover. Indirect adverse impacts from surface disturbance on vegetation would include soil compaction, erosion, sedimentation, and an increased likelihood of noxious weed invasion.

Impact analysis from ACEC management actions on upland vegetation was based on the number of acres within ACECs that are proposed for closure to livestock grazing, mineral development, and OHV use. Table 4-26 below presents the number of acres closed to all three of these land use activities, bearing the assumption that the greater number of acres closed would equate to a reduction in potential adverse impacts to upland vegetation and spread of noxious weeds.

Table 4-26. Number of Acres Closed to Livestock Grazing, Mineral Development, and OHV Use Activities within ACECs where Designated

Land Use	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres designated as ACECs	13,435	495,042	561,433	98,562	28,894
Total acres closed to grazing	0	449,747	135,480	5,735	201
Acres closed to OHV use	5,052	6,208	6,647	5,589	4,254
Acres of NSO and closed to leasable mineral development	11,997	422,462	494,794	44,683	28,894
Acres closed to salable mineral development	12,613	197,644	298,343	44,824	26,468
Acres recommended for withdrawal from locatable mineral development	13,434	96,781	154,915	43,878	26,470

Impacts from Management Common to All

There are no proposed management actions for ACECs listed under impacts from management common to all alternatives.

Impacts from Management Common to All Action Alternatives

There are no proposed management actions for ACECs listed under impacts from management common to all action alternatives.

Impacts from the No Action Alternative

Under the No Action Alternative, current ACEC designations would continue as outlined in the 1988 RMP. Six existing ACECs, totaling 13,435 acres (see Table 4-26), would continue to be managed under this alternative with no additional ACECs designated. Under this alternative, approximately 89% of the total ACEC acreage would remain designated as NSO/closed to leasable mineral exploration and development, although the majority of acreage would remain open to salable and locatable mineral development (see Table 4-26). Under the No Action Alternative, 5,052 acres would remain closed to OHV use, and 7,556 acres would be limited, while grazing would remain open on all of the 13,435 acres currently managed as ACECs within the planning area.

Adverse impacts, such as soil compaction and degradation, as well as direct vegetation removal potential increase in noxious weeds would continue within these ACEC acreages.

Impacts from Alternative A

Under Alternative A, approximately 495,042 acres would be designated under ACECs (see Table 4-26). This would mark a substantial increase in ACEC-designated acres compared to the approximately 13,516 acres designated under the No Action Alternative. Livestock grazing would be prohibited in the Carlsbad Chihuahuan Desert Rivers and Pecos Bluntnose Shiner ACECs, and reduced within the Gypsum Soils ACEC. All in all, 449,747 ACEC acres (90%) would be closed to grazing.

Under this alternative, 422,464 (85%) acres of total ACEC acreages would be designated as NSO/closed to leasable mineral development and 96,781 acres (19%) withdrawn from locatable mineral development. Additionally, 1% of total ACEC acreage would be closed to OHV use.

Qualitatively, adverse impacts associated with surface-disturbing activities would be the same as those described under the No Action Alternative; however, the magnitude of the impacts would be smaller under this alternative due to the larger number of ACEC designated acres closed to the major surface-disturbing activities depicted in Table 4-26.

Impacts from Alternative B

Under Alternative B, 561,433 acres would be designated under ACECs, representing a significantly sizable increase in the number of acres designated compared to the No Action Alternative. Of this ACEC acreage, 494,794 (88%) acres would be designated as NSO/closed to leasable minerals development and 154,915 acres (27%) would be recommended for withdrawal from locatable mineral development (see Table 4-26). Additionally, livestock grazing would be prohibited on 135,480 ACEC acres (27%) and 540,220 acres would be OHV limited and 6,647 acres (1.0%) would be closed to OHV use. Adverse impacts, such as soil compaction and degradation, as well as vegetation removal and increase in noxious weeds would be minimized within these ACECs.

Qualitatively, adverse impacts associated with surface-disturbing activities would be the same as those described under the No Action Alternative; however, the magnitude of the impacts would be smaller under this alternative due to the larger number of ACEC designated acres closed to the major surface-disturbing activities depicted in Table 4-26.

Impacts from Alternative C

Under Alternative C, approximately 98,563 acres would be designated under ACECs. This would represent a substantial increase in the number of acres designated compared to the No Action Alternative. Under this alternative, 44,683 acres of ACEC acreages would be designated as NSO/closed to leasable minerals development (45%) and 43,878 acres recommended for withdrawal (44%) from locatable minerals development; 5,735 acres closed to livestock grazing (6%), and 88,052 acres (89%) would be OHV limited and 5,589 acres (6%) would be closed to OHV use (see Table 4-26). Adverse impacts, as those described above, would be minimized within these ACECs.

Qualitatively, adverse impacts associated with surface-disturbing activities would be the same as those described under the No Action Alternative; however, the magnitude of the impacts would be smaller under this alternative due to the larger number of ACEC designated acres closed to the major surface-disturbing activities depicted in Table 4-26.

Impacts from Alternative D

Under Alternative D, five ACECs representing 28,894 acres would be designated, representing a moderate increase in the number of ACEC acres compared to the No Action Alternative. Under this alternative, 28,894 ACEC acreages would be designated as NSO/closed to leasable mineral development and 26,470 acres (91%) would be recommended for withdrawal from locatable mineral development, 201 acres (0.7%) would be closed to livestock grazing, and 22,970 acres (79%) would limit travel to existing routes and 4,254 acres (15%) would be closed to OHV use.

Qualitatively, adverse impacts associated with surface-disturbing activities would be the same as those described under the No Action Alternative; however, the magnitude of the impacts would be smaller under this alternative due to the larger number of ACEC designated acres closed to the major surface-disturbing activities depicted in Table 4-26.

Impacts of Wilderness Study Areas on Upland Vegetation/Noxious Weeds Management

Impacts from Management Common to All

All vegetation resources within the four designated WSAs would benefit from additional protection through special management requirements, including a closed designation for all future leases and no reissuing of current leases once expired, which would enhance and preserve its wilderness values, including plant communities within the unit. In addition, new permanent facilities and new surface disturbance would be prohibited, all of which would reduce adverse impacts to vegetation and noxious weed management within the units, including increased soil erosion and compaction, a reduction in plant cover, health and vigor, decreased native plant diversity, a potential increase in noxious weeds, decreased habitat fragmentation, and loss of pollinators and pollinator habitat.

Impacts from Management Common to All Action Alternatives

There are no proposed decisions listed under management common to all action alternatives.

Impacts from the No Action Alternative and Alternatives A through D

Under the No Action Alternative, the four WSAs would remain under their current designation and managed accordingly under prescriptions outlined in BLM Manual 6330, Management of Wilderness Study Areas (BLM 2012c), such as closed to all future leasing or NSO designations, closed to salables, withdrawn from locatables, OHV limited, closed or excluded from renewable energy, and designated as VRM Class I and as a ROW avoidance area. These management prescriptions would continue to minimize adverse impacts to upland vegetation resources and noxious weeds management through restrictions on surface-disturbing activities.

Impacts of Wilderness Study Area Management if WSAs Are Released from Designation on Upland Vegetation/Noxious Weeds

Impacts from Management Common to All

Impacts would be the same as those stated in Impacts of Management Common to All in the Impacts of Wilderness Study Areas on Upland Vegetation/Noxious Weeds Management section.

Impacts from the No Action Alternative

Impacts would be the same as those stated in the Impacts from the No Action Alternative in the Impacts of Wilderness Study Areas on Upland Vegetation/Noxious Weeds Management section.

Alternatives A, B, and C

If the WSA designation is removed, the four previously designated WSAs would be managed as closed to leasable and salable development and recommended for withdrawal from locatable development. Adverse impacts under these three alternatives would be comparable to those under the No Action Alternative and as described under management common to all.

Alternative D

Under Alternative D, adverse impacts resulting from loss of WSA designation would be greater than those found under the other alternatives because management prescriptions would be less stringent for surface-disturbing activities. Unlike the other four alternatives, leasable mineral development would be open with major constraints, salable mineral development would be open with special terms and conditions and the areas would be open for locatable development. In addition, the proposed VRM class on these lands would be Class III.

Adverse impacts, as those described under management common to all alternatives, would be greater under Alternative D compared to the No Action Alternative and also compared to Alternatives A through C.

Impacts of Wild and Scenic Rivers on Upland Vegetation/Noxious Weeds Management

Impacts from Management Common to All

There are no proposed management decisions common to all alternatives that would significantly impact vegetation because management prescriptions here address decisions made in Congress pertaining to WSR designations.

Impacts from Management Common to All Action Alternatives

Under management common to all action alternatives, the Black River would be recommended as suitable for inclusion in the NWSRS and would be given the same management prescriptions as other WSR areas, including a VRM Class I classification. Beneficial impacts vegetation would result, as the WSR designation would limit surface-disturbing activities that would potentially result in adverse impacts to these vegetation, such as alterations in plant community composition, direct removal of native plant species, increased erosion, compaction, and likelihood for noxious weed invasion.

Impacts from the No Action Alternative

Under the No Action Alternative, the Black River would continue to not be managed as part of the NWSRS but would be managed to maintain eligibility as a WSR until a suitability determination is made during the RMP process. The Black River would be managed with the following management prescriptions: designation as VRM Class III, closed to salable development, recommended for withdrawal from locatable mineral development, and with leasables open with major constraints. All ROW construction would continue to be designated under “avoidance” within WSR areas and all renewable energy development would not be allowed. The Delaware River would also not be managed as part of the WSR but would be managed to maintain its eligibility until a suitability determination is made during the RMP process. The Delaware River would be managed with various prescriptions, such as classifying certain segments of the river under VRM Class II and IV, closing or excluding areas adjacent to the river to renewables development, managing as NSO for leasable mineral development and closed to salable development, recommending for withdrawal from locatable development, and managing as ROW avoidance area.

Impacts from Alternatives A, B, and C

Under these three alternatives, WSR areas would be managed with the following prescriptions: VRM Class II, travel limited to designated routes, closed to leasable and salable mineral development, recommended for withdrawal from locatable mineral development, and excluded from both ROW development and renewable energy projects. All of these prescriptions would minimize surface disturbance and, therefore, reduce adverse impacts to upland vegetation resources and noxious weeds management. The potential for adverse impacts to upland vegetation and noxious weeds management would be expected to be reduced under this alternative compared to the No Action Alternative due to ROW exclusions and managing the entire area as VRM Class II.

Impacts from Alternative D

Under Alternative D, management prescriptions would be the same as those under Alternatives A, B, and C with the exception of the allowance of leasable development open with major constraints on WSR lands. The potential for adverse impacts to upland vegetation and noxious weeds management would be expected to be reduced under this alternative compared to the No Action Alternative due to ROW exclusions and managing as VRM Class II.

Impacts of Lands with Wilderness Characteristics Actions on Upland Vegetation/ Noxious Weeds Management

Those upland vegetation resources located within lands with wilderness characteristics being managed to protect wilderness characteristics would receive beneficial impacts as a result of additional management prescriptions aimed at further minimizing surface disturbances. The greater the number of acres managed to protect lands with wilderness characteristics, the greater the benefit to upland vegetation.

When units are managed to emphasize multiple uses while applying some protective management (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics, there would be some long-term benefits to vegetative communities, but it would depend on the prescriptions for the individual units. See Section 4.2.9 Lands with Wilderness Characteristics for details. Where lands with wilderness characteristics units are managed to emphasize other multiple uses as a priority over protecting wilderness characteristics, ground-disturbing activities such as minerals development may still be allowed and would offer less protection to vegetation communities.

The amount of acreages that would be managed to protect wilderness characteristics varies by alternative and are represented in Table 4-27.

Table 4-27. Number of Acres of Lands with Wilderness Characteristics and Level of Management under Each Alternative

Management Level	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Protects wilderness characteristics	*N/A	66,666	47,611	5,119	1,221
Emphasizes other multiple uses while applying some protective management	*N/A	0	18,964	30,595	0
Emphasizes other multiple uses	*N/A	0	0	30,862	65,446

*There would be no units managed lands with wilderness characteristics under the No Action Alternative.

Impacts from Management Common to All

There are no decisions listed under management common to all.

Impacts from Management Common to All Action Alternatives

Upland vegetation resources occurring on lands with wilderness characteristics would receive indirect positive impacts as a result of applicable management prescriptions, including closure to leasing or NSO stipulations; restrictions on the construction of new roads, structures, and facilities not related to the preservation and enhancement of wilderness characteristics; and vehicular use limited to designated routes only. As a result of these management prescriptions, beneficial impacts to upland vegetation resources would include a reduction in erosion and compaction and a reduction in amount of native vegetation cover lost to surface disturbance. Additionally, the likelihood of noxious weed invasion as a result of surface disturbance would be minimized.

Impacts from the No Action Alternative

Under the No Action Alternative, upland vegetation resources and noxious weed management would not receive any beneficial impacts because no acreage would be managed as lands with wilderness characteristics, and therefore no upland vegetation resources would benefit from management prescriptions, as described above, specific to lands with wilderness characteristics.

Impacts from Alternative A

Under Alternative A, the BLM would manage 66,666 acres to protect lands with wilderness characteristics. Associated management prescriptions would benefit upland vegetation by closing all lands with wilderness characteristics s to future leases, withdrawing all acres from locatables and salables, excluding ROWs, and limiting travel to existing routes. Chemical vegetation treatments would be allowed and would impart beneficial impacts to upland vegetation by eliminating competition with invasive, noxious species within lands with wilderness characteristics and would move the plant communities toward ecological objectives and desired long-term conditions. Other beneficial impacts resulting from these management prescriptions would include decreased erosion, sedimentation, and potential for noxious weed invasion.

Compared to the No Action Alternative, which manages no lands with wilderness characteristics and does not propose any new management prescriptions (including those that would address noxious weeds control), the magnitude of beneficial impacts to upland vegetation and noxious weed management is much greater under Alternative A.

Impacts from Alternative B

Under Alternative B, the BLM would designate 47,611 to protect lands with wilderness characteristics, approximately 18,964 acres to emphasize other multiple uses while applying some protective management and zero acres to emphasize other multiple uses.

Compared to the No Action Alternative, which manages no lands with wilderness characteristics and does not propose any new management prescriptions (including those that would address noxious weeds control), the magnitude of beneficial impacts to upland vegetation is much greater under Alternative B.

Impacts from Alternative C

Under Alternative C, the BLM would manage to protect wilderness characteristics on 5,119 acres, approximately 30,595 acres to emphasize other multiple uses while applying some protective management, and 30,682 acres to emphasize other multiple uses.

Compared to the No Action Alternative, which manages no lands with wilderness characteristics and does not propose any new management prescriptions (including those that would address noxious weeds control), the magnitude of beneficial impacts to upland vegetation is much greater under Alternative C.

Impacts from Alternative D

Under Alternative D, the BLM would manage to protect wilderness characteristics on 1,221 acres, approximately zero acres to emphasize other multiple uses while applying some protective management, and 65,446 acres to emphasize other multiple uses.

Compared to the No Action Alternative, which manages no lands with wilderness characteristics and does not propose any new management prescriptions (including those that would address noxious weeds control), the magnitude of beneficial impacts to upland vegetation is slightly greater under Alternative D.

Impacts of Fish and Wildlife Actions on Upland Vegetation Resources/Noxious Weeds Management

Fish and wildlife management actions would indirectly benefit upland vegetation resources and weed management if species management stipulations prohibited surface-disturbing activities. NSO stipulations to protect wildlife habitat from surface-disturbing activities, route closures to reduce road density and habitat fragmentation, and travel restrictions on motorized and mechanized travel would all benefit vegetation by reducing adverse impacts, such as loss of vegetation cover, reduced plant species abundance and diversity, soil erosion and compaction, and an increase in noxious weed invasion.

Impacts from Management Common to All

Upland vegetation resources and noxious weeds management would potentially benefit from habitat improvement projects (identified through HMPs), which would be implemented where necessary to stabilize and improve declining habitat conditions.

Stipulations contained in Appendix C provide for a 1,312-foot surface disturbance buffer around all caves with active bat roosts. This would contribute to a greater protection upland vegetation resources around these caves. In addition, plant communities that fall within Phantom Banks Heronries and other areas managed specifically for habitat improvement projects would benefit from minimized surface disturbance and subsequent impacts. Upland vegetation resources may also receive some benefits from a 1,312-foot buffer prohibiting surface-disturbing activity if located near trees with active raptors nests.

Impacts from Management Common to All Action Alternatives

Under all of the action alternatives, the BLM would implement various wildlife management prescriptions that would indirectly benefit vegetation and noxious weeds management. These would include the promotion of wildlife movement corridors, which would minimize surface disturbances, the creation of HMPs to ensure the enhancement of several vegetation communities and habitat types across the planning area, and seasonal restrictions on all surface-disturbing activities within approximately 252 acres or a 0.25-mile radius around active heronries. These prescriptions would help minimize adverse impacts associated with surface disturbance, such as a decrease in ground cover and a reduction in plant diversity and abundance, reduced habitat fragmentation, and increased likelihood of noxious weeds invasion.

Impacts of Minerals Actions on Upland Vegetation/Noxious Weeds Management

Minerals management actions include the fluid leasable minerals oil and gas; the solid leasable mineral potash; locatable minerals gypsum, copper, gold, uranium, etc.; and salable minerals sand, gravel, rock, etc. Minerals actions would cause soil surface disturbances that would directly and indirectly adversely affect upland vegetation. Surface disturbance associated with minerals actions would directly remove surface vegetation, thereby substantially altering the plant community composition, increasing potential for erosion and soil compaction and increasing the likelihood for the invasion of noxious weeds. Reclamation of disturbed sites would be required, although a return to pre-disturbance conditions may take years to achieve (Monsen et al. 2004). While the RFD assumes that reclamation of disturbance would be successful within a scope of 10 years, it does note that reclamation times would be dependent on soils, vegetation, and rainfall (BLM 2005). Revegetation is especially difficult in desert shrub habitats, because soils are shallow and highly saline, and moisture availability is relatively low (Monsen et al. 2004). As a result, many of the adverse impacts resulting from surface disturbances associated with well pads, access roads, and minerals infrastructure would be long term and, in some cases, irrevocable.

Table 4-28. Planned Acreages Closed, Open with Major or Moderate Constraints and Recommended for Withdrawal across Leasable, Salable and Locatable Mineral Exploration Management Actions across Alternatives for BLM Surface Lands

Leasables Management Decisions	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open with standard terms and conditions	1,598,870	1,142,802	1,089,481	1,750,774	1,997,681
Open with moderate constraints	956,410	799,649	449,759	786,381	631,634
Open with major constraints (NSO)	54,602	80,394	162,013	158,401	70,142
Closed	174,391	761,404	1,082,972	88,502	84,687
Total	***2,784,273***	***2,784,248***	***2,784,224***	***2,784,058***	***2,784,145***
Salables Management Decisions					
Open	2,637,465	1,160,064	1,121,118	1,784,431	2,028,324
Open with special terms and conditions	–	1,062,192	726,270	752,286	602,621
Closed	146,568	561,995	936,799	247,323	153,174
Total	***2,784,033***	***2,784,251***	***2,784,186***	***2,784,041***	***2,784,119***
Locatables Management Decision					
Open to mineral entry	2,751,856	2,403,114	2,110,098	2,651,855	2,661,705
Recommended (or previously recommended) for withdrawal	32,374	380,990	673,996	132,249	122,444
Total	***2,784,229***	***2,784,105***	***2,784,094***	***2,784,104***	***2,784,149***

Table 4-29. Predicted Number of Wells and Surface Disturbance from Planned Leasable Mineral Activities (oil and gas wells)

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Number of predicted wells on **BLM-administered surface lands only** (based on % of land open to surface disturbance)	5,874	4,465	3,538	5,832	6,044
Total predicted surface disturbance/acres on **BLM-administered surface lands only**	11,515	8,753	6,936	11,434	11,849

Impacts from Management Common to All

The BLM would encourage and facilitate the development of public land mineral resources so that national and local needs are met, and environmentally sound exploration, extraction, and reclamation practices are used. The BLM would also monitor salable and leasable mineral operations to ensure proper resource recovery. Monitoring and enforcement of lease, sale, or permit terms would help reduce adverse impacts, as those described above, to upland vegetation.

The planning area would be available for location of mining claims unless withdrawn.

Closure and rehabilitation of existing salable minerals pits would be completed on a case-by-case basis. Closure and proper rehabilitation of pits would reduce the potential for impacts to upland vegetation by reducing surface-disturbing activities. Restrictions on new salable mineral material sites in LPC habitat in the Core Management Area (CMA), Primary Population Area (PPA), and Sparse and Scattered Population Areas (SSPA), as well as restrictions on new salable mineral material sites near active lek sites in the Isolated Population Area (IPA) would reduce the potential for impacts to upland vegetation in applicable areas by reducing surface-disturbing activities.

New caliche pits would be permitted only when existing pit locations are not close enough (usually within 3 miles) to support multiple-use needs. Reduced surface disturbance would reduce the potential for impacts to upland vegetation.

The majority of the planning area would be open to salable mineral development subject to site-specific NEPA analysis, stipulations, and 43 CFR 3600 regulations. NEPA analysis and applicable stipulations and regulations may also help reduce the potential for impacts to riparian vegetation.

Upon receipt of a Notice of Intent (NOI), special mitigative measures or restrictions would be applied as necessary. The surface use and occupancy requirements and OHV use designations would also be applied to geophysical exploration, when necessary. Applicable mitigation measures, restrictions, requirements, and designations would reduce the potential for impacts to upland vegetation from surface disturbance caused by minerals development and OHV use.

The BLM would encourage the use of practices that reduce the extent of surface disturbance and to mitigate other forms of impacts. Reduced surface disturbance would lower the potential for adverse impacts to upland vegetation. Revegetation of disturbed areas would be required. Proper revegetation in upland areas would benefit upland vegetation. Reclamation techniques may be used to enhance the reclamation of pits, roads, and well pads to provide for maximum ground and surface water protection. Proper reclamation in upland areas would benefit upland vegetation.

The BLM would continue to apply reasonable mitigation measures, such as relocating proposed operations by no more than 656 feet or prohibiting new surface disturbance for a period of no more than 60 days. Applicable mitigation measures would reduce the potential for adverse impacts to upland vegetation.

A Controlled Surface Use (CSU) restriction would be applied when needed as a COA for APDs for oil or gas wells proposed in the City of Carlsbad’s municipal water well field, or within 3 miles of the field. This CSU restriction would apply to an area of about 26,800 acres of public surface and minerals, and about 2,720 acres of federal mineral estate under other surface ownerships. Restrictions on surface disturbance would help reduce the potential for adverse impacts to upland vegetation.

Management actions common to all that would not affect upland vegetation include actions that focus on other resources, such as wildlife (e.g., wildlife deterrents around open pits), required plastic pipe specification, and protection of caves and karsts.

Impacts from Management Common to All Action Alternatives

After it has been determined that a locatable mineral discovery has been made on a claim or set of claims, an interdisciplinary team would determine whether locatable mineral plans of operation cause unnecessary and undue degradation to resources on a case-by-case basis and identify stipulations or mitigation measures as appropriate. Applicable stipulations or mitigation measures would reduce the potential for adverse impacts to upland vegetation.

The BLM may require a third-party compliance monitor for oil and gas construction activities to monitor environmental concerns. A third-party compliance monitor could help reduce the potential for adverse impacts to upland vegetation.

Salable minerals pits that have been or are being reclaimed would not be re-opened for materials disposal without the authorization of the field office manager. Reduced surface disturbance would help reduce the potential for adverse impacts to upland vegetation.

Management actions common to all action alternatives that would not affect upland vegetation include actions that focus on other resources, such as water resources (e.g., restrictions on chemicals used in hydraulic fracturing pond water, casing requirements, groundwater monitoring, tailings impoundment requirements), requirements for pipeline burial, and closing access to abandoned tailings piles.

Impacts from the No Action Alternative

Under the No Action Alternative, minerals actions impacts to upland vegetation would result from the continuation of current minerals management. This alternative does not propose management prescriptions or stipulations on many aspects of mineral development, such as restrictions on locations of earthen hydraulic fracturing ponds and hydraulic fracturing water containment and testing, requirements for tank battery liners and secondary containment areas, requirements for a Plan of Development (POD) to contain an erosion control plan, or a completion deadline for all interim reclamation projects. It has no restrictions in place concerning geophysical activities.

In highly sensitive areas, this alternative does adhere to special stipulations aimed at mitigating adverse impacts to other resources, including soil and water. Stipulations include the designation of 46,481 acres as NSO, and the leasing of oil and gas in accordance with CFR 43 3100 and the EA for Oil and Gas Leasing in the Roswell District (BLM 2014b).

Under the No Action Alternative, approximately 228,993 acres would be closed or open with major constraints (NSO) to leasable mineral exploration across the planning area (see Table 4-28). Approximately 146,568 acres would be closed to salables and 32,374 acres would be recommended for withdrawal from locatables (see Table 4-28). The planned leasable mineral activities (oil and gas wells) under the No Action Alternative predict approximately 11,515 acres of surface disturbance and 5,874 new wells on BLM-administered surface lands (see Table 4-29). Adverse impacts to upland vegetation, as those described above, would continue within areas with surface-disturbing activities associated with mineral development and exploration.

Impacts from Alternative A

Under Alternative A, the BLM would manage lands for mineral development with specific stipulations that are not required or addressed under the No Action Alternative. These would include prohibiting surface disturbance within 0.5 mile from human occupied permanent structures and sensitive receptors for existing leases, prohibiting earthen hydraulic fracturing ponds within specific sensitive areas such as within gypsum and limestone soils, soils that are greater than 10%, and within floodplains and drainages. Disposal of produced water in lined pits would also be prohibited under this alternative. Other stipulations under Alternative A would include management aimed at preventing contamination of soil and water resources, which would indirectly benefit upland vegetation. Some of these stipulations are prohibiting earthen pits for recycling or flowback water, requirements for tank battery liners in secondary containment areas, and also for spill prevention and leak detection methods for both new and existing facilities. Collocation of multiple wells on a single pad, in order to reduce surface disturbance, would be required within critical karst resource zones and high karst potential occurrence zones, as well as on gypsum sensitive soils, all of which would minimize the potential for subsequent adverse impacts to upland vegetation.

Under Alternative A, approximately 228,993 acres would be closed or open with major constraints (NSO) to leasable mineral exploration across the planning area (see Table 4-28). Approximately 1,062,192 acres would be open with special terms and conditions for salables and 380,990 acres would be recommended for withdrawal from locatables (see Table 4-28). The planned leasable mineral activities (oil and gas wells) under this alternative predicts approximately 8,753 acres of surface disturbance with 6,565 acres of surface disturbance remaining after reclamation (see Table 4-29), representing a 24% decrease compared to the No Action Alternative.

Compared to the No Action Alternative, which does not require the same degree of mitigation measures as found under Alternative A and also includes a 24% increase in the number of predicted wells (see Table 4-29), the magnitude of adverse impacts to upland vegetation and noxious weeds management would be smaller under Alternative A.

Impacts from Alternative B

Under Alternative B, management prescriptions, stipulations, and mitigation measures would be identical to those under Alternative A with the exception of allowing earthen hydraulic fracturing ponds in gypsum soils (prohibited under Alternative A).

Under Alternative B, approximately 1,244,984 acres would be closed or open with major constraints (NSO) to leasable mineral exploration across the planning area (see Table 4-28). Approximately 726,270 acres would be open with special terms and conditions for salables and 326,623 acres would be recommended for withdrawal from locatables (see Table 4-28). The planned leasable mineral activities (oil and gas wells) under this alternative predicts approximately 3,538 wells with 5,202 acres of surface disturbance remaining after reclamation (see Table 4-29), representing a 40% decrease compared to the No Action Alternative.

Also, compared to the No Action Alternative, which does not require the same degree of mitigation measures as found under Alternative A and also includes a 40% increase in the number of predicted wells (see Table 4-29), the magnitude of adverse impacts to upland vegetation and noxious weeds management would be smaller under Alternative B.

Impacts from Alternative C

Under Alternative C, management prescriptions would include the requirement for wireless seismic to be considered on a case-by-case basis in areas deemed sensitive to the use of conventional seismic. Earthen hydraulic fracturing ponds, although prohibited on slopes greater than 10%, would be allowed on sensitive soils such as gypsum and within floodplains and drainages. Earthen pits for recycling produced or flowback water would be allowed on a case-by-case basis, though they are required to be netted. Other mitigation measures would be similar to those found under Alternatives A and B.

Under Alternative C, approximately 246,903 acres would be closed or open with major constraints (NSO) to leasable mineral exploration across the planning area (see Table 4-28). Approximately 999,610 acres would be closed or open with special terms and conditions for salables and 132,249 acres would be recommended for withdrawal from locatables (see Table 4-28). The planned leasable mineral activities (oil and gas wells) under this alternative predicts approximately 5,832 wells and 8,575 acres of surface disturbance remaining after reclamation (see Table 4-29), representing a 1% decrease compared to the No Action Alternative.

Also, compared to the No Action Alternative, which does not require the same degree of mitigation measures as found under Alternative C and also includes a 1% decrease in the number of predicted wells (see Table 4-29), the magnitude of adverse impacts to upland vegetation and noxious weeds management would be slightly smaller under Alternative C.

Impacts from Alternative D

Under Alternative D, management prescriptions and stipulations would include hydraulic fracturing ponds and would be allowed on a case-by-case basis, disposal of produced water would be allowed, as is the case under the No Action Alternative, however; they would be prohibited in critical karst resource zones and high karst potential occurrence zones. Leak detection systems would not be required under this alternative. Other stipulations would be identical to those found under Alternatives A and B.

Under Alternative D, approximately 154,829 acres would be closed or open with major constraints (NSO) to leasable mineral exploration across the planning area (see Table 4-28). Approximately 755,794 acres would be closed or open with special terms and conditions for salables and 122,444 acres would be recommended for withdrawal from locatables (see Table 4-28). The planned leasable mineral activities (oil and gas wells) under this alternative predicts approximately 6,044 wells and 8,887 acres of surface disturbance after reclamation representing a 3% increase compared to the No Action Alternative (see Table 4-29).

Though management actions under Alternative D do propose additional mitigation measures and stipulations than under the No Action Alternative, the acres of surface disturbance are 3% greater under this alternative. Predicted number of wells is also slightly greater under this alternative compared to the No Action Alternative (see Table 4-29); therefore, the magnitude of adverse impacts to upland vegetation and noxious weeds management would be greater under Alternative D compared to the No Action Alternative.

Impacts of Visual Resources Management Actions on Upland Vegetation/Noxious Weeds Management

VRM class designations have specific management objectives that, depending on the class designated, could beneficially impact vegetation resources. The objectives defined for VRM Class I and II include the preservation or retention of the existing character of the landscape and, therefore, minimize and at times prohibit surface-disturbing activities. Those impacts to vegetation resources associated with mineral development, ROW construction and maintenance and other land use authorizations and road and trail construction would be minimized within these VRM Class I and II designations. The number of acres designated as VRM Class I and II vary across the alternatives and is depicted in Table 4-30.

Table 4-30. VRM Management Decisions (acres) on BLM Surface Lands by Alternative

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Total	***45,809***	***236,344***	***293,805***	***116,155***	***77,595***

Impacts from Management Common to All

There are no proposed management decisions common to all alternatives that would significantly impact vegetation resources because prescriptions here address utility corridors, pipelines, etc., in leased areas with scenic quality.

Impacts from Management Common to All Action Alternatives

There are no management decisions common to all action alternatives proposed.

Impacts from the No Action Alternative

Under the No Action Alternative, a total of 50,671 acres would be designated under either VRM Class I or II (see Table 4-30). Upland vegetation would benefit from additional management prescriptions that would prohibit or minimize surface-disturbing activities within these designated acres. Various impacts on vegetation associated with surface-disturbing activities include disruptions in plant community composition, bare ground, increased erosion and sedimentation, and an increase in the likelihood of noxious weed invasion.

Impacts from Alternative A

Under Alternative A, a total of 273,709 acres would be designated under either VRM Class I or II. Qualitatively, the impacts to upland vegetation and noxious weeds management would be the same as those under the No Action Alternative; however, the magnitude of beneficial impacts would be much greater under this alternative because there is a substantially greater number of acres under the VRM Class I and II designations.

Impacts from Alternative B

Under Alternative B, a total of 357,803 acres would be designated under either VRM Class I or II. Qualitatively, the impacts to upland vegetation and noxious weeds management would be the same as those under the No Action Alternative; however, the magnitude of beneficial impacts would be much greater under this alternative because there is a substantially greater number of acres under the VRM Class I and II designations.

Impacts from Alternative C

Under Alternative C, a total of 67,963 acres would be designated under either VRM Class I or II. Qualitatively, the impacts to upland vegetation and noxious weeds management would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be slightly greater under this alternative because there is a 26% increase in the number of acres under the VRM Class I and II designations.

Impacts from Alternative D

Under Alternative D, a total of 48,263 acres would be designated under either VRM Class I or II. Qualitatively, the impacts to upland vegetation and noxious weeds management would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be slightly smaller under this alternative because there is a 5% decrease in the number of acres under the VRM Class I and II designations.

Impacts of Renewable Energy on Upland Vegetation/Noxious Weeds Management

Impacts from Management Common to All

All management common to all decisions would potentially provide some beneficial impacts to upland vegetation resources and noxious weeds management that are part of LPC and/or DSL habitat, as all applications to permit either solar or wind energy sites across the planning area would require the demonstration that proposed projects would not adversely impact these species' habitats. Vegetation communities within these species' habitat would benefit from additional protections.

Adoption of programmatic policies and BMPs in both the Solar Energy Development Programmatic EIS ROD (BLM 2012a) and the Wind Energy Development Programmatic EIS ROD (BLM 2005) would also potentially minimize adverse impacts to upland vegetation resources across the planning area.

Impacts from Management Common to All Action Alternatives

Proposed management under all of the action alternatives includes the encouraged placement of wind development projects in areas where transmission corridors are already located and where transmission systems are already in place. As a result, adverse impacts to upland vegetation and noxious weeds management, such as reduction in ground cover, reduced vegetation health and vigor, habitat fragmentation, and an increased likelihood in noxious weeds invasion, would be minimized.

Impacts from the No Action Alternative

Under the No Action Alternative, restrictions on the location of solar or wind energy sites would continue to be implemented on specific sites across the planning area. These include WSAs, WSRs, VRM Class I and II areas, and areas with known karst occurrences (for complete list of restrictions, see Chapter 2, Alternatives Matrix). In addition, applications to permit either solar or wind energy sites on public land within the planning area would be considered only if the applicant can demonstrate no negative impacts on avian and bat species. All of these management prescriptions would benefit upland vegetation and noxious weeds management by minimizing surface disturbance and its associated adverse impacts as those described under management common to all action alternatives.

Impacts from Alternative A

Under Alternative A, the BLM would exclude approximately 666,783 acres from wind development. Approximately 768,020 acres would be excluded from solar and 995,285 acres would be closed to geothermal development. Solar, wind, and geothermal development would be excluded in areas with sensitive soils, not only in SMAs as is the case under the No Action Alternative.

Compared to the No Action Alternative, the magnitude of beneficial impacts to upland vegetation and noxious weeds management would be potentially greater because all sensitive soils would be protected, and wind development would be prohibited on a substantially larger number of acres under this alternative.

Though the No Action Alternative prohibits solar development projects on a larger number of acres, the Solar Energy Development Programmatic EIS ROD (BLM 2012a) states most of the planning area would not be suitable for support solar development, thus greater number of acres closed to solar development is irrelevant.

Impacts from Alternative B

Under Alternative B, the BLM would exclude approximately 912,860 acres from wind development. Approximately 833,305 acres would be excluded from solar and 1,372,791 acres would be closed to geothermal development. Solar, wind, and geothermal development would be excluded in all areas with sensitive soils.

Compared to the No Action Alternative, the magnitude of beneficial impacts to upland vegetation and noxious weeds management would be potentially greater because all sensitive soils would be protected, and wind development would be prohibited on a substantially larger number of acres under this alternative.

Impacts from Alternatives C and D

Under Alternative C, the BLM would exclude approximately 206,184 acres from wind development. Approximately 734,636 acres would be excluded from solar and 608,850 acres would be closed to geothermal development. Under Alternative D, approximately 73,143 acres would be excluded from wind development. Under Alternative D, approximately 630,302 acres would be excluded from solar and 464,187 acres would be closed to geothermal development. Wind development would be avoided in areas with sensitive soils while solar development would be excluded.

Compared to the No Action Alternative, the magnitude of beneficial impacts to upland vegetation and noxious weeds management would be potentially greater because all sensitive soils would be avoided, and wind development would be prohibited on a substantially larger number of acres under this alternative.

4.2.3.2 Riparian and Wetland Vegetation

This section discusses impacts to riparian vegetation and wetland communities from BLM management actions for other resources. Existing riparian and wetland communities are discussed in detail in Chapter 3, while BLM proposed management actions are discussed in detail in Chapter 2. Riparian vegetation differs from upland vegetation above in that it is restricted to riparian and wetland environments and is characterized by obligate phreatophyte species that require permanent surface or near-surface water. Within the planning area, riparian areas are typically associated with perennial, intermittent, and ephemeral streams, as well as isolated springs and other water sources.

This analysis evaluates management decisions with the potential to impact riparian and wetland vegetation, the riparian PFC of streams, water resources necessary to riparian zone establishment and survival, or the physical environment on which riparian and wetland vegetation depends.

4.2.3.2.1 Analysis Methods

Indicators

The following indicators were used for the analysis of impacts to riparian and wetland vegetation from the management actions proposed under the alternatives:

- For the purposes of this broad-scale analysis, the primary indicator of impacts to riparian and wetland vegetation is the number of acres of surface disturbance resulting from proposed management actions (including mineral development, livestock grazing, and OHVs) across the planning area, particularly surface disturbance that occurs in upland areas that would impart indirect adverse impacts to riparian and wetland areas downslope.
- Riparian resources will be managed as part of riparian PFC ratings based on hydrology, riparian vegetation, and erosional/depositional balances. Any changes to riparian resources that would negatively affect its PFC rating would also be an impact indicator.

Methods and Assumptions

Management actions associated with the following resources and resource uses may result in impacts to riparian and wetland vegetation and are discussed in detail below: land use authorizations, mineral development, livestock grazing, lands with wilderness characteristics, renewable energy, recreation, special designations, visual resources, and travel management.

The following resources and resource uses are not discussed in detail because there are no management decisions identified in Chapter 2 that would impact riparian and wetland vegetation: air resources, karst resources, wildland fire management, upland vegetation and noxious weeds, riparian resources, special status species, fish and wildlife, soils and water resources, paleontological and cultural resources, health and safety, and land tenure. As a result, they are not discussed in detail below.

The following assumptions were used for the analysis of management action impacts to riparian and wetland vegetation:

- The more soil surface disturbance in any given watershed (e.g., livestock grazing, high severity wildfire, OHVs, mineral extraction, etc.), the greater the probability that precipitation surface runoff and erosion will increase because of that disturbance, resulting in the degradation of downslope stream stability and function and contributing to the loss of riparian and wetland health and functionality (DeBano and Schmidt 1989a, 1989b; DeBano et al. 2004).
- The degree of impact attributed to any one disturbance or series of disturbances would be influenced by several factors, including location within the watershed, duration, and degree of disturbance, vegetation health, soil type, precipitation, and mitigating actions applied to the disturbance (DeBano et al. 2004).
- The presence of invasive exotic saltcedar would increase the risk for wildfire in riparian areas because saltcedar is flammable and burns very hot, killing most associated native riparian trees. Saltcedar resprouts from root crowns following fire, and outcompetes native woody riparian plant species. Prescribed fire alone is not a valid management tool to control saltcedar in riparian areas (U.S. Forest Service 2012).
- Saltcedar leaf beetles (*Diorhabda* sp.; mostly *D. elongata*) are currently expanding into the planning area from the south along the Pecos River. Saltcedar leaf beetles reduce the cover and spread of saltcedar over time and would, therefore, reduce the need for saltcedar control management actions in riparian areas over the next 20 years (Tamarisk Coalition 2014).

4.2.3.2.2 Direct and Indirect Impacts

Management actions for resources or resource uses that result in surface disturbances within watersheds and areas adjacent to riparian and wetland systems, would lead to both direct and indirect adverse impacts to riparian and wetland vegetation. Alterations in upland watershed runoff, resulting from surface disturbances, would indirectly impact riparian areas and wetlands, as increased runoff from compacted or denuded surfaces leads to erosion and excessive sediment and contaminant delivery to nearby waterways. The greater the amount of watershed surface disturbance, the greater the potential for impacts to riparian and wetland areas and riparian and wetland vegetation downslope.

Other impacts to riparian and wetland vegetation from surface-disturbing activities, such as mineral exploration and development and livestock grazing, would include changes to quantity and quality (water chemistry) of surface water, potential changes to water volume and velocity, alterations in channel morphology through changes in surface drainage patterns, and reduction in overall watershed health. Loss of vegetation or prevention of revegetation would potentially lead to an increase in or introduction of invasive, non-native species that often have greater water requirements than native plants and would, therefore, potentially outcompete them. Industrial contaminants, chemicals associated with vehicles, nutrients and pathogens from livestock, and herbicides for vegetation treatments can migrate to surface water bodies, potentially degrading the PFC rate of some riparian and wetland systems.

Over the next 20 years, climate change alone may alter water availability to riparian areas and wetlands, and cause shifts to more xeric and warmer temperature adapted species. Climate change will likely affect grazing management as grass forage and stock water availability decline, causing livestock to congregate even more in riparian and wetland areas.

Impacts of Livestock Grazing Actions on Riparian and Wetland Vegetation

The removal of livestock from riparian habitats would provide both direct and indirect beneficial impacts to riparian and wetland vegetation because erosion, sedimentation, soil compaction and trampling of streambank vegetation, and degradation of water quality—all of which are associated with livestock grazing (Belsky et al. 1999)—would be reduced. In areas where livestock grazing is continuous, plant community composition would be potentially altered in favor of species better adapted to trampling and soil compaction disturbance, and also through the introduction and spread of both exotic and native weeds (USFS 2012) and Russian olive (*Elaeagnus angustifolia*) (Pearce and Smith 2001).

In semiarid regions such as the planning area, livestock tend to congregate in riparian and wetland areas because of increased water and forage availability. Livestock intensify their vegetation consumption, trampling, and defecating activities in riparian areas and wetlands (Elmore and Kauffman 1994; Bellows 2003; Clary and Kruse 2004). Livestock tend to not forage on the exotic invasive noxious weeds saltcedar and Russian olive (Pearce and Smith 2001; USFS 2012). As a result, those noxious weeds benefit from livestock activity in riparian and wetland areas. High stocking rates of livestock in watersheds tend to cause declines in upland vegetation cover; this leads to increased erosional soil runoff into riparian areas, which causes indirect adverse impacts to riparian and wetland vegetation. Some of these adverse impacts would include soil erosion and loss of streambank stability, declines in riparian and wetland-adapted plant species, increased noxious weeds and non-native plant species, sediment loading in water, water quality alterations, and the potential for large-scale changes in downstream ecosystems (DeBano and Schmidt 1989a, 1989b).

Specific riparian areas may be open or closed to livestock grazing, depending on the alternative. Table 4-31 below depicts areas associated with particular river systems across the planning area and livestock grazing management actions across the alternatives.

Table 4-31. Riparian Areas across the Planning Area by Alternative

Riparian/River Areas	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Pecos River	Open to grazing, with exception of the research natural areas of the Pecos River Canyons, bluntnose shiner habitat, and Red Bluff Area	Number of livestock and season of use to be established on allotment basis to ensure adequate growing season rest	Same as Alternative A	Same as Alternative A	Same as Alternative A
Black River Management Area	Closed to grazing	Same as No Action Alternative	Same as No Action Alternative	Same as No Action Alternative	Same as No Action Alternative
Delaware River (both sides of U.S. 285)	Livestock grazing not permitted from November to March	Same as No Action Alternative	Removal of livestock grazing from seasonal pastures	Livestock grazing permitted from November to March	Same as No Action Alternative
Small portion along Black River (outside Black River Management Area)	Open to livestock grazing	Removal of livestock grazing within 656 feet of the river bank on either side	Same as Alternative A	Same as No Action Alternative	Same as No Action Alternative

Impacts from Management Common to All

Livestock grazing management actions common to all alternatives would include the closure of the Black River Management Area to grazing. This management decision would reduce the potential for adverse impacts to riparian and wetland vegetation, including subsequent alterations in water quality, changes in species' composition, and movement away from PFC.

Impacts from Management Common to All Action Alternatives

Under management common to all action alternatives, the number of livestock and season of use on the Pecos River would be established on an allotment basis to ensure adequate growing season rest (see Table 4-31). Additionally, all riparian springs and their associated riparian zones would be closed to grazing. These actions would indirectly benefit riparian and wetland vegetation by reducing the magnitude of negative impacts associated with livestock grazing, as previously described.

Impacts from the No Action Alternative

Under the No Action Alternative, current livestock grazing management prescriptions would remain in place and include keeping 5,000 acres of unallotted tracts open to livestock grazing. This alternative would also include the continued exclusion of livestock grazing on 4,969 acres across 13 SMAs. Also included would be the authorization of approximately 350,000 AUMs to 200 permittees and approximately 18,000 AUMs to 62 lessees. These numbers would be supported by quantitative field monitoring, and any future increase or decrease in authorized numbers would need to be backed with similar data.

Adverse impacts to riparian and wetland vegetation, including increased erosion, sedimentation, water depletion, and loss of streamside vegetative cover, would continue in riparian areas that remain open to livestock grazing.

Additionally, under the No Action Alternative, the BLM would open the Pecos River to grazing, with the exception of specific Research Natural Areas (RNAs) in the Pecos River canyons and the Red Bluff area. Approximately 201 acres of the Pecos Bluntnose Shiner ACEC would be open to grazing. Livestock grazing would not be permitted from November through March on the Delaware River and a small portion along the Black River would be open to livestock grazing (see Table 4-31). Adverse impacts associated with livestock grazing, as described above, would continue in the areas open to grazing. Approximately 5,226 acres would be closed to livestock grazing.

Impacts from Alternative A

As with the No Action Alternative, livestock grazing would not be permitted along the Delaware River from November to March (see Table 4-31). In this case, impacts would be the same as those under the No Action Alternative; however, under Alternative A, livestock grazing would be removed from within 656 feet on either side of a small portion along the Black River. Compared with the No Action Alternative, which keeps this portion of the Black River open to grazing, the magnitude of beneficial impacts would be greater under this alternative.

Impacts from Alternative B

Under Alternative B, unallotted tracts encompassing 5,000 acres would remain open to grazing, as is the case under the No Action Alternative. Under this alternative, sections within 0.25 mile of riparian areas would be closed to livestock grazing, including areas around the Pecos, Black, and Delaware Rivers. Other areas closed to livestock grazing that are important riparian habitat include the Cottonwood Day Use Area, Laguna Plata ACEC, known heronries, Pecos Bluntnose Shiner ACEC, and Pope's Well ACEC. Impacts to riparian and wetland vegetation would be qualitatively similar to those described under the No Action Alternative. However, quantitatively, the magnitude of beneficial impacts would be greater because of the additional acres that would be closed to livestock grazing.

Additionally, livestock would be removed from seasonal pastures around the Delaware River and within 656 feet of the river bank (on either side) of a small portion of the Black River (see Table 4-31). Compared with the No Action Alternative, which keeps this portion of the Black River and also permits grazing along the Delaware River from November to March, the magnitude of beneficial impacts in relation to these rivers would be greater under this alternative.

Impacts from Alternative C

Under Alternative C, approximately 8,115 acres would be closed to livestock grazing, including the Pecos Bluntnose Shiner ACEC. As with the No Action Alternative, 5,000 acres of unallotted tracts would remain open to livestock grazing. Additionally, livestock grazing would be removed from all riparian pastures along both sides of the Delaware River during the active season (April–October) but would be allowed during the dormant season (November–March), and the BLM would negotiate with the grazing permittee to fence the south side of the river and provide off-site water. As with the No Action Alternative, a small portion of the Black River would be open to grazing. Qualitatively, impacts to riparian and wetland vegetation, as described under the No Action Alternative, would remain the same under Alternative C. Quantitatively, however, adverse impacts to riparian and wetland vegetation would be greater because of the additional acres of important riparian/watershed areas open to grazing under this alternative, compared with the No Action Alternative.

Impacts from Alternative D

Under Alternative D, 3,594 acres would be closed to livestock grazing, including a portion of the Black River Management Area and the Pecos Bluntnose Shiner ACEC. As with the No Action Alternative, 5,000 acres of unallotted tracts would remain open to livestock grazing.

Qualitatively, impacts to riparian and wetland vegetation as described under the No Action Alternative would remain the same under Alternative D. Quantitatively, however, adverse impacts to riparian and wetland vegetation would be greater under Alternative D because of the additional 4,234 acres of important riparian/watershed areas open under this alternative, compared with the No Action Alternative.

Impacts of Recreation/Travel Management Actions on Riparian and Wetland Vegetation

Recreation management can impact riparian and wetland vegetation in various ways. Human activity along or within streams and rivers, and around or within ponds, lakes, and reservoirs, can result in habitat alteration, reduction or loss of riparian vegetation cover and subsequent erosional runoff, increased sedimentation, and turbidity.

Acreages across the planning area designated as SRMAs or as ERMAs would not directly or indirectly impact riparian and wetland vegetation, as recreational use of these areas would not be expected to increase or decrease as a result of designation. However, proposed management actions associated with travel management may indirectly affect riparian and wetland vegetation both within and outside these RMAs and are addressed below in Table 4-32.

Travel management would potentially cause adverse impacts to riparian and wetland vegetation, as the presence of trails and roads within watersheds may lead to habitat alteration, loss or reduction of streamside vegetation cover, increased sedimentation and turbidity, and water quality degradation. Roads and trails provide a means for water conveyance, which accelerates flow velocities and increases erosion and offsite soil movement. These routes also compact soils, which reduce water absorption and infiltration rates and increase the peaks of runoff flows. Where motorized and, in some cases, mechanized use are high and/or increasing, erosion potential is increased. These impacts are amplified where user-created routes and OHV use is occurring or increasing. In areas where OHV use is occurring or would increase, impacts such as sedimentation and turbidity, soil compaction, loss of riparian vegetation and cover, habitat alteration, and water quality changes would be long term and chronic.

The number of acres limited or closed to OHV travel across the planning area varies by alternative and is presented below in Table 4-32.

Table 4-32. Travel Management Allocations (acres) by Alternative

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
OHV limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737
Total	***2,091,273***	***2,091,326***	***2,091,327***	***2,091,320***	***2,091,321***

Impacts from Management Common to All

Under management common to all alternatives, proposed management actions would include preparing RAMPs for all designated SRMAs under management common to all. The purpose of SRMAs is to focus management, better direct people to opportunities, and coordinate recreation activities with other multiple uses in the area. The RAMPs that would be prepared for the designated SRMAs identify specific recreation implementation actions, including permitting or use allocation decisions. As part of an RAMP preparation, other resources and resource use issues are considered, which generally provides for mitigation of impacts due to recreation activities proposed under SRMAs. Therefore, it is unlikely that there would be any adverse impacts from the development of RAMPs to riparian and wetland vegetation.

Additionally, all activities would adhere to BLM New Mexico Supplementary Rules, which provide for several safety and procedural parameters for activities on public lands, such as no construction of pit toilets lasting more than 14 days within 100 feet of any permanent water source, no fireworks, and no cutting or removal of woody materials. All of these rules would reduce or prevent adverse impacts to riparian and wetland vegetation from water contamination and sediment loading.

Additionally:

- The Black River SRMA (1,275 acres) would be closed to OHV, equestrian use, and grazing, which would reduce the potential for impacts to riparian and wetland vegetation, such as crushing and the spread of noxious weeds and invasive plants.
- The Conoco Lake SRMA (7 acres) would prohibit firewood collection and allow fires in grills only (subject to fire restrictions), which would help reduce the potential for wildfire in riparian and wetland areas.
- Phantom Banks Heronries would be designated as limited to OHV use, and a plan would be implemented to protect active heronries through seasonal limitations to designated routes. Emergency OHV limitations may also be imposed in problem areas. Restrictions on OHV access would reduce the potential for adverse impacts to riparian and wetland vegetation, such as crushing and the spread of noxious weeds and invasive plants.
- Within the planning area, motorized wheeled cross-country travel would be allowed for any military, fire, search and rescue, or law enforcement vehicle used for emergency purposes. Allowing motorized access would increase the potential for impacts to riparian vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Impacts from Management Common to All Action Alternatives

All action alternatives in the planning area would maintain water quality in natural water sources by prohibiting camping within 900 feet of these areas (excluding the Pecos River). This would benefit riparian and wetland vegetation by reducing disturbance in close proximity to these areas, as well as maintaining or improving water quality, reducing sedimentation, and contributing to the overall health of riparian ecosystems near recreational areas.

Additionally, roads would be constructed and maintained in accordance with the BLM's *Surface Operating Standards and Guidelines for Oil and Gas Development – The Gold Book* (BLM 2007a). Additionally, all surfacing material on oil and gas roads must be removed at the time of abandonment. Both of these management actions would lead to indirect beneficial impacts to riparian and wetland vegetation by minimizing the potential for erosion, runoff, and contamination of streams, rivers, and other water bodies that provide habitat for fish.

Impacts from the No Action Alternative

Under the No Action Alternative, 55,966 acres in the planning area would be closed to OHV use, whereas 2,035,307 acres would be managed as OHV limited (see Table 4-32). In general, as road density increases, adverse impacts to riparian and other aquatic habitats would potentially increase as well.

Alkali Lake would be managed as OHV limited (944 acres). OHV use would increase the potential for impacts to riparian and wetland vegetation, such as crushing and the spread of noxious weeds and invasive plants. It would also be managed with 944 acres open with moderate constraints to leasables with standard terms and condition and 944 acres open to salables with special terms and conditions. Fewer acres managed for mineral exploration and development means less potential for impacts to riparian and wetland vegetation from surface disturbance caused by these activities. It would also be managed as open for ROW development. Fewer acres managed for ROW means less potential for impacts to riparian and wetland vegetation from ROW-related surface disturbance.

Pecos River Corridor would be managed as an SRMA and surface disturbance would be restricted throughout the SRMA to reduce erosion and minimize impacts to riparian and wetland habitat. Reducing surface disturbance would reduce the potential for the impacts to riparian and wetland vegetation. Approximately 120 acres around the Red Bluff Reservoir would be closed to OHV use, and the remaining 5,880 acres would be managed as OHV limited. Restricting OHV use would reduce the potential for impacts to riparian vegetation and wetland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Dispersed use would be allowed in the Pecos River Equestrian ERMA (11,207 acres), but no developed trails would be allowed. Likewise, dispersed use would be allowed in the Hay Hollow area (12,913 acres), but no trails would be developed. Fewer trails means less potential for impacts to riparian and wetland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Impacts from Alternative A

Under Alternative A, approximately 2,039,299 acres would be OHV limited and 52,028 acres would be closed to travel. Compared to the No Action Alternative, the magnitude of impact would be slightly greater because of 0.2% decrease in the number of acres closed to travel.

Alkali Lake SRMA (318 acres) would be managed as NSO for leasable mineral development, closed to salable development, and as a ROW exclusion area. The greater the number of acres excluded from mineral development and ROW actions the less the potential for impacts to riparian and wetland vegetation from ROW-related surface disturbance.

The Pecos River Corridor SRMA (9,936 acres) would be managed to provide recreation opportunities on public land parcels, with an emphasis on natural and scenic qualities. Travel in the SRMA would be OHV limited, which would help limit impacts to riparian and wetland vegetation, such as crushing and the spread of noxious weeds and invasive plants. Approximately 9,118 acres would be managed as open with major constraints for fluid leasables and closed to locatable and salable development. More restrictions on mineral exploration and development means less potential for impacts to riparian and wetland vegetation from surface disturbance caused by these activities.

Square Lake (2,975 acres) would be managed as an ERMA with an objective to limiting OHV travel on approximately 2,975. Approximately 2,973 acres would be open with moderate constraints to leasable mineral development. Approximately 2,973 acres would be open to locatable and 2,975 acres would be closed to salable mineral development. Fewer acres managed for mineral exploration and development means less potential for impacts to riparian and wetland vegetation from surface disturbance caused by these activities.

The Pecos River Equestrian Trail and Hay Hollow Equestrian ERMAs would be managed as described under the No Action Alternative; therefore, impacts would be the same.

Impacts from Alternative B

Under Alternative B, approximately 2,049,391 acres would be OHV limited and 41,936 acres would be closed to travel. Compared to the No Action Alternative, the magnitude of impact would be slightly greater because of a 0.7% decrease in the number of acres closed to travel.

Alkali Lake would be managed as SRMAs, with the same prescriptions as Alternative A.

Square Lake (2,975 acres) and the Pecos River Equestrian Trail would be managed as ERMAs. Approximately 7,954 acres would be a ROW avoidance area. Fewer acres managed for ROW means less potential for impacts to riparian and wetland vegetation from ROW-related disturbance.

Hay Hollow equestrian trail (12,913 acres) would be managed as an ERMA, with potential trail and facility development.

Impacts from Alternative C

Under Alternative C, approximately 2,052,582 acres would be OHV limited, and 38,738 acres would be closed to travel. Compared to the No Action Alternative, the magnitude of impact would be greater because of a 0.8% decrease in the number of acres closed to travel.

Alkali Lake (1,341 acres) would be managed as an SRMA and 1,333 acres would be open to locatable mineral development, which could increase the potential for impacts to riparian and wetland vegetation, such as crushing and the spread of noxious weeds and invasive plants.

Hay Hollow equestrian ERMA would be managed the same as under the No Action Alternative with 12,911 acres limited to existing travel.

Square Lake would be managed as an ERMA, with 5,285 acres managed as limited to existing travel.

Impacts from Alternative D

Under Alternative D, approximately 2,052,584 acres would be managed as limited and 38,737 acres would be closed to OHV use. Compared to the No Action Alternative, the magnitude of impact would be greater because of a 0.8% decrease in the number of acres closed to travel.

Impacts of Land Use Authorization Actions on Riparian and Wetland Vegetation

Land use authorizations generally include a number of activities and features, such as access roads, transmission lines, and pipelines, along with ROWs, that would result in surface disturbances and vehicle and equipment transportation. Both of the latter could contribute to adverse impacts to riparian and wetland vegetation. Potential impacts would include direct loss of riparian vegetation and topsoil, reduced native plant diversity, habitat fragmentation, soil compaction and increased erosion, and an increased likelihood of noxious weed invasion. Additional impacts to riparian soils and native vegetation would be perpetuated over time by maintenance activities for those features. Management decisions to avoid or exclude certain areas from ROWs would have beneficial impacts to riparian and wetland vegetation (Table 4-33).

Table 4-33. Avoidance and Exclusion Areas for Land Use Authorizations (acres) by Alternative

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Avoidance	30,965	629,149	413,654	313,619	270,360
Exclusion	7,056	662,038	918,701	165,378	69,540

Impacts from the No Action Alternative

Under the No Action Alternative, six ROW corridors have already been designated by the BLM as preferred locations for all new major utility and transportation facility alignments. A total of 30,965 acres would continue to be designated as avoidance areas and 7,056 acres (all WSAs) would continue to be designated as exclusion areas. These designations would benefit riparian and wetland vegetation by minimizing ROW construction and associated disturbance near or within these important habitat areas.

Impacts from Alternative A

Under Alternative A, 629,149 acres would be designated as avoidance areas and 662,038 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative A would provide significantly fewer adverse impacts to riparian and wetland vegetation through protection of important ecosystem components.

Impacts from Alternative B

Under Alternative B, 413,654 acres would be designated as avoidance areas and 918,701 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative B would provide significantly fewer adverse impacts to riparian and wetland vegetation through protection of important ecosystem components.

Impacts from Alternative C

Under Alternative C, 313,619 acres would be designated as avoidance areas and 165,378 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative C would provide fewer adverse impacts to riparian and wetland vegetation through protection of important ecosystem components.

Impacts from Alternative D

Under Alternative D, 270,360 acres would be designated as avoidance areas and 69,540 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative D would provide fewer adverse impacts to riparian and wetland vegetation through protection of important ecosystem components.

Impacts of Leasable, Salable, and Locatable Minerals Actions on Riparian and Wetland Vegetation

Direct impacts of mineral management actions would be the removal of all natural vegetation on disturbed surface acres. Indirect impacts of mineral management actions would be the upland area soil disturbance effects on watershed vegetation, including loss of topsoil, and runoff, erosion, and sediment loading to riparian areas and wetlands.

In general, surface disturbance related to mineral extraction could potentially reduce water quality and riparian condition (PFC), causing both short- and long-term impacts to riparian and wetland vegetation, including water depletions and increased sedimentation and turbidity. Of primary concern are activities that would result in ground disturbance and the removal of native vegetation for the construction of well pads, roads, pipelines, compressor and relay stations, settling ponds, and various assorted infrastructure. Collectively, all of these activities have the potential to contribute to off-site movement of soils and increase sediment loading and turbidity into nearby water bodies. In addition, they provide opportunities for invasive vegetation and noxious, non-native species to take hold. This reduces watershed health and results in poor soil retention, increased runoff, and poor water infiltration and absorption.

An increase in the numbers and densities of roads would be a concern because they can increase the potential for movement of contaminants via vehicular travel and may serve as water conveyance corridors to live streams and the ephemeral drainages that ultimately feed live streams. Impacts are amplified and more acute in areas where natural gas development is occurring in small, discrete watersheds. Generally, where proper and timely reclamation is occurring at well pad and pipeline sites, and where proper road construction and maintenance is occurring, adverse impacts from off-site soil movement and sediment and turbidity are minimized.

Surface disturbance from the various minerals management actions would have similar impacts to riparian and wetland vegetation, and all are analyzed as one category of impact—analysis of management action acreages for the three mineral categories: 1) leasable, 2) salable, and 3) locatable (Table 4-34–Table 4-37).

Table 4-34. Number of Predicted Wells, Total Predicted Surface Disturbance, and Total Predicted Water Use by Alternative

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Number of predicted wells on **BLM-administered surface lands only** (based on % of land open to surface disturbance)	5,874	4,465	3,538	5,832	6,044
Total predicted surface disturbance/acres after reclamation on **BLM-administered surface lands only**	8,636	6,565	5,202	8,575	8,887
Total predicted water use (acre-feet)	***38,811***	***29,503***	***23,379***	***38,538***	***39,937***

Table 4-35. BLM Surface Acreage Opened and Closed to Leasable Mineral Management Decisions by Alternative

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open with standard terms and conditions	1,598,870	1,142,802	1,089,481	1,750,774	1,997,681
Open with moderate constraints (CSU)	956,410	799,649	449,759	786,381	631,634
Open with major constraints (NSO)	54,602	80,394	162,013	158,401	70,142
Closed	174,391	761,404	1,082,972	88,502	84,687
Total	***2,784,273***	***2,784,248***	***2,784,224***	***2,784,058***	***2,784,145***
% of planning area closed	***8%***	***36%***	***52%***	***4%***	***4%***

Table 4-36. BLM Surface Acreage Opened and Closed to Salable Mineral Management Decisions by Alternative

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,637,465	1,160,064	1,121,118	1,784,431	2,028,324
Avoid (open with special terms and conditions)	–	1,062,192	726,270	752,286	602,621
Closed	146,568	561,995	936,799	247,323	153,174
Total	***2,784,033***	***2,784,251***	***2,284,186***	***2,784,041***	***2,784,119***
% of planning area closed	***7%***	***27%***	***45%***	***12%***	***7%***

Table 4-37. BLM Surface Acreage Opened and Closed to Locatable Mineral Management Decisions by Alternative

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open to mineral entry	2,751,856	2,403,114	2,110,098	2,651,855	2,661,705
Recommended (or previously recommended for withdrawal)	32,374	380,990	673,996	132,249	122,444
Total	***2,784,229***	***2,784,105***	***2,784,094***	***2,784,104***	***2,784,149***
% of planning area recommended	***1.5%***	***18%***	***32%***	***6%***	***6%***

Impacts from the No Action Alternative

Under the No Action Alternative, approximately 5,874 wells and 8,636 acres of surface disturbance are predicted, along with 38,811 of water use in acre-feet (see Table 4-34). Approximately 8% of the total planning area would be closed to leasable mineral development, 7% to salable mineral development and approximately 1.5% would be recommended for withdrawal from locatable mineral development. The greater the number of acres of surface disturbance, the greater the potential for indirect adverse impacts to riparian and wetland vegetation.

Impacts from Alternative A

Under Alternative A, 4,465 wells and approximately 6,565 acres of surface disturbance after reclamation are predicted on BLM-administered surface lands. Total predicted water use is 29,503 acre-feet. A total of 36% of the planning area would be closed to leasable mineral development, 27% closed to salable mineral development, and 18% would be recommended for withdrawal from locatable mineral development (see Table 4-34).

Compared with the No Action Alternative, there would be a 24% reduction in surface disturbance and water use under Alternative A. The magnitude of adverse impacts (as those described above) to riparian and wetland vegetation would be greater under the No Action Alternative than under Alternative A.

Impacts from Alternative B

Under Alternative B, 3,538 wells and approximately 6,936 acres of surface disturbance are predicted on BLM-administered surface lands. Total predicted water use would be 23,379 acre-feet. Approximately 52% of the entire planning area would be closed to leasable mineral development, 45% closed to salable mineral development, and 32% recommended for withdrawal from locatable mineral development.

Compared with the No Action Alternative, there would be a 20% reduction in surface disturbance and water use under Alternative B. The magnitude of adverse impacts (as those described above) to riparian and wetland vegetation would be greater under the No Action Alternative than under Alternative B.

Impacts from Alternative C

Under Alternative C, 5,832 wells and approximately 8,575 acres of surface disturbance are predicted on BLM-administered lands. Total predicted water use would be 38,538 acre-feet. A total of 4% of the entire planning area would be closed to leasable mineral development, 12% closed to salable mineral development, and 6% recommended for withdrawal from locatable mineral development.

Compared with the No Action Alternative, there would be a 1% reduction in surface disturbance and water use under Alternative C. The magnitude of adverse impacts (as those described above) to riparian and wetland vegetation would be slightly greater under the No Action Alternative than under Alternative C.

Impacts from Alternative D

Under Alternative D, 6,044 wells and approximately 8,887 acres of surface disturbance are predicted on BLM-administered lands. Total predicted water use would be 39,937 acre-feet. Only 4% of the entire planning area would be closed to leasable mineral development, 7% closed to salable mineral development, and 6% recommended for withdrawal from locatable mineral development.

Under Alternative D, the acres of predicted surface disturbance are 3% greater under this alternative compared to the No Action Alternative. Predicted water use is also 3% greater under this alternative, compared with the No Action Alternative; therefore, the magnitude of adverse impacts to riparian and wetland vegetation would be greater under Alternative D, compared with the No Action Alternative.

Impacts of Special Designations Actions on Riparian and Wetland Vegetation

Special designation areas, such as ACECs, SMAs, and WSRs, would generally have long-term positive impacts on riparian and wetland vegetation that occur within their boundaries by limiting or preventing surface-disturbing activities, such as mineral development, OHV travel, and livestock grazing. Adverse impacts to riparian and wetland vegetation associated with these activities would include reduction in water quality and movement away from PFC.

Management goals within special designations would include the protection of relevant and important water resources and natural systems. These additional protections to riparian ecosystems and other water bodies would benefit riparian and wetland vegetation, as water quality and other ecosystem components are maintained or enhanced. Adverse impacts to riparian and wetland vegetation, such as habitat and water quality alterations, reduction in streamside vegetation, and excessive sediment loading and turbidity, within these designations would be minimized.

Areas of Critical Environmental Concern

ACECs are managed to protect the relevant and important values for which the ACEC would be designated such as wildlife, special status species, etc. ACEC designation would generally protect and benefit riparian and wetland vegetation from adverse impacts. The various ACECs each have specific management goals and management actions. ACEC management actions generally would have reduced direct and indirect impacts to upland vegetation and, subsequently, riparian and wetland vegetation.

Impacts from Management Common to All

There are no proposed management actions for ACECs listed under impacts from management common to all alternatives.

Impacts from Management Common to All Action Alternatives

There are no proposed management actions for ACECs listed under impacts from management common to all action alternatives.

Impacts from the No Action Alternative

Under the No Action Alternative, a total of 13,435 acres would continue to be designated as ACECs. Adverse impacts, such as those described above, to riparian and wetland vegetation would be minimized within these approximately 13,400 acres.

Impacts from Alternative A

Under Alternative A, approximately 495,042 acres would be designated as ACECs. Qualitatively, this alternative would have the same beneficial impacts as the No Action Alternative; however, the magnitude of these impacts would be greater than under the No Action Alternative because of the substantial increase in number of acres designated as an ACEC.

Impacts from Alternative B

Under Alternative B, approximately 561,433 acres would be designated as ACECs. Qualitatively, this alternative would have the same beneficial impacts as the No Action Alternative; however, the magnitude of these impacts would be exponentially greater due to the substantial increase in number of acres designated as an ACEC.

Impacts from Alternative C

Under Alternative C, approximately 98,562 acres would be designated as ACECs. Qualitatively, this alternative would have the same beneficial impacts as the No Action Alternative; however, the magnitude of these impacts would be much greater because of the increase in number of acres designated as an ACEC.

Impacts from Alternative D

Under Alternative D, approximately 28,894 acres would be designated as ACECs. Qualitatively, this alternative would have the same beneficial impacts as the No Action Alternative; however, the magnitude of these impacts would be slightly greater because of the 107% increase in number of acres designated as an ACEC.

Impacts of Wilderness Study Areas on Riparian and Wetland Vegetation

Impacts from Management Common to All

All riparian and wetland vegetation within the four designated WSAs, totaling 7,086 acres, would continue to benefit from additional protection through special management requirements, including a closed designation for all future leases and no reissuing of current leases once expired, which would enhance and preserve its wilderness values, including plant communities within the unit. In addition, new permanent facilities and new surface disturbance would be prohibited, all of which would provide beneficial impacts to riparian and wetland areas within the units, including decreased sedimentation loading and erosional runoff, decreased potential for declining water quality, and movement toward PFC.

Impacts from the No Action Alternative

Under the No Action Alternative, the four WSAs would remain under their current designation and managed according to BLM Handbook 6330 – Management of Wilderness Study Areas. Managing per the handbook would continue to minimize adverse impacts to riparian and wetland vegetation through restrictions on surface-disturbing activities.

Impacts from Alternatives A, B, and C

If the WSA designation is removed, the four previously designated WSAs would be managed as closed to leasable and salable development, recommended for withdrawal for locatable development, and excluded/closed for renewable development and ROWs. Adverse impacts under these three alternatives would be comparable to those under the No Action Alternative and as described under management common to all.

Impacts from Alternative D

Under Alternative D, adverse impacts resulting from loss of WSA designation would be greater than those found under the other alternatives because management prescriptions would be less stringent for surface-disturbing activities. Unlike the other four alternatives, leasable development would be open with major constraints and salable development would be open with special terms and conditions. In addition, the proposed VRM class on these lands would be Class III.

Adverse impacts, such as those described under management common to all alternatives, would be greater under Alternative D, compared with the No Action Alternative.

Impacts of Wild and Scenic Rivers on Riparian and Wetland Vegetation

Impacts from Management Common to All

There are no proposed management decisions common to all alternatives that would significantly impact riparian and wetland vegetation because management prescriptions here address decisions made in Congress pertaining to WSR designations.

Impacts from Management Common to All Action Alternatives

Under management common to all action alternatives, the Black River would be recommended as suitable for inclusion in the NWSRS and would be given the same management prescriptions as other WSR areas, including a VRM Class I classification. Beneficial impacts to riparian and wetland vegetation would occur, as the WSR designation would limit surface-disturbing activities that would potentially result in adverse impacts, such as decreased water quality and movement away from PFC, increased erosional runoff and sediment loading, and alterations in stream hydrology.

Impacts from the No Action Alternative

Under the No Action Alternative, the Black River would continue to not be managed as part of the NWSRS but would be managed to protect its eligibility as a WSR until a suitability determination is made in this RMP. The Black River would be managed with the following management prescriptions: designation as

VRM Class III, closed to salable development, and recommended for withdrawal for locatable mineral development, with leasable mineral development open with major constraints. All ROW construction would continue to be designated under “avoidance” within WSR areas, and all renewable energy development would be excluded. The Delaware River would also not be managed as part of the NWSRS but would also be managed to protect its eligibility as a WSR until a suitability determination is made in this RMP. The Delaware River would be managed with various prescriptions, such as classifying certain segments of the river under VRM Class II and IV, closing areas adjacent to the river to renewables and mineral development), and proposing the area as a ROW avoidance area. Adverse impacts to riparian and wetland vegetation would be minimized within these areas.

Impacts from Alternative A

Under Alternative A, the Black River would be recommended as suitable for inclusion in the NWSRS and would be managed with the following prescriptions: VRM Class II, travel limited to designated routes, closed to leasable and salable mineral development, withdrawn from locatable mineral development, and excluded from both ROW development and renewable energy projects.

Also, under this alternative the Delaware River (one segment comprising 8.22 miles) would be recommended as suitable for designation in the NWSRS and would be managed under same prescriptions above for the Black River. All of these prescriptions would minimize surface disturbance and therefore reduce adverse impacts to riparian and wetland vegetation.

Compared with the No Action Alternative, which does not designate either the Black or the Delaware River in the NWSRS, the magnitude of adverse impacts to riparian and wetland vegetation would be smaller under this alternative.

Impacts from Alternatives B and C

Under both of these alternatives, proposed management concerning the Black River would be the same as under Alternative A, resulting in minimized surface disturbance and potential adverse impacts to soil and water resources. The Delaware River (Segment 1) would not be recommended as suitable for inclusion in the NWSRS and would be managed with prescriptions, including designation as VRM Class III, OHV limited, and various portions open to leasable mineral development with standard lease terms and conditions (1.0 miles) and open with major constrains (7.5 miles). Locatable and salable mineral development would be open in some areas but closed or recommended for withdrawal in others.

Compared with the No Action Alternative, which does not designate the Black River in the NWSRS and would keep the Delaware River open to locatable mineral development, the magnitude of adverse impacts to riparian and wetland vegetation would be smaller under these alternatives.

Impacts from Alternative D

Under Alternative D, management prescriptions in relation to the Black River would be the same as those under Alternatives A, B, and C, with the exception of the allowance of leasable development open with major constraints on WSR areas. Proposed management of the Delaware River segment would be the same as under Alternatives B and C.

Compared with the No Action Alternative, which does not designate the Black River in the NWSRS and would keep the Delaware River open to locatable mineral development, the magnitude of adverse impacts to riparian and wetland vegetation would be smaller under this alternative.

Impacts of Lands with Wilderness Characteristics Actions on Riparian and Wetland Vegetation

Those riparian and wetland vegetation located within lands with wilderness characteristics would receive beneficial impacts as a result of additional management prescriptions aimed at further minimizing surface disturbances. The greater the number of acres included as lands with wilderness characteristics, the greater the benefit to riparian and wetland vegetation.

The acreages designated as lands with wilderness characteristics vary by alternative and are represented in Table 4-38.

Table 4-38. Acres within Lands with Wilderness Characteristics by Alternative

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
NA*	66,666	47,611	5,119	1,221

* There would be no units managed as lands with wilderness characteristics under the No Action Alternative.

Impacts from Management Common to All Action Alternatives

Riparian and wetland vegetation occurring on lands with wilderness characteristics would receive indirect positive impacts as a result of applicable management prescriptions, including closure to future leasing or NSO stipulations; closed to salable and withdrawn from locatable mineral development; restrictions on the construction of new roads, structures, and facilities not related to the preservation and enhancement of wilderness characteristics; VRM Class II designation; and vehicular use OHV limited. As a result of these management prescriptions, adverse impacts to riparian and wetland vegetation, such as increased erosional runoff and sediment loading downslope, decreased water quality and movement away from PFC and alterations to stream hydrology and plant communities, would be minimized.

Impacts from the No Action Alternative

Under the No Action Alternative, riparian and wetland vegetation would not receive any beneficial impacts because no lands would be designated under lands with wilderness characteristics, and therefore no riparian and wetland vegetation would benefit from management prescriptions, as described above, specific to designated lands with wilderness characteristics.

Impacts from Alternative A

Under Alternative A, the BLM would designate approximately 66,666 acres for management under lands with wilderness characteristics. Associated management prescriptions would benefit riparian and wetland vegetation by closing all lands with wilderness characteristics acres to future leases, withdrawing all acres from locatable and salable mineral development, excluding ROWs, and limiting travel to existing routes. Beneficial impacts resulting from these management prescriptions would be as those described above.

Compared with the No Action Alternative, which designates no lands with wilderness characteristics and does not propose any new management prescriptions, the magnitude of beneficial impacts to riparian and wetland vegetation is much greater under Alternative A.

Impacts from Alternative B

Under Alternative B, the BLM would designate approximately 47,611 acres for management under lands with wilderness characteristics.

Compared with the No Action Alternative, which designates no lands with wilderness characteristics and does not propose any new management prescriptions, the magnitude of beneficial impacts to riparian and wetland vegetation is much greater under Alternative B.

Impacts from Alternative C

Under Alternative C, the BLM would designate approximately 5,119 acres for management under lands with wilderness characteristics.

Compared with the No Action Alternative, which designates no lands with wilderness characteristics and does not propose any new management prescriptions, the magnitude of beneficial impacts to riparian and wetland vegetation is slightly greater under Alternative C.

Impacts from Alternative D

Under Alternative D, the BLM would designate approximately 1,221 acres for management under lands with wilderness characteristics.

Compared with the No Action Alternative, which designates no lands with wilderness characteristics and does not propose any new management prescriptions, the magnitude of beneficial impacts to riparian and wetland vegetation is slightly greater under Alternative D.

Impacts of Visual Resources Management Actions on Riparian and Wetland Resources

VRM class designations have specific management objectives that, depending on the class designated, could beneficially impact riparian and wetland vegetation. The objectives defined for VRM Class I and II include the preservation or retention of the existing character of the landscape, and they therefore minimize and at times prohibit surface-disturbing activities. Those impacts to riparian and wetland vegetation associated with mineral development, ROW construction and maintenance and other land use authorizations, and road and trail construction would be minimized within these VRM Class I and II designations. The number of acres designated as VRM Class I and II vary across the alternatives and is depicted below in Table 4-39.

Table 4-39. Visual Resource Management Decisions (acres) by Alternative

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Total	***50,671***	***273,709***	***357,803***	***67,963***	***48,263***

Impacts from the No Action Alternative

Under the No Action Alternative, a total of 50,671 acres would be designated under either VRM Class I or II (see Table 4-39). Riparian and wetland vegetation would benefit from additional management prescriptions that would prohibit or minimize ground-disturbing activities within these designated acres. Various potential adverse impacts associated with ground-disturbing activities include habitat alteration, increased erosional runoff and sediment loading downslope, water quality alterations and movement away from PFC, and changes in plant community composition.

Impacts from Alternative A

Under Alternative A, a total of 273,709 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as under the No Action Alternative; however, the magnitude of beneficial impact would be much greater under this alternative because there is a substantially greater number of acres under the VRM Class I and II designation.

Impacts from Alternative B

Under Alternative B, a total of 375,803 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as under the No Action Alternative; however, the magnitude of beneficial impact would be much greater under this alternative because there is a substantially greater number of acres under the VRM Class I and II designation.

Impacts from Alternative C

Under Alternative C, a total of 67,963 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be slightly greater under this alternative because there is an increase in the number of acres under the VRM Class I and II designation.

Impacts from Alternative D

Under Alternative D, a total of 48,263 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as under the No Action Alternative; however, the magnitude of beneficial impact would be smaller under this alternative because there is a decrease in the number of acres under the VRM Class I and II designation.

Impacts of Renewable Energy on Riparian and Wetland Vegetation

Adverse impacts to riparian and wetland vegetation would potentially occur in those areas where renewable energy projects that include surface-disturbing activities are allowed. Solar projects would result in direct removal of vegetation created by solar panels. This would potentially have indirect adverse impacts, such as increased erosional runoff, sediment loading, and degradation of water quality, within these riparian and wetland systems. Additionally, some solar projects would require substantial water resources, which would impact water availability for other resources, as well as potentially reducing water availability. Desert aquifers, springs, seeps, and other water bodies would be adversely impacted as water is extracted to meet the needs of cooling and cleaning solar systems. Wind energy, comprising the placement of wind turbines, would also result in surface disturbances that could adversely impact riparian and wetland vegetation. Impacts associated with surface-disturbing activities would include direct soil compaction and erosional runoff sediment loading, potential contaminant delivery to water bodies, and changes in plant community composition.

Impacts from Management Common to All

Adoption of programmatic policies and BMPs in both the Solar Energy Development Programmatic EIS ROD (BLM 2012a) and decisions from the Final Wind Energy Development Programmatic EIS (BLM 2005) when implemented would potentially minimize adverse impacts to riparian and wetland vegetation across the planning area.

Impacts from Management Common to All Action Alternatives

All action alternatives encourage the placement of wind development projects in areas where transmission corridors are already located and where transmission systems are already in place.

As a result, indirect impacts to riparian and wetland vegetation, such as those described at the beginning of this section, would be greatly minimized.

Impacts from the No Action Alternative

Under the No Action Alternative, the BLM would close or exclude 1,819,929 acres from each geothermal and solar development projects and 7,056 acres from wind development projects. Restrictions on the location of solar or wind energy sites would continue to be implemented on specific sites across the planning area, with the majority of the planning area excluded for solar development, as identified by the Solar Energy Development Programmatic EIS ROD (BLM 2012a). Those sites restricted from wind development projects include WSAs, WSRs, VRM Class I and II areas, and areas with known karst occurrences (for complete list of restrictions, see Chapter 2, Alternatives Matrix). Wind energy development would be restricted in designated SMAs to protect sensitive soils. In addition, applications to permit either solar or wind energy sites on public land within the planning area would be considered only if the applicant can demonstrate no negative impacts on avian and bat species. All of these management decisions would benefit riparian and wetland vegetation by minimizing surface disturbance and its associated adverse impacts, as those described above.

Impacts from Alternative A

Under Alternative A, the BLM would exclude approximately 666,783 acres from wind development. Approximately 768,020 acres would be excluded from solar development and 995,285 acres would be closed to geothermal development. Solar, wind, and geothermal development would be excluded in areas with sensitive soils, not only in SMAs, as is the case under the No Action Alternative.

Compared with the No Action Alternative, the magnitude of beneficial impacts to riparian and wetland vegetation would be potentially greater because all sensitive soils would be protected, and wind development would be prohibited on a substantially larger number of acres under this alternative. Though the No Action Alternative prohibits solar development projects on a larger number of acres, the Solar Energy Development Programmatic EIS ROD (BLM 2012a) states that most of the planning area would not be suitable to support solar development, which makes the greater number of acres closed to solar development irrelevant.

Impacts from Alternative B

Under Alternative B, the BLM would exclude approximately 912,860 acres from wind development. Under this alternative, 833,305 acres would be excluded from solar and 1,372,791 acres would be closed to geothermal development. Solar, wind, and geothermal development would be excluded in all areas with sensitive soils.

Compared with the No Action Alternative, the magnitude of beneficial impacts to riparian and wetland vegetation would be potentially greater because all sensitive soils would be protected, and wind development would be prohibited on a substantially larger number of acres under this alternative.

Impacts from Alternatives C and D

Under Alternative C, the BLM would exclude approximately 206,184 acres from wind development. Approximately 734,636 acres would be excluded from solar and 608,850 acres would be closed to geothermal development. Under Alternative D, 73,143 acres would be excluded from wind development. Under Alternative D, 630,302 acres would be excluded from solar and 464,187 acres would be closed to geothermal development. Wind and geothermal development would be avoided in areas with sensitive soils, while solar development would be excluded.

Compared to the No Action Alternative, the magnitude of beneficial impacts to riparian and wetland vegetation would be potentially greater because all sensitive soils would be avoided, and wind development would be prohibited on a substantially larger number of acres under this alternative.

4.2.4 Fish and Wildlife

4.2.4.1 Fish

This section presents an analysis of the impacts of management actions addressed in Chapter 2 on non-special status fish in the planning area. Existing conditions concerning fish across the planning area are described in Chapter 3. The fish species analyzed in this section are described in detail in Section 3.2.5.1 and include information on both game and non-game fish distributions across the planning area. Habitat locations for fish species consist of CFO lakes, rivers, and streams, as shown on Map 3-1. Impacts on special status fish and wildlife species are discussed in Section 4.2.5.1.2.

4.2.4.1.1 Analysis Methods

Indicators

In general, all protective measures that limit water pumping and ground-disturbing activities, particularly those associated with oil and gas development, would minimize adverse impacts on fish and other aquatic species.

Indicators used to assess impacts between alternatives in this analysis are the following:

- Acres of riparian habitat directly impacted.

Methods and Assumptions

Impacts to fish from management actions of the following resources, resources uses, and special designations are analyzed in detail: minerals, land use authorizations, livestock grazing, recreation, travel management, VRM and special designations. Impacts from proposed management actions for air quality, water resources, riparian, vegetative communities, fish and wildlife, special status species, wildland fire and fuels management, karst resources, lands with wilderness characteristics, paleontological and cultural resources actions are not analyzed in detail because the management actions did not vary measurably between alternatives and/or there are no or negligible impacts to fish as a result of those management actions.

The assumptions used for the impact analysis include the following:

- Those proposed management actions across the planning area that limit ground-disturbing activities would minimize resulting habitat degradation for fish and other aquatic species because impacts associated with ground disturbance, such as increased sedimentation and turbidity, alterations in water quality and loss of streamside vegetation, would not occur.
- Where special status aquatic species and native non-game fish coexist, management actions that would reduce or improve overall habitat quality would also reduce or improve overall habitat quality for native non-game fish.
- The health of fish and other aquatic wildlife populations is directly related to overall health and functional capabilities of aquatic, riparian, and wetland resources. Those proposed actions that would benefit riparian and other aquatic habitats, such as managing water pumping activities, prohibiting livestock grazing and other surface-disturbing activities, and contribute to meeting PFC would also indirectly benefit fish species by maintaining water quantity, quality, and limiting sedimentation and turbidity impacts that can negatively affect aquatic species and the habitats they depend on.

4.2.4.1.2 Direct and Indirect Impacts

Any actions that remove degrade, or fragment fish habitats are considered adverse. Beneficial impacts include actions that conserve or improve aquatic habitats, including surrounding vegetation. Proper management of soil, water, and vegetative resources, particularly in the riparian zones of watersheds, would reduce disturbances to habitat and would result in beneficial impacts to fish. Direct impacts to fish could result from the loss of habitats or key habitat features, such as spawning or feeding areas, or from the immediate loss of life.

Disturbance impacts range from short-term displacement and shifts in activities to long-term abandonment. For the purpose of this analysis, short-term impacts to fish species result from activities that contribute to the decline in abundance or distribution of a species within 5 years after the activity.

The following impacts would have the potential to affect the survivability and fecundity of fish species and are considered for this analysis:

- Sediment and turbidity—Sediment loading, resulting from increased erosion, and turbidity in waters containing sediment-intolerant fish species can reduce the availability of suitable spawning and rearing habitats, impair sources of food for fish, contribute to loss of recruitment and, in some cases, cause direct physical harm and stress.
- Habitat alteration—Changes in water quantity (instream flow) and habitat that make it nonfunctional for select species or more conducive to competitive species.
- Loss or reduction of streamside vegetation/cover—Increased temperatures, stress, reduced productivity, and disruptions to food resources.
- Water quality alteration—Actions that alter important water quality parameters, including pH, dissolved oxygen, temperature, hardness, alkalinity/salinity, and turbidity.

Impacts of Livestock Grazing Actions on Fish

The removal of livestock from riparian habitats would provide beneficial impacts to fish resources, as erosion, sedimentation, trampling of vegetation, and degradation of water quality—all of which are associated with livestock grazing (Belsky et al. 1999)—would be minimized. Fish would benefit from greater protection of these important habitat components.

Specific riparian areas may be open or closed to livestock grazing, depending on the alternative. Table 4-40 below depicts areas associated with particular river systems across the planning area and livestock grazing management actions across the alternatives.

Table 4-40. Riparian Area Management Decisions by Alternative

Riparian/River Areas	No Action	Alternative A	Alternative B	Alternative C	Alternative D
Pecos River	Open to grazing with exception of the RNAs of the Pecos River Canyons, bluntnose shiner habitat, and Red Bluff Area	Number of livestock and season of use to be established on allotment basis to ensure adequate growing season rest	Same as Alternative A	Same as Alternative A	Same as Alternative A
Black River Management Area	Closed to grazing	Same as No Action Alternative	Same as No Action Alternative	Same as No Action Alternative	Same as No Action Alternative
Small portion along Black River (outside of Black River Management Area)	Open to livestock grazing	Removal of livestock grazing within 656 feet of the river bank on either side	Same as Alternative A	Same as No Action Alternative	Same as No Action Alternative
Delaware River (both sides of U.S. 285)	Livestock grazing not permitted from November to March	Same as No Action Alternative	Removal of livestock grazing from seasonal pastures	Removal of livestock grazing from all riparian pastures	Same as No Action Alternative
Riparian springs	The following springs would be closed to grazing: Bogle Flat, Preservation, Cottonwood, Owl, Ben Slaughter, and Blue Spring	Riparian Springs and their associated riparian zones would be closed to grazing.	Same as Alternative A	Same as Alternative A	Same as Alternative A

Impacts from Management Common to All

Under all alternatives, the Black River Management Area would be closed to grazing. This proposed decision would beneficially impact fish resources through minimizing the loss of streamside vegetation cover and minimizing changes in water quality within the Black River Management Area that can result from livestock grazing.

Impacts from the No Action Alternative

Under the No Action Alternative, current livestock grazing management prescriptions would remain in place and include keeping 5,000 acres of unallotted tracts open to livestock grazing. This alternative would also close 5,226 acres to livestock grazing. Adverse impacts to fish, resulting from increased erosion, sedimentation, water depletion, and loss of streamside vegetative cover, would be minimized through greater water quality protection within these sensitive riparian habitats and fragile watersheds (see Direct and Indirect Impacts section above for further discussion on how these components impact fish).

Impacts from Alternative A

Under Alternative A, 493,120 acres would be closed to livestock grazing. This includes 5,000 acres of unallotted tracts would be closed to grazing for the purpose of protecting wildlife vegetation and watershed health. Adverse impacts to fish resources as under Alternative A would be less than those impacts described under the No Action Alternative because more acres would be closed to livestock grazing under this alternative.

Impacts from Alternative B

Under Alternative B, 153,583 acres would be closed to livestock grazing, which includes 5,000 acres of unallotted tracts. Adverse impacts to fish resources as under Alternative B would be less than those impacts described under the No Action Alternative because more acres would be closed to livestock grazing under this alternative.

Impacts from Alternative C

Under Alternative C, 8,115 acres would be closed to livestock. As with the No Action Alternative, 5,000 acres of unallotted tracts would remain open to livestock grazing. Adverse impacts to fish resources as under Alternative C would be less than those impacts described under the No Action Alternative because more acres would be closed to livestock grazing under this alternative.

Impacts from Alternative D

Under Alternative D, 3,594 acres would be closed to livestock grazing. As with the No Action Alternative, 5,000 acres of unallotted tracts would remain open to livestock grazing. Adverse impacts to fish resources as under Alternative D would be less than those impacts described under the No Action Alternative because more acres would be closed to livestock grazing under this alternative.

Impacts of Recreation Actions on Fish

Recreation management can impact aquatic species and their habitats in many ways. Human activity along or within streams and rivers, and around or within ponds, lakes, and reservoirs can, result in habitat alteration, reduced or loss of riparian vegetation cover, increased sedimentation and turbidity, and water contamination.

Acreages across the planning area designated as SRMAs or as ERMAs would not directly or indirectly impact fish resources. Recreational use of these areas would not be expected to increase or decrease as a result of designation and would not, therefore, affect vegetation cover around water bodies, sedimentation, turbidity, or overall water quality. Proposed management actions associated with mineral development and visual resources management on RMAs, however, would potentially affect fish resources and is addressed specifically within the mineral development and visual resources sections below.

Impacts from Management Common to All

RAMPs would be prepared for all designated SRMAs under management common to all. The purpose of SRMAs is to focus management, better direct people to opportunities, and coordinate recreation activities with other multiple uses in the area. The RAMPs that would be prepared for the designated SRMAs identify specific recreation implementation actions, including permitting or use allocation decisions. As part of a RAMP preparation, other resources and resource use issues are considered, which generally provides for mitigation of impacts due to recreation activities proposed under SRMAs. Therefore, it is unlikely that there would be any adverse impacts from the development of RAMPs to fish.

Under management common to all, all activities would adhere to BLM New Mexico supplementary rules that provide for several safety and procedural parameters for activities on public lands, such as no construction of pit toilets lasting more than 14 days within 100 feet of any permanent water source, no fireworks, and no cutting or removal of woody materials. All of these rules would reduce or prevent adverse impacts to fish from water contamination and sediment loading.

In addition, the Pecos River Corridor (5,619 acres) SRMA would be closed to all surface-disturbing activities, which would minimize adverse impacts such as those described above.

Impacts from Management Common to All Action Alternatives

All action alternatives in the planning area would maintain water quality in natural water sources by prohibiting camping within 900 feet of these areas (excluding the Pecos River). This would benefit native fish by reducing disturbance near riparian areas, maintaining or improving water quality, reducing sedimentation, and contributing to the overall health of riparian ecosystems near recreational areas. Other proposed decisions under management common to all action alternatives would have no effect on fish species.

Impacts of Travel Management Actions on Fish

Travel management may adversely impact fish in various ways. The presence of trails and roads within watersheds containing fish and other aquatic species can cause habitat alteration, loss or reduction of streamside vegetation cover, increased sedimentation and turbidity, and water quality alteration. Roads and trails provide means of water conveyance, which accelerates flow velocities and increases erosion and offsite soil movement and ultimately sedimentation and turbidity. These routes also compact soils, which reduce water absorption and infiltration rates and increase the peaks of runoff flows. Where motorized and, in some cases, mechanized use are high and or increasing, erosion potential is increased. These impacts are amplified where OHV use is occurring or increasing. However, the direct and indirect impacts from OHV limited travel would be minor within the planning area because OHV-caused surface disturbances would be confined to existing trails and routes.

Impacts from Management Common to All Action Alternatives

Under management common to all action alternatives, roads would be constructed and maintained as per the BLM's *Surface Operating Standards and Guidelines for Oil and Gas Development – The Gold Book* (BLM 2007a). Additionally, all surfacing material on oil and gas roads must be removed at the time of abandonment. Both of these management actions would impart indirect beneficial impacts to fish resources by minimizing the potential for erosion, runoff and contamination of streams, rivers and other water bodies that provide habitat for fish.

Impacts from the No Action Alternative

Under the No Action Alternative, 2,035,307 acres would be managed as OHV limited and approximately 55,966 acres would be closed to travel. In general, as route density increases, adverse impacts to riparian and other aquatic habitats potentially increases as well. With the majority of the planning area designated as OHV limited use under this alternative, fish resources, and habitat components upon which they depend, would be affected to a minor adverse degree because OHV travel would be confined to existing routes. The minor impacts would include those discussed above: soil erosion, sedimentation, runoff, and the potential for stream and river contamination.

Impacts from Alternative A

Under Alternative A, approximately 2,039,299 acres would be managed as OHV limited and 52,028 acres would be closed to travel. Compared to the No Action Alternative, the magnitude of impact would be slightly greater because of a 0.2% decrease in the number of acres closed to travel.

Impacts from Alternative B

Under Alternative B, approximately 2,039,299 acres would be managed as OHV limited and 41,936 acres would be closed to travel. Compared to the No Action Alternative, the magnitude of impact would be slightly greater because of a 0.7% decrease in the number of acres closed to travel.

Impacts from Alternatives C and D

Under these action alternatives, approximately 2,052,582 acres would be managed as OHV limited and 38,738 acres would be closed to travel under Alternative C, and approximately 2,052,584 acres would be managed as OHV limited and 38,737 would be managed as closed under Alternative D. Compared to the No Action Alternative, the magnitude of impact would be greater from either Alternative C or Alternative D because of a 0.8% decrease in the number of acres closed to travel.

Impacts of Land Use Authorizations Actions on Fish

The authorization of ROWs for utility and communication infrastructure (among others) could have direct, long-term, adverse impacts on fish resources as a result of fragmentation and erosion during construction and maintenance activities. These actions could contribute to an increase in sedimentation and turbidity and reduce overall riparian habitat condition and water quality. Management decisions to avoid or exclude certain areas from ROWs would have beneficial impacts to fish resources (Table 4-41).

Table 4-41. Avoidance and Exclusion Areas for Land Use Authorizations (acres) by Alternative

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Avoidance	30,965	629,149	413,654	313,619	270,360
Exclusion	7,056	662,038	918,701	165,378	69,540

Impacts from the No Action Alternative

Under the No Action Alternative, six ROW corridors have already been designated by the BLM as preferred locations for all new major utility and transportation facility alignments. A total of 30,965 acres would continue to be designated as avoidance areas and 7,056 acres (all WSAs) would continue to be designated as exclusion areas. These designations would benefit fish resources by minimizing ROW construction and associated fragmentation and disturbance near or within these important habitat areas.

Impacts from Alternative A

Under Alternative A, 629,149 acres would be designated as avoidance areas and 918,701 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative A would have fewer adverse impacts to fish resources through protection of important habitat components.

Impacts from Alternative B

Under Alternative B, 413,654 acres would be designated as avoidance areas and 704,445 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative B would provide fewer adverse impacts to fish resources through protection of important habitat components.

Impacts from Alternative C

Under Alternative C, 313,619 acres would be designated as avoidance areas and 165,378 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative C would provide fewer adverse impacts to fish resources through protection of important habitat components.

Impacts from Alternative D

Under Alternative D, 270,360 acres would be designated as avoidance areas and 69,540 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative D would provide fewer adverse impacts to fish resources through protection of important habitat components.

Impacts of Mineral Resource Actions on Fish

The majority of the planning area would be available for leasable, salable, and locatable mineral development. Mineral development activities would be subject to site-specific NEPA analysis, stipulations, COAs, and other authorities as described in Chapter 3, Section 3.3.1. In general, surface disturbance related to mineral extraction could reduce water quality and riparian condition (PFC), causing both short- and long-term impacts to native fish. Other impacts from minerals development could potentially include water depletions and increased sedimentation and turbidity.

Of primary concern are activities that result in ground disturbance and the removal of native vegetation for the construction of well pads, roads, pipelines, compressor and relay stations, settling ponds, and various assorted infrastructure. Collectively, all of these activities have the potential to provide for the off-site movement of soils and increase sediment loading and turbidity into nearby water bodies. In addition, they provide opportunities for invasive vegetation and noxious, non-native species to take hold. This reduces watershed health and results in poor soil retention, increased runoff, and poor water infiltration and absorption.

An increase in the numbers and densities of roads would be a concern because they are long-term chronic point sources of sediment input, contamination from vehicles, and serve as water collection and conveyance corridors to live streams and ephemeral drainages that ultimately feed live streams. Impacts are amplified and more acute in areas where natural gas development is occurring in small discrete watersheds. Generally, where proper and timely reclamation is occurring at well pad and pipeline sites, and where proper road construction and maintenance is occurring, impacts from off-site soil movement and sediment and turbidity would be minimized.

The acreage of land open to minerals extraction (for leasable, salable, and locatable minerals) varies across the action alternatives and is discussed below. Since leasable mineral development is the most common and prolific type of mineral development in the planning area, acres of BLM-administered lands subject to leasable mineral decisions are used to define impacts to fish in this section.

Impacts from the No Action Alternative

The greater the numbers of acres open to mineral development, the greater the potential for impacts to fish resources, as watershed health and overall riparian condition would become more vulnerable to degradation. Under the No Action Alternative, 1, 598,870 BLM surface acres would be open to leasable mineral development with standard terms and conditions. A combined 1,011,012 acres would be open with either moderate constraints (CSU) or major constraints (NSO). These lands would have greater protection from surface disturbance than those lands open under standard terms and conditions. Approximately 174,391 acres would be closed to leasable mineral development.

Impacts from Alternative A

Alternative A would open 1,142,802 surface acres within the planning area to leasable mineral development with standard terms and conditions, while a combined 880,043 surface acres would be managed as CSU or NSO. Approximately 761,404 surface acres would be closed to leasable mineral development. Alternative A provides less open areas to leasable mineral development than the No Action Alternative. Additionally, more acres would be closed to leasable mineral development than the No Action Alternative; thereby reducing the amount of surface disturbance, which would reduce sedimentation, potential improve water quality, and reduce indirect impacts to riparian areas.

Impacts from Alternative B

Alternative B would open 1,089,481 surface acres within the planning area to leasable mineral development, while a combined 614,772 acres would be managed as CSU or NSO. Approximately 1,082,972 surface acres would be closed to leasable mineral development. Alternative B provides less open areas to leasable mineral development than the No Action Alternative. Additionally, more acres would be closed to leasable mineral development than the No Action Alternative; thereby reducing the amount of surface disturbance, which would reduce sedimentation, potential improve water quality, and reduce indirect impacts to riparian areas.

Impacts from Alternative C

Alternative C would open 1,750,774 surface acres within the planning area to leasable mineral development, while a combined 944,782 surface acres would be managed as CSU or NSO. Approximately 88,502 surface acres would be closed to leasable mineral development. Alternative C provides more open areas to leasable mineral development than the No Action Alternative. Additionally, fewer acres would be closed to leasable mineral development than the No Action Alternative; thereby increasing the amount of surface disturbance, which would reduce sedimentation, potential improve water quality, and reduce indirect impacts to riparian areas. Alternative C would have a greater adverse impact on soil resources than the No Action Alternative because more acreage would be open to minerals-related surface disturbances.

Impacts from Alternative D

Alternative D would open 1,997,681 surface acres within the planning area to leasable mineral development, while a combined 701,776 surface acres would be managed as CSU or NSO. Approximately 84,687 surface acres would be closed to leasable mineral development. Alternative D provides less more areas to leasable mineral development than the No Action Alternative. Additionally, fewer acres would be closed to leasable mineral development than the No Action Alternative; thereby increasing the amount of adverse surface disturbance, which would potentially increase sedimentation, degrade water quality, and increase indirect impacts to riparian areas (the same as Alternative C).

Impacts of Special Designation Actions on Fish

Special designation areas, such as ACECs, WSRs, and WSAs would generally have long-term positive impacts on fish resources that occur within their boundaries by limiting or preventing ground disturbance, human activities, and associated habitat degradation and fragmentation. Management goals within special designations would include the protection of relevant and important fish resources and natural systems. These additional protections to riparian ecosystems and other water bodies would benefit native fish, as water quality and other food and habitat components are enhanced. Adverse impacts to fish resources, such as habitat and water quality alterations, reduction in streamside vegetation, and excessive sedimentation and turbidity within these designations would be minimized.

Areas of Critical Environmental Concern

Impacts from the No Action Alternative

Under the No Action Alternative, a total of 13,435 acres would continue to be designated as ACECs. Adverse impacts, as those described above, to fish resources and associated habitat components would be minimized within this acreage.

Impacts from Alternative A

Under Alternative A, 495,042 acres would be designated as ACECs. This alternative would have the same beneficial impacts as under the No Action Alternative; however, the magnitude of these impacts would be greater than under the No Action Alternative due to the substantial increase in the land designated as ACECs.

Impacts from Alternative B

Under Alternative B, 561,441 acres would be designated as ACECs. This alternative would have the same beneficial impacts as under the No Action Alternative; however, the magnitude of these impacts would be greater than under the No Action Alternative due to the substantial increase in the land designated as ACECs.

Impacts from Alternative C

Under Alternative C, 98,562 acres would be designated as ACECs. This alternative would have the same beneficial impacts as under the No Action Alternative; however, the magnitude of these impacts would be greater than under the No Action Alternative due to the increase in land designated as ACECs.

Impacts from Alternative D

Under Alternative D, 28,894 acres would be designated as ACECs. This alternative would have the same beneficial impacts as under the No Action Alternative; however, the magnitude of these impacts would be greater than under the No Action Alternative due to the increase in land designated as ACECs.

Wild and Scenic Rivers

Impacts from Management Common to All Action Alternatives

Under all action alternatives, 3.7 miles the Black River would be recommended as suitable for inclusion in the NWSRS. Management prescriptions for Black River WSR would vary across alternatives and are described below. Management prescriptions associated with the designated WSR segment would beneficially impact fish resources because potential adverse impacts, such as increased sedimentation and turbidity, decreased stream vegetation, and water quality alterations, would be minimized.

Impacts from the No Action Alternative

Under the No Action Alternative, the Black and Delaware Rivers would not be managed as part of NWSRS but would be managed to protect their eligibility until suitability determinations are made in this RMP. Both eligible river segments would be managed as NSO for leasable minerals, closed to salables, recommended for withdrawal for locatables, closed or excluded to renewables, and managed as a ROW avoidance areas. The Black River would be managed as VRM Class III, whereas the Delaware River would be managed as

VRM Class II and IV. These prescriptions would reduce surface disturbance, thereby reducing potential adverse impacts to fish resources including habitat and water quality alterations, reduction in streamside vegetation, and excessive sedimentation and turbidity.

Impacts from Alternative A

Under Alternative A, one segment (8.22 miles) of the Delaware River would be recommended as suitable for WSR designation. Management prescriptions under WSR designation would include manage as VRM Class II, travel limited to designed routes, closed or withdrawn from mineral development, and excluded from ROW corridors and renewable energy development. The Black River WSR would be managed with the same prescriptions. These management prescriptions provide a slightly greater degree of protection to fish resources compared to the No Action Alternative because the rivers would be exclusion areas rather than avoidance areas and would be managed as VRM Class II in their entirety

Impacts from Alternative B

Under Alternative B, the Black River would be recommended as suitable for inclusion in the NWSRS and would be managed as described under Alternative A. The Delaware River would not be recommended as suitable for inclusion in the NWSRS; however, management prescriptions would be more protective of riparian habitat than as described under the No Action Alternative. Adverse impacts to fish resources would be less than those described under the No Action Alternative.

Impacts from Alternative C

Under Alternative C, the Black River would be recommended as suitable for inclusion in the NWSRS and would be managed as described under Alternative A. The Delaware River would not be recommended as suitable for inclusion in the NWSRS and would be managed as described under Alternative B. Adverse impacts to fish resources would be less than those described under the No Action Alternative.

Impacts from Alternative D

Under Alternative D, the Black River would be recommended as suitable for inclusion in the NWSRS and would be managed as described under Alternative A, except the area would be managed as open with major constraints (NSO) for leasable development. The Delaware River would not be recommended as suitable for inclusion in the NWSRS and would be managed as described under Alternative B. Adverse impacts to fish resources would be less than those described under the No Action Alternative.

Wilderness Study Areas

Impacts from Management Common to All

Under all of the alternatives, 7,086 acres would remain under WSA designation. Management prescriptions under WSA designation include closure to mineral development leasing. This would minimize potential adverse impacts to fish resources associated with ground disturbances, such as increased sedimentation and erosion, increased turbidity, alterations in habitat and water quality, and water depletions.

Impacts of Visual Resources Management Actions on Fish

VRM class designations have specific management objectives that, depending on the class designated, could beneficially impact fish resources. The objectives defined for VRM Class I and II include the preservation or retention of the existing character of the landscape and, therefore, minimize and at times prohibit surface-disturbing activities. Those impacts to fish resources associated with mineral development, ROW construction and maintenance and other land use authorizations and road and trail construction would be minimized within these VRM Class I and II designations. The number of acres designated as VRM Class I and II vary across the alternatives and is depicted below (Table 4-42).

Table 4-42. Visual Resource Management Decisions (acres) by Alternative

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Total	***50,671***	***273,710***	***357,802***	***67,962***	***48,263***

Impacts from the No Action Alternative

Under the No Action Alternative, a total of 50,671 acres would be designated under either VRM Class I or II (see Table 4-42). Fish resources would benefit from additional management prescriptions that would prohibit or minimize ground-disturbing activities within these designated acres. Various impacts associated with ground-disturbing activities include habitat alteration, loss or reduction in streamside vegetation cover, water quality alteration, water depletions, and increased sediment loading and turbidity.

Impacts from Alternative A

Under Alternative A, a total of 273,710 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be much greater under this alternative because there are a greater number of acres under the VRM Class I and II designation.

Impacts from Alternative B

Under Alternative B, a total of 357,802 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be greater under this alternative because there are a greater number of acres under the VRM Class I and II designation.

Impacts from Alternative C

Under Alternative C, a total of 67,962 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be greater under this alternative because there would be an increase in the number of acres under the VRM Class I and II designation.

Impacts from Alternative D

Under Alternative D, a total of 48,263 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, there would be more adverse impacts under this alternative because there would be a decrease in the number of acres under the VRM Class I and II designation when compared to the No Action Alternative.

4.2.4.2 Wildlife

This section discusses impacts to wildlife from management decisions for resources and resource uses discussed in Chapter 2. Existing conditions and trends concerning wildlife and the ecosystems on which they depend are described in Section 3.2.5. Impacts to resources and resource uses resulting from implementation of wildlife management actions, including habitat improvement projects and restrictions placed on development around sensitive wildlife habitat features (e.g., bat roosts, heronries), are discussed in those particular resource sections of this chapter.

Actions that remove, degrade, or fragment wildlife habitats are considered to result in adverse impacts. Beneficial impacts include impacts from actions that conserve or improve habitats, and those that mitigate for and/or avoid adverse impacts.

Activities on public lands that could result in adverse impacts to wildlife (including insect pollinators) and fisheries include, but are not limited to:

- Direct or indirect harm, harassment, or loss of an individual animal regardless of how long the impact may occur;
- Human activities, such as OHV use, recreation, and noise from equipment associated with development and surface-disturbing activities;
- Loss of habitats or key habitat features, such as a nest site or lek area;
- Habitat fragmentation by activities such as vegetation treatments, fire management, mineral exploration and extraction, construction and maintenance of roads and trails, and development of wind-energy facilities;
- Toxic contamination of wildlife or the loss of habitat for populations to reestablish caused by toxic material either on the surface or belowground;
- Short- or long-term loss or degradation of wildlife abundance and/or diversity from impacts to wildlife habitat;
- Loss or degradation of wildlife habitat from introduction of invasive, non-native, or exotic flora or fauna.

Disturbance impacts range from short-term displacement and shifts in activities to long-term abandonment of home range (Connelly et al. 2000; Miller et al. 1998; Yarmaloy et al. 1988). Many human activities are considered to be particularly detrimental to nesting and lekking LPCs, nesting raptors, and wintering big game. Disturbance during sensitive periods (e.g., winter, nesting) is known to adversely impact wildlife by causing increased energy expenditure during times when the energy input/output balance is already tenuous (Boyle and Samson 1985; Knight and Cole 1991). Increased energy expenditure and home range abandonment can result in reduced breeding fitness and/or opportunities, ultimately leading to reduced abundance.

Avoidance is the preferred method to prevent loss or degradation of wildlife and wildlife habitat. If a measure to prevent the loss of habitat is not available, then an action (mitigation) would be designed to minimize impacts to all affected areas, including consideration of off-site mitigation and studies to determine the magnitude of impacts for adaptive resource management techniques, which would adjust management accordingly.

4.2.4.2.1 Analysis Methods

Indicators

The indicators used for the analysis of impacts to wildlife consist of habitat quality, loss or gain of habitat, and wildlife surveys. These indicators are explained in detail in Section 4.2.4.2.2 of this document. Impacts are not analyzed for every indicator in every section of this analysis; only those indicators relevant to the management in each section are used.

Methods and Assumptions

Impacts to wildlife from management actions described in Chapter 2 are analyzed in detail here for the following resources and resource uses: fish and wildlife, riparian areas, special status species, visual resources, air resources, livestock grazing, recreation and travel management, land use authorizations, renewable energy, minerals, and special designations. Impacts from decision related to cave and karst resources, soil resources, vegetative communities, riparian, wildland fire and fuels management, water resources, cultural resources, paleontological resources, land tenure, lands with wilderness characteristics, Outstanding Natural Areas (ONAs), RNAs, SMAs, and backcountry byways are not analyzed in detail. This is because there would be no or negligible impacts to wildlife and wildlife habitat as a result of those management actions because wildlife habitat would not be measurably altered, and individuals would not be impacted. Management actions related to tribal rights and interests, social and economic conditions, and public safety do not authorize, contemplate, or otherwise intersect with surface-disturbing activities or the mitigation thereof, so these decisions also do not impact wildlife or wildlife habitat.

Impacts to wildlife from proposed management actions are analyzed based on the scientific literature, including published studies and government reports. Assumptions used in this impact analysis consist of the following:

- Disturbance impacts to wildlife are evaluated by comparison to current management practices in the planning area; increased protection in time or space is beneficial, whereas reduced protection results in adverse impacts.
- Disturbance during sensitive periods, such as nesting and wintering, adversely impacts wildlife.
- Habitat fragmentation adversely impacts wildlife.
- The amount of surface disturbance due to leasable, salable, and locatable minerals development increases as a function of the acreage open to mineral development. Although that acreage does not quantify the exact amount of surface disturbance related to minerals development, it measures potential wildlife impacts as a result of the surface-disturbing activities associated with mineral development.

4.2.4.2.2 Direct and Indirect Impacts

Impacts of Fish and Wildlife Management Actions on Wildlife

Impacts from the No Action Alternative and Alternatives C and D

Under the No Action Alternative and Alternatives C and D, there would be no specific action to manage the proposed Birds of Prey Grassland ACEC as an ACEC. As such, the area would remain open to wind and solar energy development, as well as OHV limited use and grazing. Mineral leasing would continue to be associated with standard terms and regulations. As a result, the potential for mortality of individuals, habitat degradation, and removal of grassland wildlife species associated with these activities would not change from the current conditions.

Impacts from Alternatives A and B

Under Alternatives A and B, 349,355 acres of grasslands would be designated as the Birds of Prey Grassland ACEC. Within the ACEC, development would adhere to prescriptions and stipulations, consisting of OHV limited travel, placing a cap on the amount of area that can be disturbed in a lease, requiring bird nest surveys, restricting the routing of new pipelines and power lines, and locating wells in already disturbed areas. Grazing would be closed under Alternative A but would continue to be allowed in the ACEC under Alternative B. The proposed ACEC prescriptions and restrictions would benefit wildlife that occur in the Birds of Prey Grassland ACEC by reducing allowable amounts of habitat degradation, removal, and disturbance from human noise and activity. This management action would provide for greater benefits to grassland wildlife than the No Action Alternative because these restrictions would not apply under the No Action Alternative.

Impacts of Special Status Species Management Actions on Wildlife

Impacts from Management Common to All Alternatives

All action alternatives would define LPC habitat areas and restrict oil and gas activities within these area, as described in Chapter 2. Management actions focusing on the LPC habitat areas are also beneficial for other wildlife species that use the sand shinnery oak habitat within the habitat areas because these management actions are targeted toward maintaining large patches of diverse habitat and reducing disturbance during the breeding season.

Impacts of Visual Resources Management Actions on Wildlife

Impacts on wildlife from lighting requirements would be the same as described for Impacts of Visual Resource Management Actions on Special Status Wildlife, except for statements made about a particular special status species. This is because common terrestrial wildlife would react to proposed management actions in ways similar to special status wildlife.

Impacts from Management Common to All Alternatives

The impacts to wildlife from visual resources decisions are primarily associated with limitations on surface disturbance intended to reduce impacts to areas with high visual resource values. VRM Class I and II designations are the most restrictive of surface-disturbing activities and would therefore be the most beneficial to wildlife and their habitats. In areas designated as VRM Class I or II, surface-disturbing activities are generally prohibited or limited. Table 4-43 shows the proposed VRM classes in acres.

Table 4-43. Visual Resource Management Classes in Acres

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Class III	402,725	367,205	294,177	549,329	546,205
Class IV	2,330,462	2,142,600	2,131,501	2,166,266	2,189,116
Total	***2,783,858***	***2,783,514***	***2,783,481***	***2,783,558***	***2,783,585***

Impacts from the No Action Alternative

The No Action Alternative would designate 50,671 acres (or 1.8% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit wildlife in the ways described in Impacts from Management Common to All Alternatives.

Impacts from Alternative A

Alternative A would designate 273,710 acres (or 9.8% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit wildlife in the ways described in Impacts from Management Common to All Alternatives more than the No Action Alternative.

Impacts from Alternative B

Alternative B would designate 357,802 acres (or 12.8% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit wildlife in the ways described in Impacts from Management Common to All Alternatives more than the No Action Alternative. Because of the large area designated as Class I or II, this alternative is the most beneficial for wildlife, compared with all other alternatives.

Impacts from Alternative C

Alternative C would designate 67,962 acres (or 2.4% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit wildlife in the ways described in Impacts from Management Common to All Alternatives more than the No Action Alternative.

Impacts from Alternative D

Alternative D would designate 48,263 acres (or 1.7% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit wildlife in the ways described in Impacts from Management Common to All Alternatives less than the No Action Alternative.

Impacts of Air Resources Management Actions on Wildlife

No impacts to wildlife have been identified from any air resources management actions.

Impacts of Livestock Grazing Actions on Wildlife

Impacts from Management Common to All Alternatives

Under all alternatives, livestock grazing would continue. Livestock grazing can affect grassland wildlife species through such impacts as trampling wildlife individuals, competing for forage, destruction of pollinator nests and potential nest sites, removal of pollinator food resources, and habitat degradation by the spread of invasive weeds and promoting the spread of mesquite. Cattle disperse honey mesquite (*Prosopis* *glandulosa*) seeds far from their source, contributing to an ongoing trend of mesquite encroachment on grasslands habitat (Drewa et al. 2001). Mesquite trees grow in dense stands, outcompeting most other vegetation. Mesquite encroachment reduces the availability of habitat for wildlife that occurs in grasslands. Other detrimental impacts from grazing could include loss of forage diversity, lowering of plant and animal population densities, disruption of some ecosystem functions (such as changes in fire frequency and soil composition), changes to community organization, and changes to the physical characteristics of both terrestrial and aquatic habitats (Fleischner 1994; Chaneton and Lavado 1996; Olff and Ritchie 1998).

Livestock grazing management actions primarily focus on the amount of wildlife habitat open and closed to grazing activities. Table 4-44 displays these decisions by alternative. Generally, acres open to livestock grazing lead to higher potential for the negative impacts described above. Acres closed to grazing are generally beneficial to wildlife because the potential for those negative impacts is avoided.

Table 4-44. Livestock Grazing Management Decisions (acres) by Alternative

Status	No Action	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,086,107	1,598,198	1,937,725	2,083,232	2,087,759
Closed	5,226	493,120	153,583	8,115	3,594
Total	***2,091,333***	***2,091,318***	***2,091,308***	***2,091,347***	***2,091,353***

Impacts from the No Action Alternative

Under the No Action Alternative, 2,086,107 acres would remain open to livestock grazing, and 5,226 acres would be closed. Livestock grazing would be removed from 13 SMAs to reduce conflicts between sensitive riparian habitats, fragile watersheds, and other multiple-use values. Removing grazing from these sensitive habitat areas would benefit the local wildlife by helping to avoid the negative impacts described in Impacts from Management Common to All Alternatives.

Under the No Action Alternative, the following management actions regarding livestock grazing in riparian areas would occur: livestock would be removed from SMAs that contain riparian areas within their designated boundaries; riparian areas of the Pecos River would be open to grazing, except the RNA of the Pecos Rivers Canyons/Complex ACEC, bluntnose shiner habitat, and the Red Bluff area; the Black River Management Area would be closed, but areas of the Black River outside the management area would be open to grazing; grazing would be allowed during the dormant season (November–March) along the Delaware River; and six riparian springs (Bogle Flat, Preservation, Cottonwood, Owl, Ben Slaughter, and Blue Spring) would be closed. In addition to the impacts listed in Impacts from Management Common to All Alternatives, the presence of cattle can be especially detrimental in riparian areas because cattle tend to congregate in riparian areas for shade and water, leading to trampling and overgrazing of stream banks, soil erosion, and loss of stream bank stability (Belsky et al. 1999). This management action could benefit riparian wildlife by enhancing food quality and availability, increasing thermal and hiding cover, decreasing local soil compaction and erosion, and avoiding the loss of stream bank habitat.

Impacts from Alternative A

Under Alternative A, 493,120 acres of BLM-administered land would be closed to livestock grazing, 25.0% more than under the No Action Alternative. In areas closed to livestock grazing, many wildlife species would benefit directly because competition with livestock for forage would be eliminated. As described in Impacts from Management Common to All Alternatives, the spread of mesquite could slow, resulting in maintaining natural ecological processes in areas closed to grazing. Most of the closure to livestock grazing would be in the Birds of Prey, Gypsum Soils, and Chihuahuan Rivers proposed ACECs.

Alternative A would place restrictions on livestock grazing in riparian areas, such as removing grazing within 656 feet of the Black River bank (outside the management area), allowing grazing only during the dormant season (November–March) adjacent to the Delaware River (like the No Action Alternative), removing livestock from the Riparian Springs and associated riparian zones, and establishing grazing systems to ensure adequate growing and rest seasons adjacent to the Pecos River. This alternative would result in the same types of beneficial impacts described in the No Action Alternative, but in a greater riparian area, thereby increasing the magnitude of the impacts.

Impacts from Alternative B

Under Alternative B, 153,583 acres of BLM-administered land would be closed to livestock grazing, primarily in the proposed Desert Heronries ACEC and Gypsum Soils ACEC. In all closure areas, the absence of livestock grazing would benefit wildlife because vegetation would become available for foraging and for cover for wildlife.

Under Alternative B, management actions removing grazing from the riparian areas would be identical to Alternative A except the Black River Management Area would also be closed to grazing, and livestock grazing on the Delaware River would be removed from seasonal pastures. This alternative would result in the same types of beneficial impacts described in the No Action Alternative, but to a greater degree in riparian areas, thereby increasing the magnitude of the beneficial impacts. Compared to the No Action Alternative, this alternative would be more beneficial for wildlife because more acreage would be closed to livestock grazing.

Impacts from Alternative C

Under Alternative C, 8,115 acres of BLM-administered land would be closed to livestock grazing, which is approximately 4 times more than under the No Action Alternative. All increased vegetation from restoration efforts would be allocated to livestock. All increased forage/cover would be allocated to watershed and wildlife resources, which would benefit wildlife due to increased forage availability.

Under Alternative C management actions regarding grazing in the Black River Management Area and the Black River (outside the management area) would be the same as the No Action Alternative. Actions regarding grazing on the Pecos River and Riparian Springs would be the same as Alternative A, and grazing would be removed from the riparian pastures of the Delaware River, including fencing the south side of the river and providing off-site water to pastures where there was previous access to the river. This alternative would result in the same nature of beneficial impacts described in the No Action Alternative, but in a greater riparian area, thereby increasing the magnitude of the impacts.

Impacts from Alternative D

Under Alternative D, 3,594 acres would be closed to livestock grazing. All increased vegetation from restoration efforts would be allocated to livestock and would not provide increased available forage for wildlife.

Under Alternative D, nearly the entire planning area would be adversely open to livestock grazing, with the exception of Pecos bluntnose shiner habitat and the Pope’s Well ACEC. That would leave most riparian areas, important grasslands, karst high occurrence zones, and other special habitat types open to livestock grazing, which may result in the adverse impacts described in Impacts from Management Common to All Alternatives.

Under Alternative D management, actions regarding grazing in the Black River Management Area and the Black River (outside the management area) would be the same as the No Action Alternative. Actions regarding grazing on the Pecos River, Delaware River, and Riparian Springs would be the same as Alternative A. This alternative would result in the same types of beneficial impacts described in the No Action Alternative, but in a greater riparian area, thereby increasing the magnitude of the impacts. Alternative D would be the least beneficial of the action alternatives because the fewest acres would be closed to livestock grazing to protect wildlife habitat.

Impacts of Recreation and Travel Management Actions on Wildlife

Impacts from Management Common to All

Under all alternatives, recreational activities would continue to be permitted in the planning area, with adverse impacts on wildlife species primarily from OHV use. OHVs can adversely impact wildlife through multiple mechanisms that include short-term adverse impacts to air quality from dust production, short- and long-term loss of vegetation cover from damage by vehicles and soil disturbance, mortality by collision, loss and disturbance of nests for ground-nesting avian and pollinator species, habitat fragmentation, degradation of habitat through introduction of invasive and exotic weed species and associated impacts to habitat quality and quantity of available habitat, and displacement due to human noise and activity. However, these adverse impacts would be mitigated by designating OHVs as limited -l, which would greatly reduce the impacts of vegetation and habitat loss, but all other impacts would potentially occur. The scale of these impacts, however, would only occur adjacent to OHV limited routes. Closure of areas to OHV use would help to prevent these negative impacts on wildlife that inhabit the closed areas, which would be a beneficial impact. Table 4-45 displays the amount of habitat open, limited to designated and existing routes, and closed to OHV use.

Table 4-45. Travel Management Decisions (acres) by Alternative on BLM-administered Lands

Management	No Action	Alternative A	Alternative B	Alternative C	Alternative D
Limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966 (2.7%)	52,028 (2.5%)	41,936 (2.0%)	38,738 (1.9%)	38,737 (1.9%)
Total	***2,091,273***	***2,091,326***	***2,091,327***	***2,091,320***	***2,091,321***

In addition to OHV use, impacts from recreation can be placed into three categories: potential for fire, equestrian activities, and hunting. Where recreational activities are permitted, there is a risk of unplanned wildfire associated primarily with campfires and cigarette smoking, leading to the adverse impacts of fire. Equestrian recreational activities may promote the spread of invasive and noxious weeds from livestock feed (hay) containing invasive and noxious weed seeds, thus degrading habitat quality by reducing biodiversity and available nutrients for forage. Hunting can adversely affect game species by being a direct source of mortality. Hunting may adversely or beneficially affect non-game species by directly reducing population numbers of prey, competitors, or predators.

Impacts from the No Action Alternative

Under the No Action Alternative, 55,966 acres (2.7% of the planning area) would be closed to OHVs, and approximately 2,035,307 acres would be managed as OHV limited. There would be potentially adverse impacts of OHV use on wildlife (discussed above in Impacts from Management Common to All Alternatives) under this alternative from engine and human-caused noise disturbance, possible mortality by collision, or habitat fragmentation and degradation. However, the impacts would be minor because OHV travel would be confined to trails and routes.

Impacts from Alternative A

Under Alternative A, 52,028 acres (2.5% of the planning area) would be closed to OHVs and 2,039,299 acres (97.5% of the planning area) would be managed as OHV limited. Compared to the No Action Alternative, the magnitude of impact would be slightly greater because of a 0.2% decrease in the number of acres closed to travel. Compared with the No Action Alternative, wildlife populations adjacent to existing or designated routes would potentially be adversely impacted slightly more by fugitive dust, habitat fragmentation, displacement due to human noise and activity, and habitat degradation from the introduction of invasive and exotic weed species; however, the impacts to wildlife from OHV limited use would be minor because OHV travel would be confined to existing routes and trails.

Impacts from Alternative B

Under Alternative B, 41,936 acres (2.0% of the planning area) would be closed to OHVs, and 2,049,391 acres (98% of the planning area) would be OHV limited. Compared to the No Action Alternative, the magnitude of impact would be slightly greater because of a 0.7% decrease in the number of acres closed to travel. The adverse impacts would be minor for the same reasons as discussed under the No Action Alternative for the same reasons.

Impacts from Alternatives C and D

Under Alternatives C, 38,738 acres (1.9% of the planning area) would be closed to OHVs, and 2,052,582 acres (98.1% of the planning area) would be OHV limited, and under Alternative D, approximately 2,052,584 acres would be managed as limited and 38,737 acres would be closed to OHV use. Compared to the No Action Alternative, the magnitude of impact would be greater because of a 0.8% decrease in the number of acres closed to travel under Alternatives C and D. The types of the impacts would be the same as that described for Impacts from Management Common to All Alternatives, but the beneficial impacts of closure would be less because OHV closed areas would be reduced under these alternatives, with more of the planning area would be designated as OHV limited. The adverse impacts would be minor for the same reasons as discussed under the No Action Alternative.

Impacts of Land Use Authorizations Actions on Wildlife

Impacts from Management Common to All Action Alternatives

All action alternatives would designate a combination of “exclusion” and “avoidance” areas for ROWs, as shown in Table 4-46. ROWs would be prohibited in exclusion areas and would be avoided when possible in avoidance areas. Exclusion areas would have beneficial impacts to most wildlife because the adverse habitat fragmentation, surface disturbance, weed invasion, and displacement due to human noise and activity would not occur. Avoidance areas would often result in avoidance of negative impacts, as described for exclusion areas. However, some ROWs would be approved in these areas, and wildlife and pollinator species could be impacted by the construction of overhead power lines. Overhead power lines result in adverse impacts to some wildlife species and beneficial impacts for others. In general, overhead power lines add to habitat fragmentation. In addition, the presence of power lines raises the potential for avian species to collide with the wires or be electrocuted. On the other hand, power line towers increase perching and hunting habitat for raptor species, allowing them to hunt more efficiently. The towers are also often used for nesting and may beneficially increase raptor populations because of the greater availability of nesting sites.

Table 4-46. ROW Lands Use Authorizations by Alternative on BLM-administered Lands (acres)

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Avoid	30,965	629,149	413,654	313,619	270,360
Exclude	7,056	662,038	918,701	165,378	69,540

Impacts from the No Action Alternative

The No Action Alternative would exclude WSAs (7,056 acres) from ROW development, which would protect wildlife from the noise and surface disturbance. Approximately 30,965 acres would be managed as an avoidance area for ROWs, which would reduce negative impacts to wildlife.

Impacts from Alternative A

Alternative A would include 662,038 acres for exclusion, including the following areas: habitat for federally listed/proposed threatened and endangered species, designated and proposed critical habitat for federally threatened and endangered species, wetland and riparian areas, and lands with wilderness characteristics. Alternative A would designate 629,149 acres for ROW avoidance, including the following: BLM sensitive plant and animal species’ habitat, federal candidate species’ habitat, and open sand dunes. Wildlife that occurs in the areas designated as exclusion zones would benefit from the avoidance of habitat fragmentation impacts and the impacts of overhead power lines described in Impacts from Management Common to All Action Alternatives. Wildlife that occur in avoidance areas would also benefit from avoidance of habitat fragmentation, but to a lesser degree because some power lines may be approved. This alternative would be more beneficial for wildlife than the No Action Alternative because of the greatly increased acreage of habitat avoided or excluded from ROW development.

Impacts from Alternative B

Alternative B would include 918,701 acres for ROW exclusion and 413,654 acres for ROW avoidance. The nature of impacts in exclusion and avoidance areas would be similar under Alternative B to those described for Alternative A because the management actions would be similar, with large areas designated as exclusion and avoidance. This alternative would be the most beneficial for wildlife when compared to all other alternatives because of the amount of habitat avoided or excluded from ROW development.

Impacts from Alternative C

Under this alternative, 165,378 acres would be ROW exclusion areas and 313,619 acres would be avoidance areas. Lands with wilderness characteristics would constitute exclusions areas only for pipeline and power line projects, and wetland and riparian areas would constitute exclusion areas only for roads. Under this alternative, the following would be designated as avoidance areas: habitat for federally listed/proposed threatened and endangered species, designated and proposed critical habitat for federally threatened and endangered species, BLM sensitive plant and animal species' habitat, federal candidate species' habitat, and open sand dunes. Wetland and riparian areas would be avoidance areas for pipelines and power lines. Lands with wilderness characteristics would be avoidance areas for roads and sites. The impacts to wildlife would be similar to those discussed under Alternative A, but to a lesser degree. This alternative would be more beneficial for wildlife than the No Action Alternative because of the greatly increase acreages of habitat avoided or excluded from ROW development.

Impacts from Alternative D

Under this alternative, 69,540 acres would be ROW exclusion areas and 270,360 acres would be avoidance areas. Under this alternative, all of the habitat types and designations listed under the other action alternatives as exclusion or avoidance areas would be avoidance areas under this alternative, resulting in fewer beneficial impacts to wildlife than all other action alternatives. However, this alternative would still be more beneficial for wildlife than the No Action Alternative because of the increased acreages of habitat avoided or excluded from ROW development.

Impacts of Renewable Energy Management Actions on Wildlife

Impacts from Management Common to All

Renewable energy management actions consist of choosing areas where the BLM will consider applications for the permitting, construction, and maintenance of wind, solar, and geothermal energy projects. The adverse impacts on wildlife from renewable energy projects include short- and long-term displacement caused by habitat removal and surface disturbance; habitat fragmentation, especially from linear projects such as power lines and pipelines; disruption of breeding and other sensitive activities caused by human noise and disturbance; reduction in available foraging habitat and available prey; destruction of pollinator nests and potential nest sites; and removal of pollinator food resources. Each of these impacts could result in decreased health of the individual and/or of the local wildlife population.

In addition to the impacts described above, wind energy projects can also directly impact bird and bat species through collision with turbine blades (Arnett et al. 2007). For avian species, songbird and raptor mortality has been most often documented at wind farms, and due to the timing of mortality most are thought to be killed while on their migration route (Arnett et al. 2007). Migrating bats have also been killed by wind turbines from both collision and barotrauma—bursting of lung capillaries due to extreme pressure changes (Baerwald et al. 2008). Hoary and silver-haired bats have been killed most often at wind farms. In general, the presence of a wind farm raises the potential for mortality for many bird and bat species and could result in population-level impacts (Kuvlesky et al. 2007). Three years of baseline bird and bat use surveys and 2 years of post-construction surveys would be required as part of the application to permit renewables projects on public land within the planning area.

Impacts from the No Action Alternative

Under this alternative, restrictions would be placed on the locations where wind energy projects could be permitted, such as along the face of the Guadalupe Mountains, grassland areas in the northwestern portion of the planning area, within cave/karst occurrences, and ACECs. Because of these restrictions, impacts that could result from renewable energy development, such as those described in Impacts from Management Common to All Alternatives, would be avoided in certain parts of the planning area. Wildlife occupying those areas would benefit from the restrictions. However, the short- and long-term negative impacts associated with renewable energy development could occur throughout the remainder of the planning area.

Impacts from Alternative A

Alternative A would exclude wind and solar and close areas to geothermal development in the following areas that are relevant to this discussion: lands with wilderness characteristics managed to protect wilderness characteristics or managed to emphasize other multiple uses while applying some protective management, LPC habitat areas, wetlands and riparian areas, areas along the face of the Guadalupe Mountains, grassland areas in the northwestern portion of the planning area, designated and proposed critical habitat for federally threatened and endangered species, and habitat for federally listed and proposed threatened and endangered species for which critical habitat has not been designated. Wildlife occupying those areas would benefit because the impacts associated with renewable energy development (as described in Impacts from Management Common to All Alternatives) would be avoided. Compared with the No Action Alternative, this alternative would be more beneficial to wildlife, especially those species occupying LPC habitat areas, wetland and riparian areas, and habitat for federally listed and proposed threatened and endangered species for which critical habitat has not been designated.

Impacts from Alternative B

The management actions under Alternative B are identical to Alternative A, except that wind development would be avoided (not excluded) in habitat for federally listed and proposed threatened and endangered species for which critical habitat has not been designated. Avoidance means that development could occur if no other option is feasible, and so these types of projects could occur within this habitat designation. This alternative would result in more negative impacts, as described in Impacts from Management Common to All Alternatives, than the No Action Alternative, to the wildlife inhabiting those areas.

Impacts from Alternative C

The management actions under Alternative C are identical to Alternative B, except that wind development would also be avoided (not excluded) in the grassland areas in the northwestern portion of the planning area. By not excluding this area from development, wildlife species occupying this grassland habitat could be negatively impacted from renewable energy development.

Impacts from Alternative D

The management actions under Alternative D are identical to Alternative B, except that wind development would be open in the Chaves City and Bootheel areas, which are located in the grasslands in the northwestern portion of the planning area. This alternative would result in more impacts than all other alternatives on wildlife species occupying this area.

Impacts of Leasable, Salable, and Locatable Minerals Actions on Wildlife

Impacts from Management Common to All Alternatives

Under all alternatives the BLM would continue to dispose of leasable, salable, and locatable minerals in accordance with applicable regulations. The number of acres leased would not directly correspond to the amount of habitat lost, since some leases may not be fully developed. However, it can be used as an estimate to project which areas would be more heavily impacted. Minerals leasing is divided into four categories: open, open with moderate constraints, open with major constraints (NSO), and closed/withdrawn. These categories are defined in Chapter 3, Section 3.3.1. For the purposes of wildlife impact analysis, NSO and closed are synonymous because NSO would require that there be no surface disturbances, so there would be no adverse surface-disturbing impacts to wildlife. Possible impacts for each minerals leasing category are summarized below. The precise impacts would be dependent on each project and would be analyzed in detail in the corresponding site-specific documentation required under NEPA.

Wildlife habitat designated as open could be impacted by minerals development. Impacts from minerals development include habitat removal, crushing or trampling of individuals, destruction of pollinator nests and potential nest sites, removal of pollinator food resources, habitat fragmentation, displacement from breeding locations or other sensitive habitats (e.g., wintering, roosting habitats), increased fugitive dust, changes in habitat structure or composition from the introduction and spread of invasive and weedy plant species, increased potential for ingestion of toxic substances, and increased energy expenditure from aversion to human noise and activity. These impacts can harm wildlife individuals and decrease the health and abundance of populations.

Wildlife habitat designated as open with moderate constraints would apply restrictive lease stipulations on minerals development, including actions required to mitigate negative impacts such as those listed above. Negative impacts associated with minerals development could occur in these areas, but mitigative and avoidance actions would be stipulated to avoid or reduce those impacts.

Acres designated as closed, withdrawn, or open with major constraints would avoid all negative impacts associated with minerals management actions. This is because no minerals exploration or development could take place on areas that are closed or withdrawn. Areas that would be open with major constraints would be subject to NSO, meaning that habitat would not be removed and surface-disturbing activities would not occur.

Impacts from the No Action Alternative

Under the No Action Alternative, minerals development would continue as under current conditions. A total of 57% of the BLM surface lands in the planning area would remain open for leasable minerals with standard terms and conditions, 95% would be open for salable minerals development, and 98% would be open for locatable minerals development. Overall, more of the planning area is open to minerals development under this alternative than under any of the action alternatives. Wildlife habitat and individuals could be impacted in areas open to minerals development in the ways described in Impacts from Management Common to All Alternatives.

Impacts from Alternative A

Under Alternative A, 41% of the surface lands in the planning area would remain open for leasable minerals, 42% would be open for salable mineral development, and 86% would be open for locatable minerals development. This would be a decrease in lands open to minerals development, compared with the No Action Alternative. Wildlife habitat and individuals could be impacted in areas open to minerals development in the ways described in Impacts from Management Common to All Alternatives.

High, moderate, and low productive playas would require a range of mitigation for oil and gas activities, with highly productive playas requiring the most restrictive mitigation. Mitigation for playa habitat is described in detail in Chapter 2, Alternatives Matrix. These mitigation measures would mitigate negative impacts to wildlife and their habitat of oil and gas activities in sensitive playa habitat. Without these measures, there would be increased potential for wildlife displacement, habitat degradation due to weed introduction and failed reclamation, and altered water flow. Playas are especially sensitive to these types of disturbances because they may seasonally support large numbers of migrating wildlife, such as shorebirds.

Impacts from Alternative B

Under Alternative B, 39% of the surface lands in the planning area would remain open for leasable mineral development with standard terms and conditions, 40% would be open for salable mineral development, and 76% would be open for locatable mineral development. This represents a decrease in lands open to minerals development, compared with the No Action Alternative, and is the most restrictive of all the action alternatives. Wildlife habitat and individuals could be impacted in areas open to minerals development in the ways described in Impacts from Management Common to All Alternatives, and impacts would be avoided in those areas closed to minerals development.

No surface disturbances would be allowed within 656 feet of any playa in the CFO, regardless of its productivity rating. This action would lead to similar impacts as described for Alternative A, but because it is more restrictive, the magnitude of beneficial impacts would be greater.

Impacts from Alternative C

Under Alternative C, 63% of the surface lands in the planning area would remain open for leasable mineral development with standard terms and conditions, 64% would be open for salable mineral development, and 95% would be open for locatable mineral development. This represents a decrease in lands open to minerals development, compared with the No Action Alternative. Wildlife habitat and individuals could be impacted in areas open to minerals development in the ways described in Impacts from Management Common to All Alternatives.

The management actions regarding playas under this alternative would be identical to Alternative A, resulting in identical impacts.

Impacts from Alternative D

Under Alternative D, 72% of the surface lands in the planning area would remain open for leasable mineral development, 73% would be open for salable mineral development, and 96% would be open for locatable mineral development. This represents a decrease in lands open to minerals development, compared with the No Action Alternative; however, it is the least restrictive, compared with all other action alternatives. Wildlife habitat and individuals could be impacted in areas open to minerals development in the ways described in Impacts from Management Common to All Alternatives.

There would be no management actions regarding playas, which would result in the same impacts as described for the No Action Alternative.

Impacts of ACEC Actions on Wildlife

Impacts from Management Common to All

ACEC management decisions would generally reduce long-term impacts to wildlife species that occur inside their boundaries. Impacts to wildlife vary among alternatives, based on the acreage of areas designated as ACECs and the land management prescriptions within each area. ACECs are designated to protect identified relevant and important values, such as cultural resources, scenic qualities, and natural systems. Each ACEC is prescribed various levels of limitations on activities such as oil and gas leasing, ROWs development, renewables development, livestock grazing, and travel. See Chapter 2, Alternatives Matrix - Special Designations, for details on ACEC prescriptions by alternative. In general, ACEC designation would reduce the adverse impacts to wildlife and their habitat by limiting human activity and associated surface disturbances and thereby prevent habitat loss and degradation.

Impacts from Management Common to All Action Alternatives

Under all action alternatives, additional ACECs would be established across the planning area, with beneficial impacts on non-game species through reduced potential for habitat loss, degradation, and fragmentation and reduced noise disturbance. For example, the Cave Resources ACEC (19,625 acres) which includes Boyd’s Cave, Burton’s Flat Cave Complex, Chosa Draw Caves, Fence Canyon Caves, Lost Cave, Manhole/Mudgett’s Caves, McKittrick Hill Caves, Sinkhole Flats, and Yellowjacket Cave, would be designated and would be managed with numerous prescriptions, including NSO within 656 feet of surface drainages that feed into cave systems, withdrawal of the ACEC from solid mineral extraction and disposal, restriction of motorized vehicles to established roads, and OHV limited travel. All of these management actions would prevent adverse impacts on the local wildlife, such as surface disturbance and human noise and activity.

Impacts from the No Action Alternative

Under the No Action Alternative, the five already established ACECs, totaling 13,453 acres, would continue to be managed as ACECs. Management would continue under current conditions. Restrictions put in place for the protection of those important resources in each ACEC would likely benefit wildlife by limiting the amount of habitat loss or degradation and reducing the potential for noise disturbance. For example, restrictions within the Lonesome Ridge ACEC have been put in place to ensure that the area's outstanding natural values persist through time in an unaltered condition. As a result, activities permitted within the ACEC are restricted to primitive non-motorized recreational opportunities, including cave exploration, hiking on semi-developed trails, hunting, and outstanding opportunities for wildlife and scenic photography, all of which are activities that would have a negligible impact on wildlife individuals.

Impacts from Alternative A

Under Alternative A, 495,042 acres would be designated as ACECs, approximately 36 times more area than the No Action Alternative. Because the ACEC designation carries with it management actions that result in less surface disturbance and stricter management restrictions and stipulations than current conditions, the ACEC designation under Alternative A would have beneficial impacts for many wildlife species. Compared to the No Action Alternative, this alternative would be substantially more beneficial for wildlife because a much greater acreage would be managed for wildlife protection under ACEC prescriptions.

Impacts from Alternative B

Under Alternative B, 561,441 acres would be managed as ACECs, which is more than any other alternative and more than 40 times more area than the No Action Alternative. The ACECs proposed under Alternative B include Salt Playas, Desert Heronries, and Maroon Cliffs, all of which would not become designated ACECs under the other alternatives. Because the ACEC designation carries with it management actions that result in less surface disturbance and stricter management restrictions and stipulations than current conditions, this alternative would provide the greatest benefits for wildlife species among all alternatives. The impacts would be the same as discussed for Alternative A, but to a greater degree because more of the planning area would be managed as ACECs. Compared to the No Action Alternative, the impacts would be the same as discussed under Alternative A for the same reasons.

Impacts from Alternative C

Under Alternative C, 98,563 acres would be managed as ACECs, which is seven times more than the No Action Alternative. A total of eight ACECs would be designated under Alternative C, and of those, six would contain riparian areas and riparian vegetation, resulting in increased protection for riparian habitats. The impacts would be the same as discussed under Alternative, but to a lesser degree because of the substantially smaller ACEC acreage, with the same comparison to the No Action Alternative for the same reasons.

Impacts from Alternative D

Under Alternative D, 28,894 acres would be managed as ACECs, which is more than twice the No Action Alternative acreage and the smallest area among the action alternatives. In addition to those listed under the No Action Alternative, four ACECs would be designated: Lonesome Ridge, Maroon Cliffs, Pecos River Canyon Complex, and Serpentine Bends. The impacts would be the same as discussed under Alternative C, but to a lesser degree, because the acreage designated as ACECs would be smaller. This alternative would be the least protective of wildlife when compared to the other action alternatives.

4.2.5 Special Status Species

This section discusses impacts to special status plants, fish, and terrestrial animals from management actions of other resources and resource uses discussed in Chapter 2. Existing conditions concerning special status species are described in Section 3.2.6.

4.2.5.1 Special Status Plants

Special status plants are those that occur on USFWS, New Mexico Energy, Minerals and Natural Resources Department, and/or BLM lists of threatened, endangered, and otherwise sensitive species. The special status plant species analyzed in this section are described in detail in Section 3.2.6, and locations of known habitat are displayed in Map 3-8.

4.2.5.1.1 Analysis Methods

Indicators

Acres of special status plant habitat are used for assessing impacts from management actions across alternatives. Known acres of gypsum wild buckwheat (*Eriogonum gypsophilum*), Kuenzler's hedgehog cactus (*Echinocereus fendleri* var. *kuenzleri*), and Lee's pincushion cactus (*Escobariasneedii sneedii* var. *leei*) habitats were used as quantifiable indicators in the analysis. Impacts to all other species are discussed in terms of the vegetative communities impacted, as described in Section 3.2.6.1. Occurrences of Tharp's bluestar (*Amsonia tharpii*) and Scheer's beehive cactus (*Coryphantha robustispina* var. *scheeri*) in the CFO planning area are also known, but habitat areas have not been quantified (Map 3-8). Impacts to these two species are also discussed in terms of vegetative communities.

Methods and Assumptions

Impacts to special status plants from management actions of the following resources, resources uses, and special designations are analyzed in detail: vegetative communities, wildland fire and fuels management, lands with wilderness characteristics, air resources, minerals, land use authorizations, renewable energy, livestock grazing, travel management, and special designations. Impacts from soil resources, water resources, cave and karst, special status species, cultural resources, paleontological resources, visual resources, land tenure, ONAs, RNAs, SMAs, backcountry byways, and wilderness areas are not analyzed in detail. These resources, resources uses, and special designations are not analyzed because there would be no or negligible impacts to special status plants as a result of those management actions due to the assessment that special status plant habitat would not be measurably altered and individuals would not be impacted. Management actions related to tribal rights and interests, social and economic conditions, and public safety do not authorize, contemplate, or otherwise intersect with surface-disturbing activities or the mitigation thereof, so these decisions also do not impact special status plants.

Impacts to special status plants from management actions are analyzed based on the scientific literature, including published and government studies, and local knowledge of the area. All habitat impacts analyzed in this section are approximations based on delineated habitat and assumptions regarding potential locations of facilities, vegetation treatments, grazing, and other management decisions.

The alternatives have potential for both adverse and beneficial impacts on special status plants through management actions such as travel management, recreational use of lands, noxious weed treatment, and minerals development. Wherever possible, this document quantifies the amount and type of habitats that would be directly disturbed or reclaimed due to such actions. However, it is often difficult to quantify the loss or improvement in quality of the condition of a habitat. Subtle increases or decreases in weeds, shrubs, forbs, water availability, and undisturbed areas can greatly affect the distribution, health, and survival of sensitive plant species. The degree to which these impacts could occur varies by alternative, with alternatives that increase the amount of surface disturbance within special status plant species' habitats generally having greater potential adverse impacts on these species. Attempts are made to address potential impacts within each action analysis, but the discussions are often qualitative due to the difficulty in measuring such changes. Furthermore, due to the programmatic nature of the plan, analysis must be conducted at the landscape level, with detailed analysis being very difficult if not impossible. Detailed analysis is more appropriate at the site-specific planning scale because the impacts can be more precisely forecast when siting and construction details are known about proposed projects.

Inherent to the "special status" designation, many of these species are vulnerable to extinction by natural processes or human disturbance (Stephens and Sutherland 1999). The analysis in this section is largely based on the concept that increases in population size, occupied habitat, and available habitat are beneficial impacts on special status plants species. This is because larger population sizes lead to increased genetic variability, which may increase a species' ability to respond to changing environmental conditions, decrease the risk of inbreeding depression, and persist after random and/or large disturbance events, all of which can decrease fertility and survival rates. Due to the programmatic nature of this document, the potential for extinction resulting from specific management actions cannot be assessed.

Gypsum wild-buckwheat has been proposed for delisting. The recovery and delisting of gypsum wild buckwheat relies on the BLM and industry partners continuing their legacy of gypsum wild-buckwheat conservation. This 990 foot (300 meters) avoidance buffer, consistent with the USFWS minimum “No Effects” distance for the direct and indirect adverse effects of surface denuding activities on sensitive plants (USFWS 2013) will enable natural resource managers to relocate surface-displacing activities, when appropriate, to avoid adverse direct and indirect impacts to gypsum wild-buckwheat. This avoidance buffer would keep lease parcels available for energy development in a manner consistent with gypsum wild-buckwheat conservation. A total of 2,115 acres, dispersed across four locations, would be expected to be affected by this buffer; this is 0.10% of the total 2,091,369 ac of BLM administered surface in the planning area. The expected impact to energy development would be isolated and slight. These impacts would be minimized by making avoidance areas available to operators before they develop and submit drill plans for permitting. If the specie is delisted BLM will update its management prescriptions in accordance with any change in Gypsum wild-buckwheat status.

4.2.5.1.2 Direct and Indirect Impacts

Impacts of Vegetative Communities Management Actions on Special Status Plants

Impacts from Management Common to All

Under all alternatives, the objectives of noxious weed control are to minimize or stop the spread of noxious and other exotic invasive plant species, including single seed juniper. The encroachment of single seed juniper into grassland habitat reduces the amount of available Kuenzler’s hedgehog cactus habitat. All noxious weed control targeting juniper would benefit Kuenzler’s hedgehog cactus by reclaiming historic habitat areas and potentially creating additional habitat that would be available for colonization, thus allowing the population abundance to be maintained and potentially to grow.

Impacts of Wildland Fires and Fuels Management Actions on Special Status Plants

Impacts from Management Common to All Alternatives

Under all alternatives, wildland fire would be used to protect or enhance resource values. When possible, fire would be allowed to function in its natural ecological role. Wildland fire can be both beneficial and harmful to special status plant populations. Historic fire suppression has led to conditions in many fire-adapted areas that are overgrown and in need of fire (Allen et al. 2002). Wildland fire in these areas would help restore the ecosystem to a healthier state, potentially making the habitat more suitable for colonization by special status plant species and supporting range expansion. However, many special status plant species are not adapted to withstand wildland fire, and individuals and populations could be burned beyond recovery, leading to a reduction in overall population abundance. Special status plant species are inherently vulnerable to population declines from large-scale disturbance, such as wildfire, because of the limited amount of available suitable habitat and/or already small population sizes. Because of this, large-scale wildfire could be detrimental to special status plant populations. Exact impacts, whether beneficial or harmful, would depend on the location and nature of each individual fire.

Impacts of Lands with Wilderness Characteristics Management Actions on Special Status Plants

The lands with wilderness characteristics alternatives consist of differing amounts of acres managed to protect those characteristics. Table 4-47 displays the acres of Kuenzler’s hedgehog cactus and Lee’s pincushion cactus habitat that overlap with lands with wilderness characteristics that are being managed to protect wilderness characteristics by alternative. No gypsum wild buckwheat habitat overlaps with lands with wilderness characteristics. Other special status plant populations for which there is no geographical information may also occur on lands proposed with wilderness characteristics.

Table 4-47. Lands with Wilderness Characteristics Overlapping Potential Special Status Plant Species Populations by Alternative on BLM-administered Lands

Special Status Plant Species	No Action	Alternative A (acres/% habitat)	Alternative B (acres/% habitat)	Alternative C (acres/% habitat)	Alternative D (acres/% habitat)
Kuenzler's hedgehog cactus (potential habitat)	NA	16,153/17%	16,153/17%	2,734/3%	1,993/2%
Lee's pincushion cactus habitat	NA	115/91%	115/91%	115/91%	115/91%
Total lands with wilderness characteristics designated	NA	66,666	47,611	5,119	1,221

Impacts from Management Common to All Action Alternatives

Under all action alternatives, lands with wilderness characteristics would be managed to reduce or eliminate surface disturbance and other impacts and maintain those characteristics. Some of the management prescriptions include the exclusion of ROWs, closure to new road construction, closure to motor vehicles, restricted construction of new structures, and limitations on minerals development. Managing lands to maintain wilderness characteristics is beneficial for special status plants because future potential impacts associated with human disturbance (motorized recreation, minerals development) and construction (new roads and structures, infrastructure) would be avoided. Special status plant populations would be allowed to occur in a natural setting, without the threat of disturbance. Furthermore, these lands would be retained in federal ownership, guaranteeing these management prescriptions for the planning period.

No acres of known wild gypsum buckwheat habitat overlaps areas that would be managed for wilderness characteristics, so there would be no known benefit to this species as a result of these management actions.

Impacts from the No Action Alternative

Under the No Action Alternative, no lands with wilderness characteristics would be designated, meaning that special status plant populations would not gain the increased protections on the newly designated lands, as described above. The No Action Alternative would not result in the beneficial impacts described in Impacts from Management Common to All Action Alternatives on newly designated lands.

Impacts from Alternative A

Under Alternative A, 66,666 acres would be managed as lands with wilderness characteristics, including 16,153 acres (17%) of potential Kuenzler's hedgehog cactus habitat and 115 acres (91%) of Lee's pincushion cactus habitat. This alternative is the most inclusive, compared with all other alternatives, and would provide the beneficial impacts described in Impacts from Management Common to All Action Alternatives on the largest area. The nature of impacts on special status species would be identical to that described for the Impacts from Management Common to All Action Alternatives. Other special status plant species may also benefit from this designation if located in lands with wilderness characteristics.

Impacts from Alternative B

Under Alternative B, 47,611 acres would be managed as lands with wilderness characteristics, including 16,153 acres (17%) of potential Kuenzler's hedgehog cactus habitat and 115 acres (91%) of Lee's pincushion cactus habitat. The nature of impacts on special status species would be identical to that described for the Impacts from Management Common to All Action Alternatives. Other special status plant species may also benefit from this designation if located in lands with wilderness characteristics.

Impacts from Alternative C

Under Alternative C, 5,119 acres would be managed as lands with wilderness characteristics, including 2,734 acres (3%) of potential Kuenzler's hedgehog cactus habitat and 115 acres (91%) of Lee's pincushion cactus habitat. The nature of impacts on special status species would be identical to that described for the Impacts from Management Common to All Action Alternatives, except there would be no benefit for Lee's pincushion cactus because no habitat would be lands with wilderness characteristics. Other special status plant species may also benefit from this designation if located in lands with wilderness characteristics.

Impacts from Alternative D

Under Alternative D, 1,221 acres would be managed as lands with wilderness characteristics, including 1,993 acres (2%) of potential Kuenzler's hedgehog cactus habitat and 115 acres (91%) of Lee's pincushion cactus habitat. The nature of impacts on that species would be identical to that described for the No Action Alternative; however, other special status plant species may benefit if located in lands with wilderness characteristics.

Impacts of Air Resources Management Actions on Special Status Plants

Impacts from the No Action Alternative

Under the No Action Alternative, stipulations regarding fugitive dust would be incorporated into project proposals as needed to meet air quality standards. Fugitive dust could result from construction activities, vehicle traffic, equipment operations, and wind events. Dust can harm vegetation by injuring leaves and reducing transpiration, photosynthesis, and growth rates, thereby reducing overall fitness and resiliency (Farmer 1993; Sharifi et al. 1997). Special status plant species populations, especially those located near unpaved roads and surface-disturbing activities, could be impacted by fugitive dust. Incorporating stipulations to maintain air quality would help to mitigate the negative impacts of dust.

Impacts from Alternatives A and B

Alternatives A and B would require twice-daily watering (or equivalent) of construction areas and associated roads to prevent at least 50% of fugitive dust from vehicular traffic, equipment operations, or wind events. This action would be beneficial for special status plants because it would reduce potential for fugitive dust impacts, as described for the No Action Alternative.

Impacts from Alternatives C and D

Alternatives C and D do not include a similar management action, meaning that fugitive dust mitigation for site-specific impacts would be determined during permitting. Under these alternatives, the potential for impacts of fugitive dust on special status plants would be the same as under the No Action Alternative because the end result of required mitigation actions would be the same.

Impacts of Minerals Allocations Management Actions (Leasable, Salable, and Locatable) on Special Status Plants

Impacts from Management Common to All Alternatives

Minerals designation definitions are given in Section 3.3.1. The impacts analysis below is based on potential for the following impacts.

Acres designated as open could be impacted by minerals development. Impacts from minerals development include habitat removal, crushing or trampling of individuals, habitat fragmentation, increased fugitive dust, and changes in habitat structure or composition due to the introduction and spread of invasive and weedy plant species. These impacts could decrease the health of populations of special status plant species.

Acres designated as open with moderate constraints would apply restrictive lease stipulations on minerals development, including actions required to mitigate the negative impacts listed above. Negative impacts associated with minerals development could occur in these areas, but mitigative and avoidance actions would be stipulated to lessen and mitigate those impacts.

Acres designated as closed, withdrawn, or open with major constraints would avoid all negative impacts on special status plants species associated with minerals management actions. This is because no minerals exploration or development could take place on areas that are closed or withdrawn. Areas that would be open with major constraints would be subject to NSO, meaning that habitat would not be removed and surface-disturbing activities would not occur.

Table 4-48 displays acres of special status plant habitat impacted by minerals management decisions.

Table 4-48. Minerals Management Decisions (acres and % of habitat) by Alternative on BLM-administered Lands

Species	Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Leasable Minerals						
Gypsum wild buckwheat	Closed and open with major constraints designations	177/100%	177/100%	177/100%	177/100%	177/100%
	Open with moderate constraints	0/0%	0/0%	0/0%	0/0%	0/0%
	Open designations	0/0%	0/0%	0/0%	0/0%	0/0%
Kuenzler's hedgehog cactus	Closed and open with major constraints designations	5,952/6%	36,589/38%	36,586/38%	4,229/4%	4,228/4%
	Open with moderate constraints	16,010/16%	1,977/2%	1,977/2%	21,390/22%	915/1%
	Open designations	74,772/78%	58,184/60%	58,184/60%	71,107/73%	91,601/95%
Lee's pincushion cactus	Closed designations	127/100%	127/100%	127/100%	127/100%	127/100%
Salable Minerals						
Gypsum wild buckwheat	Closed designation	177/100%	136/77%	163/92%	177/100%	177/100%
	Open with special terms and conditions	0/0%	0/0%	0/0%	0/0%	0/0%
	Open designation	0/0%	40/23%	14/8%	0/0%	0/0%
Kuenzler's hedgehog cactus	Closed designation	5,405/6%	26,387/27%	26,332/27%	3,913/44%	4,228/4%
	Open with special terms and conditions	0/0%	9,273/10%	9,288/10%	21,377/22%	3,511/4%
	Open designation	91,340/94%	61,087/63%	61,087/42%	71,450/74%	89,007/92%
Lee's pincushion cactus	Closed designation	127/100%	127/100%	127/100%	127/100%	127/100%
Locatable Minerals						
Gypsum wild buckwheat	Withdrawn	36/20%	136/77%	165/93%	40/23%	40/23%
	Open designation	141/80%	40/23%	12/7%	137/77%	137/77%
Kuenzler's hedgehog cactus	Withdrawn	3,752/4%	26,219/27%	26,220/27%	4,067/5%	4,067/5%
	Open designation	92,984/97%	70,527/73%	70,526/73%	92,676/96%	92,679/96%
Lee's pincushion cactus	Withdrawn	115/91%	127/100%	127/100%	127/100%	127/100%
	Open designation	12/9%	0/0%	0/0%	0/0%	0/0%

Table 4-48 displays acres of known habitat for three special status plant species; however, areas open to minerals development could also impact special status plant species for which habitat is not defined and/or known at this time.

Impacts from Management Common to All Action Alternatives

Under all Action Alternatives for leasable and salable minerals, Lee's pincushion cactus would be managed as closed designation.

Impacts from the No Action Alternative

Leasable Minerals

Under the No Action Alternative, 100% (177 acres) of gypsum wild buckwheat habitat would be open with major constraints (NSO). At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under the No Action Alternative, 6% (5,952 acres) of known Kuenzler's hedgehog cactus habitat would be subject to closure or

NSO, 16% (16,010 acres) would have moderate constraints, and 77% (74,722 acres) would be open to leasable mineral development on BLM surface lands. Under the No Action Alternative, known Lee's pincushion cactus habitat would be subject to closure. The No Action Alternative would designate the least amount of acres of special status plant habitat as open, compared with all other alternatives, which would subject special status plants to the adverse impacts described in Impacts from Management Common to All Alternatives.

Salable Minerals

Under the No Action Alternative, 100% (177 acres) of gypsum wild buckwheat habitat would be managed as closed. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under the No Action Alternative, 6% (5,405 acres) of potential Kuenzler's hedgehog cactus habitat would be subject to closure or NSO and 94% (91,340 acres) would be open to salable minerals. Under the No Action Alternative, known Lee's pincushion habitat would be subject to closure. The No Action Alternative would designate the greatest amount of acres of special status plant habitat as open, compared with all other alternatives, which would subject special status plants to the adverse impacts described in Impacts from Management Common to All Alternatives.

Locatable Minerals

Under the No Action Alternative, 20% (36 acres) of gypsum wild buckwheat habitat on BLM surface lands would be withdrawn or recommended for withdrawal and 80% (141 acres) would be open to locatable mineral development. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. The No Action Alternative would withdraw or recommend for withdrawal 4% (3,752 acres) of potential Kuenzler's hedgehog cactus habitat from locatable mineral development and open 96% (92,984 acres) habitat to locatable mineral development on BLM surface lands. The No Action Alternative would withdraw 91% (115 acres) of known Lee's pincushion habitat from locatable mineral development and open 9% (12 acres) habitat to locatable mineral development on BLM surface lands. The No Action Alternative would designate the greatest amount of acres of special status plant habitat as open, compared with all other alternatives, which would subject special status plants to the adverse impacts described in Impacts from Management Common to All Alternatives.

Impacts from Alternative A

Under all impacts from Alternative A, all known Lee's pincushion habitat (127 acres) would be closed to or withdrawn from leasable, salable, and locatable minerals development. This management action would avoid all impacts from minerals development on that species.

Leasable Minerals

Under Alternative A, 100% (177 acres) of gypsum wild buckwheat habitat would be closed to leasable mineral development on BLM surface lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under Alternative A, 38% (36,589 acres) of potential Kuenzler's hedgehog cactus habitat would be subject to closure or NSO, 2% (1,977 acres) would have moderate constraints, and 60% (58,124 acres) would be open to leasable mineral development on BLM surface lands. This alternative would avoid more negative impacts than the No Action Alternative by closing or subjecting more habitat to NSO stipulations and opening the smallest amount of habitat to leasable minerals.

Salable Minerals

Under Alternative A, 77% (136 acres) of gypsum wild buckwheat habitat would be closed to salable mineral development and 23% (40 acres) would be open to salable mineral development. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under Alternative A, 27% (26,387 acres) of potential Kuenzler's hedgehog cactus habitat would be subject to closure or NSO, 10% (9,273 acres) would be open with special terms and conditions, and 42% (61,087 acres) would be open to salable minerals. This alternative would avoid more adverse impacts than the No Action Alternative by closing or subjecting more habitat to NSO stipulations and opening the smallest amount of habitat to salable minerals.

Locatable Minerals

Under Alternative A, 77% (136 acres) of gypsum wild buckwheat habitat on BLM surface lands would be withdrawn from locatable minerals and 23% (40 acres) would be open from locatable minerals on BLM surface lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Alternative A would withdraw or recommend for withdrawal 27% (26,219 acres) of known Kuenzler's hedgehog cactus habitat from locatable mineral development and open 73% (70,527 acres) more habitat to locatable mineral development on BLM surface lands. This alternative would avoid more adverse impacts than the No Action Alternative by closing or subjecting more habitat to closures.

Impacts from Alternative B

Under all impacts from Alternative B, all known Lee's pincushion habitat (127 acres) would be closed to or withdrawn from leasable, salable, and locatable minerals development. This management action would avoid all impacts from minerals development on that species.

Leasable Minerals

Impacts to Kuenzler's hedgehog cactus from leasable mineral management decisions under Alternative B would be the same as under Alternative A because the management actions and acres of impact would be the same.

Under Alternative B, 100% (177 acres) of gypsum wild buckwheat habitat would be closed to leasable mineral development on BLM surface lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. This alternative would be the most beneficial for this species because of the closures and NSO stipulations.

Salable Minerals

Under Alternative B, 92% (163 acres) of gypsum wild buckwheat habitat would be closed and 8% (14 acres) would be open to salable mineral development on BLM lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under Alternative B, 27% (26,332 acres) of potential Kuenzler's hedgehog cactus habitat would be subject to closure or NSO, 10% (9,288 acres) of the habitat would be open with special terms and conditions, and 42% (61,087 acres) would be open to salable minerals on BLM surface lands. This alternative would be the most beneficial for these species because of the closures and NSO stipulations.

Locatable Minerals

Under Alternative B, 93% (165 acres) of gypsum wild buckwheat habitat would be withdrawn and 7% (12 acres) would be open to locatable mineral development on BLM surface lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Alternative B would subject 27% (26,220 acres) of potential Kuenzler's hedgehog cactus habitat to withdrawal from locatable minerals, and 73% (70,526 acres) would be open on BLM surface lands. This alternative would be the most beneficial for this species because of the closure and NSO stipulations.

Impacts from Alternative C

Under all impacts from Alternative C, all known Lee's pincushion habitat (127 acres) would be closed to or withdrawn from leasable, salable, and locatable minerals development. This management action would avoid all impacts from minerals development on that species.

Leasable Minerals

Under Alternative C, 100% (177 acres) of gypsum wild buckwheat habitat would be managed as open with major constraints to leasable mineral development on BLM lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under Alternative C, 4% (4,229 acres) of potential Kuenzler's hedgehog cactus habitat would be subject to closure or NSO, 22% (21,390 acres) would be open with moderate constraints, and 73% (71,107 acres) would be open to leasable mineral development on BLM surface lands. This alternative would avoid more negative impacts than the No Action Alternative by closing or subjecting more habitat to NSO stipulations and opening the least amount of habitat to leasable minerals.

Salable Minerals

Under Alternative C, 100% (177 acres) of gypsum wild buckwheat habitat would be closed to salable mineral development on BLM lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under Alternative C, 44% (3,913 acres) of potential Kuenzler's hedgehog cactus habitat would be subject to closure or NSO, 22% (21,377 acres) would be open with special terms and conditions, and 74% (71,450 acres) would be open to salable mineral development on BLM surface lands. This alternative would avoid more negative impacts than the No Action Alternative by closing or subjecting more habitat to NSO stipulations and opening the smallest amount of habitat to salable minerals.

Locatable Minerals

Under Alternative C, 23% (40 acres) of gypsum wild buckwheat habitat would be withdrawn and 77% (137 acres) would be open to locatable mineral development. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under Alternative C, 5% (4,067 acres) of potential Kuenzler's hedgehog cactus habitat would be subject to withdrawal from locatable mineral development, and 96% (92,676 acres) would be open on BLM lands. This alternative would avoid more negative impacts than the No Action Alternative by closing or subjecting more habitat to NSO stipulations and opening the least amount of habitat to locatable mineral development.

Impacts from Alternative D

Under all impacts from Alternative D, all known Lee's pincushion habitat (127 acres) would be closed to or withdrawn from leasable, salable, and locatable minerals development. This management action would avoid all impacts from minerals development on that species.

Leasable Minerals

Under Alternative D, 100% (177 acres) of gypsum wild buckwheat habitat would be managed as open with major constraints. to leasable mineral development on BLM lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under Alternative D, 4% (4,228 acres) of potential Kuenzler's hedgehog cactus habitat would be closed to leasable minerals on BLM lands, 1% (915 acres) of the habitat would be open with moderate constraints, and 95% (91,601 acres) of the habitat would be open to leasable mineral development with standard terms and conditions on BLM lands. This alternative would designate the greatest amount of habitat open to leasable mineral development and would have potential for the greatest amount of negative impacts on special status species.

Salable Minerals

Under Alternative D, 100% (177 acres) of gypsum wild buckwheat habitat would be closed on BLM surface lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under Alternative D, 4% (4,228 acres) of potential Kuenzler's habitat would be subject to closure or NSO, 4% (3,511 acres) habitat would be open with special terms and conditions, and 92% (89,007 acres) habitat would be open to salable mineral development on BLM lands. This alternative would designate the greatest amount of habitat open to salable mineral development and would have potential for the greatest amount of negative impacts on special status species.

Locatable Minerals

Under Alternative D, 23% (40 acres) of gypsum wild buckwheat habitat would be withdrawn and 77% (137 acres) would be open to locatable mineral development on BLM lands. At this time, there are no known gypsum wild buckwheat populations on lands with federal mineral rights and state or private ownership; however, should this species be discovered on BLM lands, applicable lease stipulations protecting this species would apply. Under Alternative D, 5% (4,067 acres) of potential Kuenzler's hedgehog cactus habitat would be subject to withdrawal from locatable mineral development, and 96% (92,679 acres) would be open on BLM lands. This alternative would designate the greatest amount of habitat open to locatable minerals, and would have potential for the greatest amount of negative impacts on special status species.

Impacts of Land Use Authorizations Management Actions on Special Status Plants

Impacts from Management Common to All Alternatives

Land use authorization generally manages ROWs for linear projects, such as power lines, pipelines, and roads. Development from land use authorizations could lead to negative impacts on special status plant species such as habitat removal, crushing or trampling of individuals, increased habitat fragmentation, increased fugitive dust, and changes in habitat structure or composition from the introduction and spread of invasive and weedy plant species (Forman and Alexander 1998; Forman et al. 2003). These impacts can harm special status plant individuals, as well as decrease the health of populations, by creating barriers for seed dispersal. This may result in decreased reproduction rates and/or reduced genetic flow, stunted growth from reduced transpiration rates, and increased competition for resources.

Table 4-49 displays the amount of gypsum wild buckwheat, Kuenzler's hedgehog cactus, and Lee's pincushion cactus habitat that would be open, avoided, or excluded from ROW development under each alternative.

Table 4-49. Land Use Authorizations Management Decisions on BLM-administered Lands

Species	Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Gypsum wild buckwheat	Open	139/79%	38/21%	12/7%	12/7%	136/77%
	Avoid	36/20%	0/0%	0/0%	125/71%	0/0%
	Exclude	0/0%	136/77%	163/92%	38/21%	38/21%
Kuenzler's hedgehog cactus	Open	48,467/95%	21,134/22%	21,134/22%	29,260/30%	49,311/51%
	Avoid	5,029/5%	1,198/1%	1,198/1%	20,964/22%	923/11%
	Exclude	2,985/3%	31,579/33%	31,579/33%	3,681/4%	3,672/4%
Lee's pincushion cactus	Open	12/10%	0/0%	0/0%	0/0%	0/0%
	Avoid	115/90%	0/0%	0/0%	0/0%	0/0%
	Exclude	0/0%	127/100%	127/100%	127/100%	127/100%

Impacts from Management Common to All Action Alternatives

Under all action alternatives, 90% (115 acres) to 100% (127 acres) of Lee's pincushion cactus habitat would be avoided or excluded to ROW development. This would be beneficial for this species because it would greatly minimize or avoid the adverse impacts described in Impacts from Management Common to All Alternatives.

Impacts from the No Action Alternative

Lands acquired for special status species would be considered exclusion areas (areas for which ROW development is prohibited), although there are no exclusion area locations specifically defined under this alternative. Development would be avoided in specially designated areas such as SMAs, ACECs, and WSAs. Exclusion areas would avoid the impacts described in Impacts from Management Common to All Alternatives. Those impacts would occur in avoidance areas where linear projects are permitted. However, it is expected that fewer projects would be allowed in avoidance areas, and this would thereby decrease the impacts on special status plants.

Impacts from Alternative A

Under Alternative A, designated and proposed critical habitat for federally threatened and endangered species, and habitat for federal listed/proposed threatened and endangered species for which critical habitat has not been designated would be considered exclusion areas for ROWs for pipelines, roads, communication sites, and power line development. This management action would help avoid the potential for the negative impacts on federally threatened and endangered plants, as described under Impacts from Management Common to All Alternatives.

Habitat for federal candidate and BLM sensitive plant species would be considered avoidance areas for ROWs, meaning that these areas would be avoided if possible, but may be considered if no other routes or sites are feasible. This management action would discourage ROW development in habitat areas, and so would likely avoid the negative impacts described in Impacts from Management Common to All Action Alternatives when other routes or sites could be used. If no other routes or sites are feasible, negative impacts resulting from ROW development could impact these species.

Impacts from Alternative B

Impacts from Alternative B would be identical to impacts under Alternative A, except that habitat for federal candidate species would also be considered exclusion areas. BLM sensitive plant species' habitats would remain avoidance areas.

Impacts from Alternatives C and D

Under Alternative C, designated and proposed critical habitat for federally threatened and endangered species, habitat for federal listed/proposed threatened and endangered species for which critical habitat has not been designated, habitat for federal candidate species, and BLM sensitive plant species' habitat would be ROW avoidance areas. No special status plant species' habitats would be exclusion areas. This management action would lead to the negative impacts described under Impacts from Management Common to All Action Alternatives on special status plant species if no routes or sites that would avoid habitat would be feasible.

Impacts of Renewable Energy Management Actions on Special Status Plants

Impacts from Management Common to All

Renewable energy management actions consist of choosing areas where the BLM will consider applications for the permitting, construction, and maintenance of wind, solar, and geothermal energy projects. Impacts from renewable energy projects on special status plants in the areas designated as "open" to wind and geothermal or "variance" for solar development include short- and long-term habitat loss and degradation due to surface disturbance; and habitat fragmentation, especially from linear aspects of projects such as power lines and pipelines. Each of these impacts could result in decreased health of the individual and/or of the local population. Areas designated as "avoid" for wind development would be less likely to incur these impacts, because development would be avoided; however, development and associated impacts could still occur if the development was allowed. The adverse impacts resulting from surface-disturbing activities and habitat fragmentation would not occur from renewable energy development under the "exclude" or "close" designations. Table 4-50 presents the planning area BLM-administered lands open/variance, avoided, and closed/exclude for renewable energy (geothermal, solar, and wind) under each alternative.

Under Alternatives A through D, 100% (127 acres) of Lee's pincushion cactus habitat would be withdrawn from geothermal, solar, and wind energy. Under the No Action Alternative for geothermal and solar development, 100% (127 acres) would be withdrawn from renewables development and 100% (127 acres) would be avoided for wind development.

Table 4-50. Renewable Energy Management Decisions on BLM-administered Lands

Species	Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Geothermal and Solar						
Gypsum wild buckwheat	open/variance	0/0%	78/44%	14/8%	14/8%	139/78%
	close/exclude	175/98%	136/78%	165/93%	163/93%	38/22%
Kuenzler's hedgehog cactus	open/variance	46/<1%	62,869/65%	62,869/65%	64,581/67%	82,189/85%
	close/exclude	5,385/6%	33,864/35%	33,849/35%	32,136/33%	14,526/15%
Wind						
Gypsum wild buckwheat	Open	0/0%	38/22%	12/7%	12/7%	136/77%
	Avoid	175/98%	0/0%	0/0%	121/69%	0/0%
	Exclude	0/0%	136/78%	163/93%	38/21%	38/22%
Kuenzler's hedgehog cactus	Open	1,509/2%	21,134/22%	21,126/22%	21,163/22%	22,951/24%
	Avoid	49,339/51%	1,198/1%	1,198/1%	11,054/11%	27,284/28%
	Exclude	2,985/3%	31,579/33%	31,587/33%	3,672/4%	3,672/4%

Impacts from Management Common to All Action Alternatives

Wind development would be encouraged in areas where transmission corridors are located, or where transmission systems are already in place. Adverse impacts on special status plants due to surface disturbance and habitat fragmentation would be avoided by siting wind development near transmission. This is because power lines would not need to be constructed to connect the wind facility with a transmission line.

Impacts from the No Action Alternative

Under the No Action Alternative, 98% (175 acres) of known gypsum wild buckwheat habitat would be closed or excluded from geothermal and solar development, and 98% (175 acres) would be avoided for wind development. Under the No Action Alternative for potential Kuenzler's hedgehog cactus habitat, less than 1% (46 acres) would be open and 6% (5,385 acres) would be closed to geothermal and solar development. Under the No Action Alternative, 2% (1,509 acres) would be open, 51% (49,339 acres) would be avoided, and 3% (2,985 acres) would be closed or excluded from wind development within potential Kuenzler's hedgehog cactus habitat. This alternative would remove more habitat than all other alternatives from geothermal and solar development, benefiting these special status plant species by avoiding the impacts described in Impacts from Management Common to All Alternatives. The avoidance of all habitat for wind development would make adverse impacts less likely to occur than if the areas were open for development.

Impacts from Alternative A

Under Alternative A, 44% (78 acres) of known gypsum wild buckwheat habitat would be open to geothermal and solar development and 78% (136 acres) of habitat would be closed or excluded. Under Alternative A, 7% (12 acres) of gypsum wild buckwheat habitat would be open to wind development and 93% (163 acres) would be excluded. In addition, 65% (62,869 acres) of potential Kuenzler's hedgehog cactus habitat would be open to geothermal and solar development and 35% (33,864 acres) of habitat would be closed or excluded. Under Alternative A, 22% (21,126 acres) of potential Kuenzler's hedgehog cactus would be open to wind development, 1% (1,198 acres) would be avoided and 33% (31,587 acres) would be closed or excluded. Compared with the No Action Alternative, this alternative would be more beneficial to potential Kuenzler's hedgehog cactus habitat, especially those species occupying the excluded areas. However, the No Action Alternative for known gypsum wild buckwheat for renewable energy development would be more beneficial than Alternative A because of greater avoidance or exclusion areas.

Impacts from Alternative B

Under Alternative B, 93% (165 acres) of gypsum wild buckwheat habitat would be closed or excluded from geothermal, solar, and wind development, 8% (14 acres) would be open to geothermal and solar development, and 7% (12 acres) would be open to wind development. Also, 35% (33,849 acres) of potential Kuenzler's hedgehog cactus habitat would be closed or excluded from geothermal and solar development and 33% (31,587 acres) would be closed from wind development. In addition, 65% (62,869 acres) of potential Kuenzler's hedgehog cactus habitat would be open for geothermal and solar development, 22% (21,126 acres) would be open for wind development and 1% (1,198 acres) would be avoided for wind development. This alternative would open more habitat of both species to renewable energy development than the No Action Alternative, making it more likely for the adverse impacts described in Impacts from Management Common to All Alternatives to occur.

Impacts from Alternative C

Under Alternative C, 93% (163 acres) of gypsum wild buckwheat habitat would be closed or excluded from geothermal and solar development and 8% (14 acres) would be open or variance. For wind development, 69% (121 acres) would be avoided and 21% (38 acres) acres would be excluded. Also, 67% (64,481 acres) of potential Kuenzler's hedgehog cactus habitat would be managed as open for geothermal and variance for solar; 33% (32,136 acres) would be closed or excluded. For wind development within potential Kuenzler's hedgehog cactus habitat, 11% (11,054 acres) would be managed as avoid and 4% (3,672 acres) would be managed as exclude. This alternative would open more habitat of both species to renewable energy development than the No Action Alternative, making it more likely for the adverse impacts described in Impacts from Management Common to All Alternatives to occur.

Impacts from Alternative D

Under Alternative D, 22% (38 acres) of gypsum wild buckwheat habitat would be closed or excluded from geothermal, solar, and wind development and 78% (137 acres) would be open or variance. Also, 15% (14,526 acres) of potential Kuenzler's hedgehog cactus habitat would be closed or excluded for solar and geothermal, 28% (27,284) would be avoided for wind, and 24% (22,951 acres) would be open or variance. This alternative would open more habitat of both species to renewable energy development than the No Action Alternative, making it more likely for the adverse impacts described in Impacts from Management Common to All Alternatives to occur.

Impacts of Livestock Grazing Management Actions on Special Status Plants

Impacts from Management Common to All

Livestock grazing can directly affect special status plants as a result of livestock eating or trampling special status plant individuals. Other detrimental impacts from grazing could include habitat degradation from disruption of some ecosystem functions, changes to community organization, and changes to the physical characteristics of both terrestrial and aquatic habitats, ultimately leading to a reduction in population densities of special status plants (Fleischner 1994; Chaneton and Lavado 1996; Olff and Ritchie 1998). The presence of cattle can also degrade special status species' habitat because cattle disperse honey mesquite seeds far from their source, contributing to an ongoing trend of mesquite encroachment on grasslands habitat (Drewa et al. 2001). Mesquite trees grow in dense stands, which outcompete most other vegetation. Mesquite encroachment could reduce the availability of habitat for special status plants that occur in grasslands, such as Kuenzler's hedgehog cactus and Sneed's pincushion cactus.

Under all alternatives, livestock grazing would continue on an area of land specific to each alternative. Table 4-51 presents the planning area BLM-administered lands open and closed to grazing under each alternative. Long-term range monitoring studies established on 84 allotments in the planning area would continue. These studies, which collect data on livestock use, vegetation production and use, climatic patterns, and ecological condition and trend, would benefit grassland special status species by guiding livestock grazing management actions as they relate to rangeland health by informing mangers of current conditions and helping prevent overgrazing and undue habitat degradation.

Table 4-51. Livestock Grazing Management Decisions on BLM-administered Lands

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,086,107	1,598,198	1,937,725	2,083,232	2,087,759
Closed	5,226	493,120	153,583	8,115	3,594
Total	***2,091,333***	***2,091,318***	***2,091,308***	***2,091,347***	***2,091,353***

Impacts from the No Action Alternative

Under the No Action Alternative, livestock grazing would be removed from 5,226 acres of the planning area. Grazing would remain open on 2,086,107 acres of BLM-administered lands in the planning area. Approximately 350,000 AUMs would be authorized to 200 permittees, and approximately 18,000 AUMs would be made available to 62 lessees. The removal of grazing from 1,939 acres would be beneficial for special status plant species if those acres overlap known or potential habitat. The negative impacts of livestock grazing as described in Impacts from Management Common to All Alternatives would continue on all other lands open to grazing that overlap special status plant species' habitat.

Impacts from Alternative A

Under Alternative A, 493,120 acres of BLM-administered land would be closed to livestock grazing; this is nearly 225 times the acreage closed under the No Action Alternative. The closed area would include known habitat for Tharp's bluestar and gypsum wild buckwheat. In areas closed to livestock grazing, these special status plants would benefit because the negative impacts described in Impacts from Management Common to All Alternatives would no longer occur. The spread of mesquite would likely be reduced with the removal of cattle, as described in Impacts from Management Common to All Alternatives. Where feasible, grasses such as black grama may be allowed through management actions to grow sufficiently for fire to occur as a natural disturbance, promoting the persistence of grasslands in the long run and thus habitat for grassland special status plant species. The Chihuahuan Desert Rivers proposed ACEC, which encompasses 118 acres of gypsum wild buckwheat habitat, would be closed to livestock grazing. That species would benefit from the removal of the negative impacts described under Impacts from Management Common to All Alternatives. This alternative would benefit special status plant species where their known and potential habitat overlaps grazing allotments by decreasing the potential for the negative impacts described in Impacts from Management Common to All Alternatives.

Impacts from Alternative B

Under Alternative B, more than 153,583 acres of BLM-administered land would be closed to livestock grazing, which is approximately 79 times more acreage closed than under the No Action Alternative. The closures would primarily occur in the proposed Birds of Prey Grasslands ACEC, which encompasses 6,584 acres of potential Kuenzler's hedgehog cactus habitat, and the proposed Gypsum Soils ACEC, which encompasses 137 acres of known gypsum wild buckwheat habitat. This closure would lead to the same nature and comparable magnitude of beneficial impacts as described under Alternative A.

Impacts from Alternative C

Under Alternative C, 8,115 acres would be closed to livestock grazing, or approximately 4 times the acreage closed under the No Action Alternative. The locations of the area closed to grazing would not overlap any known special status plant species habitat, but may impact unknown and/or potential habitat for grassland species. The nature of impacts to special status plant species under this alternative would be the same as those described under the No Action Alternative, but would occur over a greater area.

Impacts from Alternative D

Impacts on special status plant species under Alternative D would be the same as those described for Alternative C, except that 3,594 acres would be closed to grazing. This would lead to beneficial impacts on an area approximately twice as large as under the No Action Alternative.

Impacts of Travel Management Actions on Special Status Plants

Impacts from Management Common to All Alternatives

Impacts of travel management actions on special status plants are mainly due to decisions related to OHV use. Impacts from OHV use on special status plant species are mostly associated with unrestricted cross-country travel (i.e., in areas designated as open). Potential direct and indirect, and short- and long-term, impacts could occur in all habitat types where OHV use is open (unrestricted). Impacts include short-term, adverse impacts to individuals from dust production, potential for trampling and damage by vehicles and soil disturbance, habitat fragmentation, and degradation of habitat from introduction of invasive and exotic weed species. These impacts could directly impact special status individuals and lead to a reduction in abundance. Restricting OHVs to designated or existing routes would help avoid the potential of trampling individuals, but all other impacts would occur because they are caused by the presence of OHVs. The scale of these impacts would be considerably less than in unrestricted areas, however, because they would only occur adjacent to OHV routes. Closure to OHV use would be beneficial for special status plant species that occur within the closure areas.

Table 4-52. Travel Management Decisions by Alternative (acres) on BLM-administered Lands

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
OHV limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737
Total	***2,091,273***	***2,091,326***	***2,091,327***	***2,091,320***	***2,091,321***

Impacts from the No Action Alternative

Under the No Action Alternative 55,966 acres (2.7% of the planning area) would be closed to OHVs, 2,035,307 acres (97% of the planning area) would be OHV limited. Existing OHV closures consist of the Laguna Plata and Pope's Well areas.

Impacts from Alternative A

Under Alternative A, 52,028 acres (2.5% of the planning area) would be closed to OHVs and 2,039,299 acres (97.5% of the planning area) would be OHV limited. Compared with the No Action Alternative, the decrease in closed areas would increase negative impacts of unrestricted OHV travel on special status plants as described in Impacts from Management Common to All Alternatives for populations that are not adjacent to existing or designated routes. Populations adjacent to existing or designated routes would still be impacted by fugitive dust, habitat fragmentation, and introduction of invasive and exotic weed species.

Impacts from Alternative B

Under Alternative B, 41,936 acres (2.0% of the planning area) would be closed to OHVs and 2,049,391 acres (98.0% of the planning area) would be OHV limited. The nature of the impacts would be the same as that described for Alternative A, but the beneficial impacts of closure would decrease under this alternative, because less of the planning area would be designated as closed.

Impacts from Alternative C

Under Alternative C, 38,738 acres (1.9% of the planning area) would be closed to OHVs and 2,052,582 acres (98.1% of the planning area) would be OHV limited. The nature of the impacts would be the same as that described for Alternative A, but the beneficial impacts of closure would decrease compared to the No Action Alternative because less of the planning area would be designated as closed.

Impacts from Alternative D

Under Alternative D, 38,737 acres (1.9% of the planning area) would be closed to OHVs and 2,052,584 acres (98.1% of the planning area) would be OHV limited. The nature of the impacts would be the same as that described for Alternative A, but the beneficial impacts of closure would decrease compared to the No Action Alternative and because less of the planning area would be designated as closed.

Impacts of Special Designations Management Actions on Special Status Plants

Impacts from Management Common to All Alternatives

ACEC management decisions would generally reduce long-term impacts to the special status plant species that occur inside their boundaries. Impacts to special status plant species vary between alternatives based on the acreage of areas designated as ACECs and management of each ACEC. ACECs are designated to protect identified relevant and important values such as cultural resources, scenic qualities, and natural systems. Each ACEC is prescribed various levels of limitations on activities such as oil and gas leasing, ROWs, renewable energy development, livestock grazing, and travel. See Chapter 2 Alternatives Matrix-Special Designations, for details on ACECs by alternative. In general, ACEC designation would reduce impacts to special status plant species and habitats by limiting human activity and associated surface disturbances and thereby preserving habitat.

Seven proposed ACECs overlap the known distribution of special status plants in the planning area: Birds of Prey Grasslands, Chihuahuan Desert Rivers, Gypsum Soils, Lonesome Ridge, Serpentine Bends, Seven Rivers Hills, and Six Shooter Canyon. Other unknown and/or currently undefined special status plant habitats may occur in other proposed ACECs. For this reason, the total amount proposed under each alternative, as well as acres of known special status plant habitat, are reported for each alternative. Table 4-53 lists the total amount of area and known special status plant species habitats proposed for ACEC designation by alternative.

Table 4-53. Acres of ACEC Designations by Alternative on BLM-administered Lands

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
13,435	495,042	561,433	98,562	28,894

Decisions to designate RNAs, WSAs, and WSRs would also benefit the special status plants that inhabit each particular area. WSAs are established to provide for the protection of wilderness character and for the use and enjoyment of visitors in a manner that leaves the areas unimpaired for future use. By definition, no surface disturbance, permanent new development, or rights would occur in these areas. This is because these designations generally reduce long-term impacts to vegetation that occurs within their boundaries. ROW would be allowed in the WSAs; the lands would be closed to oil, gas, and mineral leasing.

Impacts from the No Action Alternative

Under the No Action Alternative, no new ACECs would be designated, and currently designated ACECs, totaling 13,435 acres, would continue to be managed as such. Special status plant species' habitats are not known in areas currently managed as ACECs, but other unknown and undefined species may occur there. This alternative would not provide any of the beneficial impacts associated with ACEC designation, as described in Impacts from Management Common to All Alternatives, for known special status species' plant habitat, but it may provide protection for species that occur on the currently designated ACECs.

Impacts from Alternative A

Under Alternative A, 495,042 acres of the planning area would be managed as ACECs. Birds of Prey Grasslands, Serpentine Bends, and Chihuahuan Desert Rivers would be designated as ACECs, with benefits to the Kuenzler's hedgehog cactus, Lee's pincushion cactus, and gypsum wild buckwheat. This alternative would provide more ACEC protections described in Impacts from Management Common to All Alternatives on more known and potential habitat than the No Action Alternative.

Impacts from Alternative B

Under Alternative B, 561,433 acres of the planning area would be managed as ACECs. Birds of Prey Grasslands, Gypsum Soils, Serpentine Bends, and Seven Rivers Hills would all be designated as ACECs, with benefits to the gypsum wild buckwheat, Kuenzler's hedgehog cactus, and Lee's pincushion cactus. This alternative would provide the ACEC protections described in Impacts from Management Common to All Alternatives on more known and potential habitat than all other alternatives, and would provide the most beneficial impacts for special status plant species.

Impacts from Alternative C

Under Alternative C, 98,562 acres of the planning area would be managed as ACECs. Gypsum Soils, Serpentine Bends, and Seven Rivers Hills would all be designated as ACECs, with benefits to the gypsum wild buckwheat, and Lee's pincushion buckwheat. This alternative would provide more ACEC protections described in Impacts from Management Common to All Alternatives on more known and potential habitat than the No Action Alternative.

Impacts from Alternative D

Under Alternative D, 28,894 acres of the planning area would be managed as ACECs. Seven Rivers Hill and Serpentine Bends would both be designated as ACECs, with benefits to the gypsum wild buckwheat and Lee's pincushion cactus. This alternative would provide the fewest ACEC protections described in Impacts from Management Common to All Alternatives, compared with all action alternatives. It would therefore provide fewer beneficial impacts for special status plant species. However, this alternative would still provide more ACEC protections than the No Action Alternative.

4.2.5.2 Special Status Fish

Special status fish species are those that occur on USFWS, NMDGF, and/or BLM lists of threatened, endangered, and otherwise sensitive species. Existing conditions concerning fish across the planning area are described in Chapter 3. The fish species analyzed in this section are described in detail in Section 3.2.6.3. Habitat locations for fish species consist of CFO lakes, rivers, and streams, as shown on Map 3-3.

4.2.5.2.1 Analysis Methods

Indicators

In general, all protective stipulations that limit water pumping and ground-disturbing activities, particularly those associated with oil and gas development, would minimize adverse impacts on special status fish species. The indicator used to assess impacts between alternatives in this analysis is acres of riparian habitat directly impacted.

Methods and Assumptions

Impacts to special status fish from management actions of the following resources, resources uses, and special designations are analyzed in detail: minerals, land use authorizations, recreation, livestock grazing, travel management, visual resource management, and special designations.

Impacts from proposed management actions for air quality, water resources, riparian, vegetative communities, fish and wildlife, special status species, wildland fire and fuels management, karst resources, paleontological resources, and cultural resources actions are not analyzed in detail because the management actions did not vary measurably between alternatives and/or there would be no or negligible impacts to fish as a result of those management actions.

Assumptions used for the impact analysis include the following:

- Those proposed management actions across the planning area that limit ground-disturbing activities would minimize habitat degradation for special status fish species because impacts associated with ground disturbance such as increased sedimentation and turbidity, alterations in water quality, and loss of streamside vegetation would not occur.
- Where special status aquatic species and native non-game fish coexist, management actions that would reduce or improve overall habitat quality for non-game fish would also reduce or improve overall habitat quality for special status fish.
- The health of special status fish is directly related to the overall health and functional capabilities of aquatic, riparian, and wetland resources. Those proposed actions that would benefit riparian and other aquatic habitats—e.g., managing water-pumping activities and prohibiting livestock grazing and other surface-disturbing activities—and contribute to meeting PFC would also indirectly benefit special status fish species by maintaining water quantity and quality, and limiting sedimentation and turbidity impacts that can negatively affect aquatic species and the habitats they depend on.
- Inherent to the “special status” designation, many of these species are vulnerable to extinction by natural processes or human disturbance (Stephens and Sutherland 1999). The analysis in this section is largely based on the concept that increases in population size, occupied habitat, and available habitat are beneficial impacts on special status plants species. This is because larger population sizes lead to increased genetic variability, which may increase a species’ ability to respond to changing environmental conditions, decrease the risk of inbreeding depression, and persist after random and/or large disturbance events—all of which can decrease fertility and survival rates. Due to the programmatic nature of this document, the potential for extinction resulting from specific management actions cannot be assessed.

4.2.5.2.2 Direct and Indirect Impacts

Any actions that remove, degrade, or fragment aquatic habitats are considered adverse. Beneficial impacts include actions that conserve or improve aquatic habitats, including surrounding vegetation. Proper management of soil, water, and vegetative resources, particularly in the riparian zones of watersheds, would reduce disturbances to habitat and result in beneficial impacts to special status fish. Direct impacts to fish could result from the loss of habitats or key habitat features, such as spawning or feeding areas, or from the immediate loss of life.

The following impacts would have the potential to affect the survivability and fecundity of fish species, and are considered for this analysis:

- Sediment and turbidity—Sediment loading resulting from increased erosion, and turbidity in waters containing sediment-intolerant fish species can reduce the availability of suitable spawning and rearing habitats, impair sources of food for fish, contribute to loss of recruitment, and, in some cases, cause direct physical harm and stress.
- Habitat alteration—Changes in water quantity (instream flow) and habitat that make it nonfunctional for select species, or more conducive to competitive species.
- Loss or reduction of streamside vegetation/cover—Increased temperatures, stress, reduced
- productivity, and disruptions to food resources.
- Water quality alteration—Actions that alter important water quality parameters, including pH, dissolved oxygen, temperature, hardness, alkalinity/salinity, and turbidity.

Impacts of Livestock Grazing Actions on Special Status Fish

The removal of livestock from riparian habitats would provide beneficial impacts to special status fish because erosion, sedimentation, trampling of vegetation, and degradation of water quality—all of which are associated with livestock grazing (Belsky et al. 1999)—would be minimized. Fish would benefit from greater protection of these important habitat components.

Specific riparian areas may be open or closed to livestock grazing, depending on the alternative. Table 4-54 depicts areas associated with particular river systems across the planning area and livestock grazing management actions across the alternatives.

Table 4-54. Riparian Area Management Decisions by Alternative

Riparian/River Areas	No Action	Alternative A	Alternative B	Alternative C	Alternative D
Pecos River	Open to grazing with the exception of RNA of the Pecos River Canyons/Complex ACEC, bluntnose shiner habitat, and Red Bluff Area	Number of livestock and season of use to be established on allotment basis to ensure adequate growing season rest	Same as Alternative A	Same as Alternative A	Same as Alternative A
Black River Management Area	Closed to grazing	Same as No Action Alternative	Same as No Action Alternative	Same as No Action Alternative	Same as No Action Alternative
Small portion along Black River (outside of Black River Management Area)	Open to livestock grazing	Removal of livestock grazing within 656 feet of the river bank on either side	Same as Alternative A	Same as No Action Alternative	Same as No Action Alternative
Delaware River (both sides of U.S. 285)	Livestock grazing not permitted during the active season (April–October), but would be allowed during the dormant season use (November–March)	Same as No Action Alternative	Removal of livestock grazing from seasonal pastures	Removal of livestock grazing from all riparian pastures	Same as No Action Alternative
Riparian Springs	The following springs would be closed to grazing: Bogle Flat, Preservation, Cottonwood, Owl, Ben Slaughter, and Blue Spring	Riparian springs and their associated riparian zones would be closed to grazing	Same as Alternative A	Same as Alternative A	Same as Alternative A

Impacts from Management Common to All

Under all alternatives, the Black River Management Area would be closed to grazing. This proposed decision would beneficially impact special status fish through minimizing the loss of streamside vegetation cover and minimizing changes in water quality that can result from livestock grazing.

Impacts from Management Common to All Action Alternatives

Under management common to all action alternatives, the livestock grazing along the Pecos River, number of livestock and season of use, would be established on an allotment basis to ensure adequate growing season rest. This would indirectly benefit special status fish by minimizing the degree of negative impacts associated with livestock grazing, as previously described. The Pecos Bluntnose Shiner Habitat ACEC (200 acres) would be designated and closed to grazing under all action alternatives. This would directly benefit the Pecos bluntnose shiner and other special status fish that may utilize habitat within the ACEC.

Impacts from the No Action Alternative

Under the No Action Alternative, current livestock grazing management prescriptions would remain in place and include keeping 2,086,107 acres of unallotted tracts open to livestock grazing. This alternative would also close 5,226 acres to livestock grazing. Adverse impacts to special status fish from increased erosion, sedimentation, water depletion, and loss of streamside vegetative cover would be minimized through greater water quality protection within these sensitive riparian habitats and fragile watersheds (see the Direct and Indirect Impacts section above for further discussion on how these components impact fish).

Impacts from Alternative A

Under Alternative A, 493,120 acres would be closed to livestock grazing. This includes 5,000 acres of unallotted tracts that would be closed to grazing to protect wildlife vegetation and watershed health. Adverse impacts to special status fish under Alternative A would be less than those impacts described under the No Action Alternative because more acres would be closed to livestock grazing under this alternative.

Impacts from Alternative B

Under Alternative B, 153,583 acres would be closed to livestock grazing, which includes 5,000 acres of unallotted tracts. Adverse impacts to special status fish under Alternative B would be less than those impacts described under the No Action Alternative because more acres would be closed to livestock grazing under this alternative.

Impacts from Alternative C

Under Alternative C, 8,115 acres would be closed to livestock. As with the No Action Alternative, 5,000 acres of unallotted tracts would remain open to livestock grazing. Adverse impacts to special status fish under Alternative C would be less than those impacts described under the No Action Alternative because more acres would be closed to livestock grazing under this alternative.

Impacts from Alternative D

Under Alternative D, 3,594 acres would be closed to livestock grazing. As with the No Action Alternative, 5,000 acres of unallotted tracts would remain open to livestock grazing. Adverse impacts to special status fish under Alternative D would be greater than those impacts described under the No Action Alternative because less acres would be closed to livestock grazing under this alternative.

Impacts of Recreation Actions on Special Status Fish

Recreation management can impact aquatic species and their habitats in many ways. Human activity along or within streams and rivers and around or within ponds, lakes, and reservoirs can result in habitat alteration, reduced or loss of riparian vegetation cover, increased sedimentation and turbidity, and water contamination.

Acreages across the planning area designated as SRMAs or ERMAs would not directly or indirectly impact special status fish or their habitats. Recreational use of these areas would not be expected to increase or decrease as a result of designation and would therefore not affect vegetation cover around water bodies, sedimentation, turbidity, or overall water quality.

Impacts from Management Common to All

RAMPs would be prepared for all designated SRMAs under management common to all. The purpose of SRMAs is to focus management, better direct people to opportunities, and coordinate recreation activities with other multiple uses in the area. The RAMPs that would be prepared for the designated SRMAs identify specific recreation implementation actions, including permitting or use allocation decisions. As part of a RAMP preparation, other resources and resource use issues are considered, which generally provides for mitigation of impacts due to recreation activities proposed under SRMAs. Given this, there are unlikely to be any adverse impacts from the development of RAMPs to special status fish.

Under management common to all, all activities would adhere to BLM New Mexico supplementary rules that provide for several safety and procedural parameters for activities on public lands. These rules include no construction of pit toilets lasting more than 14 days within 100 feet of any permanent water source, no fireworks, and no cutting or removal of woody materials. All these rules would reduce or prevent adverse impacts to fish from water contamination and sediment loading. In addition, the Pecos River Corridor (8,348 acres) SRMA would be closed to all surface-disturbing activities, which would minimize adverse impacts such as those described above. These management actions would provide beneficial impacts to special status fish such as the Pecos bluntnose shiner and other species that occur in waterways adjacent to recreation areas.

Impacts from Management Common to All Action Alternatives

All action alternatives in the planning area would maintain water quality in natural water sources by prohibiting camping within 900 feet of these areas (excluding the Pecos River). This would benefit special status fish by reducing disturbance near riparian areas, maintaining or improving water quality, reducing sedimentation, and contributing to the overall health of riparian ecosystems near recreational areas.

Impacts of Travel Management Actions on Special Status Fish

Travel management may adversely impact special status fish and their habitats in various ways. The presence of trails and roads within watersheds containing fish and other aquatic species can cause habitat alteration, loss or reduction of streamside vegetation cover, increased sedimentation and turbidity, and water quality alteration. Roads and trails provide means of water conveyance, which accelerates flow velocities and increases erosion and off-site soil movement and ultimately sedimentation and turbidity. These routes also compact soils, which reduces water absorption and infiltration rates and increase the peaks of runoff flows. Where motorized and, in some cases, mechanized use are high and/or increasing, erosion potential is increased. These impacts are amplified where user-created routes and OHV use is occurring or increasing. In areas where OHV use is occurring or would increase, impacts such as sedimentation and turbidity, soil compaction, loss of riparian vegetation and cover, habitat alteration, and water quality changes would be long term and chronic.

Impacts from Management Common to All Action Alternatives

Under management common to all action alternatives, roads would be constructed and maintained per the BLM's *Surface Operating Standards and Guidelines for Oil and Gas Development – The Gold Book* (BLM 2007a). Additionally, all surfacing material on oil and gas roads would be removed at the time of abandonment. Both these management actions would impart indirect beneficial impacts to special status fish by minimizing the potential for erosion, runoff, and contamination of streams, rivers, and other water bodies that provide habitat for fish.

Impacts from the No Action Alternative

Under the No Action Alternative, 0 acres in the planning area would remain open to OHV use, approximately 2,035,307 acres would be OHV limited, and 55,966 acres (2.7%) would be closed to travel). In general, as road density increases, adverse impacts to riparian and other aquatic habitats potentially increase as well. Special status fish and the habitat components upon which they depend would be negatively affected by the greater potential of adverse impacts to watershed health and subsequent water quality.

Impacts from Alternative A

Under Alternative A, 0 acres would be open to OHV use, approximately 2,039,299 acres would be OHV limited, and 52,028 acres would be closed to travel. Qualitatively, this would have the same adverse impacts to special status fish as the No Action Alternative. The magnitude of impacts, however, would be greater due to a slight decrease (0.2%) in number of acres closed to travel relative to the No Action Alternative.

Impacts from Alternative B

Under Alternative B, 0 acres would be open to OHV use, approximately 2,049,391 acres would be OHV limited, and 41,936 acres would be closed to travel. Qualitatively, this would have the same adverse impacts to special status fish as the No Action Alternative. The magnitude of impacts, however, would be greater due to a 0.7% decrease in number of acres closed to travel relative to the No Action Alternative.

Impacts from Alternative C

Under Alternative C, 0 acres would be open to OHV use, approximately 2,052,582 acres would be OHV limited, and 38,738 acres would be closed to travel. Qualitatively, this would have the same adverse impacts to special status fish as the No Action Alternative. The magnitude of impacts, however, would be greater due to a 0.8% decrease in number of acres closed to travel relative to the No Action Alternative.

Impacts from Alternative D

Under Alternative D, 0 acres would be open to OHV use, approximately 2,052,584 acres would be OHV limited, and 38,737 acres would be closed to travel. Qualitatively, this would have the same adverse impacts to special status fish as the No Action Alternative. The magnitude of impacts, however, would be greater due to a 0.8% decrease in number of acres closed to travel relative to the No Action Alternative.

Impacts of Land Use Authorizations Actions on Special Status Fish

The authorization of ROWs for utility and communication infrastructure (among others) could have direct, long-term adverse impacts on special status fish as a result of fragmentation and erosion during construction and maintenance activities. These actions could contribute to an increase in sedimentation and turbidity, and reduce overall riparian habitat condition and water quality. Management decisions to avoid or exclude certain areas from ROWs would have beneficial impacts to special status fish (Table 4-55).

Table 4-55. Avoidance and Exclusion Areas for Land Use Authorizations (acres) by Alternative

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,051,927	98,544	757,380	1,610,692	1,749,782
Avoidance	30,965	629,149	413,654	313,619	270,360
Exclusion	7,056	662,038	918,701	165,378	69,540

Impacts from the No Action Alternative

Under the No Action Alternative, six ROW corridors have already been designated by the BLM as preferred locations for all new major utility and transportation facility alignments. A total of 30,965 acres would continue to be designated as avoidance areas and 7,056 acres (all WSAs) would continue to be designated as exclusion areas. These designations would benefit special status fish by minimizing ROW construction and associated fragmentation and disturbance near or within these important habitat areas. Under the No Action Alternative, 2,051,927 acres would be open to ROWs.

Impacts from Alternative A

Under Alternative A, 629,149 acres would be designated as avoidance areas and 662,038 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative A would provide fewer adverse impacts to special status fish through protection of important habitat components. Under the Alternative A, 98,544 acres would be open to ROWs.

Impacts from Alternative B

Under Alternative B, 413,654 acres would be designated as avoidance areas and 918,701 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative B would provide fewer adverse impacts to special status fish through protection of important habitat components. Under Alternative B, 757,380 acres would be open to ROWs.

Impacts from Alternative C

Under Alternative C, 313,619 acres would be designated as avoidance areas and 165,378 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative C would provide fewer adverse impacts to special status fish through protection of important habitat components. Under Alternative C, 1,610,692 acres would be open to ROWs.

Impacts from Alternative D

Under Alternative D, 270,360 acres would be designated as avoidance areas and 69,540 acres would be designated as exclusion areas for ROWs. Compared to the No Action Alternative, Alternative D would provide fewer adverse impacts to special status fish through protection of important habitat components. Under Alternative D, 1,749,782 acres would be open to ROWs.

Impacts of Mineral Resource Actions on Special Status Fish

The majority of the planning area would be available for leasable, salable, and locatable mineral development. Mineral development activities would be subject to site-specific NEPA analysis, stipulations, COAs, and other authorities as described in Chapter 3, 3.3.1. In general, surface disturbance related to mineral extraction could potentially reduce water quality and riparian condition (PFC), causing both short- and long-term impacts to special status fish. Other impacts from minerals development could potentially include water depletions and increased sedimentation and turbidity. If adverse impacts to special status fish were identified during site-specific NEPA analysis, the BLM would consult with the USFWS prior to approving the proposed project.

Of primary concern are activities that result in ground disturbance and the removal of native vegetation for the construction of well pads, roads, pipelines, compressor and relay stations, settling ponds, and various assorted infrastructure. Collectively, these activities could result in the off-site movement of soils and increase sediment loading and turbidity into nearby water bodies. In addition, such activities provide opportunities for invasive vegetation and noxious, non-native species to take hold. This reduces watershed health, and results in poor soil retention, increased runoff, and poor water infiltration and absorption.

An increase in the number and density of roads would be a concern because they are long-term chronic point sources of sediment input, contamination from vehicles, and serve as water collection and conveyance corridors to live streams and ephemeral drainages that ultimately feed live streams. Impacts are amplified and more acute in areas where natural gas development is occurring in small discrete watersheds. Generally, where proper and timely reclamation is occurring at well pad and pipeline sites, and where proper road construction and maintenance is occurring, impacts from off-site soil movement and sediment and turbidity would be minimized.

The acreage of land open to minerals extraction (for leasable, salable, and locatable minerals) varies across the action alternatives and is discussed below. Because leasable mineral development is the most common and prolific type of mineral development in the planning area, acres of BLM-administered lands subject to leasable mineral decisions are used to define impacts to special status fish in this section.

Impacts from the No Action Alternative

The greater the numbers of acres open to mineral development, the greater the potential for impacts to special status fish, as watershed health and overall riparian condition would become more vulnerable to degradation. Under the No Action Alternative, 1,598,870 acres of BLM lands would be open to leasable mineral development with standard terms and conditions. A combined 1,011,012 acres would be open with either moderate constraints (CSU) or major constraints (NSO). In all, 174,391 acres would be closed to leasable mineral development.

Impacts from Alternative A

Alternative A would open 1,142,802 acres of BLM lands in the planning area to leasable mineral development with standard terms and conditions, while a combined 880,043 acres would be managed as CSU or NSO. In all, 761,404 acres would be closed to leasable mineral development. Alternative A would provide fewer open areas to leasable mineral development than the No Action Alternative. Additionally, more acres would be closed to leasable mineral development than under the No Action Alternative, thereby reducing the amount of surface disturbance, which would reduce sedimentation, potentially improve water quality, and reduce indirect impacts to riparian areas.

Impacts from Alternative B

Alternative B would open 1,089,481 acres of BLM lands within the planning area to leasable mineral development with standard terms and conditions while a combined 611,772 acres would be managed as CSU or NSO. In all, 1,082,972 acres would be closed to leasable mineral development. Alternative B would provide fewer open areas to leasable mineral development than the No Action Alternative. Additionally, more acres would be closed to leasable mineral development than under the No Action Alternative, thereby reducing the amount of surface disturbance, which would reduce sedimentation, potentially improve water quality, and reduce indirect impacts to riparian areas.

Impacts from Alternative C

Alternative C would open 1,750,774 acres of BLM lands within the planning area to leasable mineral development with standard terms and conditions, while a combined 944,782 acres would be managed as CSU or NSO. In all, 88,502 acres would be closed to leasable mineral development. Alternative C would provide more open areas to leasable mineral development than the No Action Alternative. Additionally, less acres would be closed to leasable mineral development than under the No Action Alternative, thereby increasing the amount of surface disturbance, which would potentially result in greater sedimentation, impact water quality, and increase indirect impacts to riparian areas.

Impacts from Alternative D

Alternative D would open 1,997,681 acres of BLM lands within the planning area to leasable mineral development, while a combined 701,776 acres would be managed as CSU or NSO. In all, 84,687 acres would be closed to leasable mineral development. Alternative D would provide more open areas to leasable mineral development than the No Action Alternative. Additionally, less acres would be closed to leasable mineral development than under the No Action Alternative, thereby increasing the amount of surface disturbance, which would potentially result in greater sedimentation, impact water quality, and increase indirect impacts to riparian areas.

Impacts of Special Designation Actions on Special Status Fish

Special designation areas such as ACECs, WSRs, and WSAs would generally have long-term positive impacts on special status fish that occur within their boundaries by limiting or preventing ground disturbance, human activities, and associated habitat degradation and fragmentation. Management goals within special designations would include the protection of riparian ecosystems and other water bodies, which would benefit special status fish as water quality and other food and habitat components are enhanced. Adverse impacts to special status fish, such as habitat and water quality alterations, reduction in streamside vegetation, and excessive sedimentation and turbidity within these designations would be minimized.

Areas of Critical Environmental Concern

Impacts from the No Action Alternative

Under the No Action Alternative, approximately 13,435 acres would continue to be designated as ACECs. Adverse impacts, such as those described above, to special status fish and associated habitat components would be minimized within the 13,435 acres.

Impacts from Alternative A

Under Alternative A, 495,042 acres would be designated as ACECs. This alternative would have the same beneficial impacts as the No Action Alternative; however, the magnitude of these impacts would be greater than under the No Action Alternative due to the 481,607-acre increase in land designated as ACECs. Approximately 200 acres would be designated as the Pecos Bluntnose Shiner Habitat ACEC, which would beneficially impact the Pecos bluntnose shiner and other special status fish species that use the same habitat, such as Rio Grande shiner (*Notropis jemezanus*), gray redhorse (*Moxostoma congestum*), and blue sucker (*Cycleptus elongatus*).

Impacts from Alternative B

Under Alternative B, 561,441 acres would be designated as ACECs. This alternative would have the same beneficial impacts as the No Action Alternative; however, the magnitude of these impacts would be greater than under the No Action Alternative due to the 547,998-acre increase in land designated as ACECs. The Pecos Bluntnose Shiner Habitat ACEC would be designated and managed as described under Alternative A.

Impacts from Alternative C

Under Alternative C, 98,562 acres would be designated as ACECs. This alternative would have the same beneficial impacts as the No Action Alternative; however, the magnitude of these impacts would be greater than under the No Action Alternative due to the 85,127-acre increase in land designated as ACECs. The

Pecos Bluntnose Shiner Habitat ACEC would be designated and managed as open with major constraints (NSO) for leasable mineral development. This decision would have the same impact to special status fish as described under Alternative A.

Impacts from Alternative D

Under Alternative D, 28,894 acres would be designated as ACECs. This alternative would have the same beneficial impacts as the No Action Alternative; however, the magnitude of these impacts would be greater than under the No Action Alternative due to the 15,459-acre increase in land designated as ACECs. The Pecos Bluntnose Shiner Habitat ACEC would be designated and managed as open with moderate constraints (CSU) for leasable mineral development. This decision would provide less protection to the special status fish and their associated habitats than Alternatives A, B, and C because some surface disturbance within the ACEC would be allowed to occur.

Wild and Scenic Rivers

Impacts from Management Common to All Action Alternatives

Under all action alternatives, 3.7 miles of the Black River would be recommended as suitable for inclusion in the NWSRS. Management prescriptions for Black River WSR would vary across alternatives and are described below. Designation of WSR segments would beneficially impact special status fish, including big scale logperch (*Percina macrolepida*), blue sucker, and gray redhorse, because it would prioritize resource management for the protection of the river.

Impacts from the No Action Alternative

Under the No Action Alternative, the Black and Delaware Rivers would not be managed as part of the NSRS but would be managed to protect their eligibility until suitability determinations are made in the RMP. The Black River would be managed with the following prescriptions: designation as VRM Class III, closed to salable development, recommended for withdrawal from locatable mineral development, and open with major constraints for leasable development. All ROW construction would continue to be designated under “avoidance” within WSR areas and all renewable energy development would not be allowed. The Delaware River would be managed with various prescriptions, such as classifying certain segments of the river under VRM Class II and IV, closing or excluding areas adjacent to the river to renewables development, managing as NSO for leasable mineral development, closing to salable development, recommending for withdrawal from locatable development and designating as ROW avoidance area. Potential adverse impacts to special status fish, including bigscale logperch, blue sucker, and gray redhorse, would include habitat and water quality alterations, reduction in streamside vegetation, and excessive sedimentation and turbidity.

Impacts from Alternative A

Under Alternative A, one segment (8.22 miles) of the Delaware River would be recommended as suitable for WSR designation. Management prescriptions under WSR designation would include management as VRM Class II; travel limited to designed routes, closed, or withdrawn from mineral development; and travel excluded from ROW corridors and renewable energy development. The designation and management prescriptions would benefit the Mexican tetra, which is known to occur in the Delaware River. The Black River WSR would be managed with the same prescriptions. These management prescriptions provide a slightly greater degree of protection to special status fish, including bigscale logperch, gray redhorse, and blue sucker, and their habitats compared to the No Action Alternative because they would be managed as exclusion areas for ROWs and would be managed under a more stringent VRM class.

Impacts from Alternative B

Under Alternative B, the Black River would be recommended as suitable for inclusion in the WSR system and would be managed as described under Alternative A. The Delaware River would not be recommended as suitable for inclusion in the WSR system; however, management prescriptions would be more protective of riparian habitat than as described under the No Action Alternative. Adverse impacts to special status fish and their habitats would be less than those described under the No Action Alternative.

Impacts from Alternative C

Under Alternative C, the Black River would be recommended as suitable for inclusion in the WSR system, and would be managed as described under Alternative A. The Delaware River would not be recommended as suitable for inclusion in the WSR system, and would be managed as described under Alternative B. Adverse impacts to special status fish would be less than those described under the No Action Alternative.

Impacts from Alternative D

Under Alternative D, the Black River would be recommended as suitable for inclusion in the WSR system, and would be managed as described under Alternative A; however, the area would be managed as open with major constraints (NSO) for leasable development. The Delaware River would not be recommended as suitable for inclusion in the WSR system, and would be managed as described under Alternative B. Adverse impacts to special status fish and their habitats would be less than those described under the No Action Alternative.

Wilderness Study Areas

Impacts from Management Common to All

Under all alternatives, 7,086 acres would remain under WSA designation. Management prescriptions under WSA designation include closure to mineral development leasing. This would minimize potential adverse impacts to special status fish resources associated with ground disturbances such as increased sedimentation and erosion, increased turbidity, alterations in habitat and water quality, and water depletions.

Impacts of Visual Resources Management Actions on Special Status Fish

VRM class designations have specific management objectives that, depending on the class designated, could beneficially impact special status fish and their habitats, especially where VRM Class I and II areas are located adjacent to the Pecos, Black, and Delaware Rivers, where special status fish are known to occur. The objectives defined for VRM Classes I and II include the preservation or retention of the existing character of the landscape and would therefore minimize and at times prohibit surface-disturbing activities. Those impacts to fish resources associated with mineral development, ROW construction and maintenance, and other land use authorizations and road and trail construction would be minimized within these VRM Class I and II designations. The number of acres designated as VRM Class I and II varies across the alternatives (Table 4-56).

Table 4-56. Visual Resource Management Decisions (acres) by Alternative

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Total	***50,671***	***273,710***	***357,802***	***67,962***	***48,263***

Impacts from the No Action Alternative

Under the No Action Alternative, 50,671 acres would be designated under either VRM Class I or II (see Table 4-56). Special status fish and their habitats would benefit from additional management prescriptions that would prohibit or minimize ground-disturbing activities within these designated acres. Various impacts associated with ground-disturbing activities include habitat alteration, loss or reduction in streamside vegetation cover, water quality alteration, water depletions, and increased sediment loading and turbidity.

Impacts from Alternative A

Under Alternative A, 273,710 acres would be designated as either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be much greater under this alternative because a larger number of acres would be under the VRM Class I and II designation.

Impacts from Alternative B

Under Alternative B, 357,802 acres would be designated as either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be greater under this alternative because a larger number of acres would be under the VRM Class I and II designation.

Impacts from Alternative C

Under Alternative C, 67,962 acres would be designated as either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be greater under this alternative because a larger number of acres would be under the VRM Class I and II designation.

Impacts from Alternative D

Under Alternative D, 48,263 acres would be designated under either VRM Class I or II. Qualitatively, the impacts would be the same as those under the No Action Alternative; however, the magnitude of beneficial impact would be greater under this alternative because a larger number of acres would be under the VRM Class I and II designation.

4.2.5.3 Special Status Wildlife

Special status wildlife species are those that occur on USFWS, NMDGF, and/or BLM lists of threatened and endangered species, and otherwise protected by the BLM by conservation agreements. The special status wildlife species analyzed in this section are described in detail in Section 3.2.6.4, Special Status Wildlife. Locations of known special status species habitat are displayed on Map 3-9 (Aplomado Falcon Habitat, including aplomado falcon grasslands habitat and aplomado falcon grasslands boundaries level 1, 2, and 3 habitats, and Lesser Prairie Chicken Habitat) and Map 3-10 (Dune Sagebrush Lizard Habitat).

4.2.5.3.1 Analysis Methods

Indicators

Acres of special status wildlife habitat overlapping areas subject to management actions under the alternatives are used for quantifying impacts in the analysis. Known acres of LPC habitat, including suitable LPC habitat, LPC isolated population area, and LPC timing restrictions area; aplomado falcon habitat, including aplomado falcon grasslands habitat and aplomado falcon grasslands boundary levels 1, 2, and 3 habitats; and DSL habitats were used in the analysis. Impacts to all other species are discussed in terms of the vegetative communities impacted, as described in Section 3.2.6.2, Special Status Plants.

Methods and Assumptions

Impacts to special status wildlife from management actions of the following resources, resource uses, and special designations are analyzed in detail: riparian, fish and wildlife, wildland fire and fuels management, lands with wilderness characteristics, visual resources, minerals, land use authorizations, renewable energy, livestock grazing, travel management, and special designations. Impacts from cave and karst, such as recreation within cave and karst features, to special status wildlife species are not analyzed in detail in this section; however, impacts and mitigation to any bat species, including special status bat species, is captured in Appendix C. Impacts from soil and water, riparian, vegetative communities, special status species, cultural resources, paleontological resources, land tenure, air resources and backcountry byways are not analyzed in detail. This is because there would be no or negligible impacts to special status wildlife as a result of those management actions because special status wildlife habitat would not be measurably altered and individuals would not be impacted. Management actions related to tribal rights and interests, social and economic conditions, and public safety do not authorize, contemplate, or otherwise intersect with surface-disturbing activities or the mitigation thereof, so these decisions also do not impact special status wildlife.

The assumptions used for this analysis are identical to those described for special status plants. Also, some of the analysis with regards to special status wildlife refers to Section 4.2.5.1, Special Status Plants. This is because the assumptions and analysis describe impacts based on basic biological, ecological, and demographic concepts that apply to all living things and are applicable to both plants and wildlife.

4.2.5.3.2 Direct and Indirect Impacts

Impacts of Fish and Wildlife Management Actions on Special Status Wildlife

Impacts from the No Action Alternative, Alternative C, and Alternative D

Under the No Action Alternative, Alternative C, and Alternative D, the Birds of Prey Grassland would not be managed as an ACEC, but would be managed with standard stipulations for mineral leasing, not withdrawn from locatable minerals, open to salable minerals and renewable energy development, and open to OHV use and grazing. The negative impacts associated with energy development, OHV use, and grazing (as discussed in Impacts from Minerals Management Actions on Special Status Wildlife, Impacts from Travel Management Actions on Special Status Wildlife, and Impacts from Livestock Grazing Actions on Special Status Wildlife) would continue to impact the species using this area; in particular, the aplomado falcon and special status bat species because this area contains suitable habitat for these species.

Impacts from Alternatives A and B

Under Alternative A, 349,355 acres of the planning area would be designated and managed as the Birds of Prey Grassland ACEC. Management actions would be prescribed for this ACEC that would focus on reclaiming and restoring grasslands habitat, including reclaiming abandoned well pads, prescribing NSO for minerals leasing, exclusion of wind and solar development, restricting vehicles to designated routes, and avoidance of grassland bird nests. In addition to the falcon, these actions would be beneficial for all grassland special status wildlife because localized habitat fragmentation would be prevented, thereby maintaining habitat connectivity. Also, the negative impacts of surface-disturbing activities, such as increased potential for mortality through crushing, habitat loss and degradation, and human noise and activity, would be avoided. Grassland birds, such as aplomado falcon and Sprague's pipit (*Anthus spragueii*), would benefit because nests would not be disturbed, which would increase the potential for nests to be productive and for population abundance to be maintained at current levels or increase.

Impacts of Special Status Species Management Actions on Special Status Wildlife

Impacts from Management Common to All

Under all alternatives, oil and gas activities including 3-D geophysical exploration and drilling would not be allowed in occupied LPC habitat during the period from March 1 through June 15 annually. During that period, other activities that produce noise or involve human activity, such as the maintenance of oil and gas facilities, geophysical exploration other than 3-D operations, and pipeline, road, and well pad construction, would be allowed except between 3:00 a.m. and 9:00 a.m. The 3:00 a.m. to 9:00 a.m. restriction would not apply to normal, around-the-clock operations, such as venting, flaring, or pumping, which do not require a human presence during this period. Additionally, no new drilling would be allowed within up to 656 feet of lek locations known at the time of permitting. Normal vehicle use on existing roads would not be restricted. Exhaust noise from pump jack engines would be muffled or otherwise controlled so as not to exceed 49 decibel (dB) measured at 30 feet from the source of the noise. These stipulations would mitigate the disruption of LPC mating and nesting by activities associated with energy exploration and development.

Impacts of Wildland Fire and Fuel Management Actions on Special Status Wildlife

Impacts from Management Common to All

Under all alternatives, wildland fire would be used to protect, maintain, and enhance resources. When possible, fire would be allowed to function in its natural ecological role. It would also be used to reduce hazardous fuels with the goal of restoring ecosystems and protecting other natural resources. Wildland fire can be both beneficial and harmful to special status animal populations. Historic fire suppression has led to conditions in many fire-adapted areas that are overgrown and in need of fire to return it to its natural state. Wildland fire in these areas would help restore the ecosystem to a more typical state, potentially making the habitat more suitable for use and colonization by special status wildlife and potentially supporting range expansions in the long term. In the short term, burned-over landscapes would be unusable by wildlife, displacing them into other habitats until the burned area recovered. Additionally, individuals could be killed in the fire, leading to a short-term reduction in population abundance. Special status wildlife is inherently vulnerable to population declines from large-scale disturbance, such as wildfire, due to the limited amount of available suitable habitat and/or already small population sizes. Because of this, large-scale wildfire could be detrimental to special status animal populations. Exact impacts, whether beneficial or harmful, would depend on the location and nature of each individual fire.

Impacts of Lands with Wilderness Characteristics Management Actions on Special Status Wildlife

Impacts from Management Common to All Action Alternatives

The lands with wilderness characteristics alternatives consist of differing amounts of acres managed to maintain those characteristics (Table 4-57). Management actions on lands with wilderness characteristics would include recommended withdrawal from mineral entry, closing to leasing or NSO, ROW exclusion, and closure or limited motor vehicle use. Exact impacts of each of these actions are described in detail in Impacts of Mineral Leasing Management Actions on Special Status Wildlife, Impacts of Land Use Authorizations Management Actions on Special Status Wildlife, and Impacts of Travel Management Actions on Special Status Wildlife, respectively, but because of the emphasis placed on naturalness, solitude, and primitive/unconfined recreation, managing lands as lands with wilderness characteristics is generally beneficial for special status wildlife.

Table 4-57. Acres of Special Status Wildlife Habitat That Would Be Managed as Lands with Wilderness Characteristics under Each Alternative

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Aplomado falcon habitat (acres) within lands with wilderness characteristics	0	0	0	0	0
Total area managed as lands with wilderness characteristics (acres)	0	66,666	47,611	35,715	4,348

Impacts from the No Action Alternative

Under the No Action Alternative, no BLM-administered lands would be managed as lands with wilderness characteristics. Management of all lands would continue under current conditions, with a mixture of minerals leasing, travel management, and land use authorizations. Therefore, there would be no beneficial impacts to special status wildlife from lands with wilderness characteristics management under this alternative.

Impacts from Alternative A

Under Alternative A, a total of 66,666 acres including 0 acres of aplomado falcon habitat would be managed as lands with wilderness characteristics, providing the benefits described in management common to all action alternatives for the species on that amount of habitat. Other special status animal species for which there is no geographical information likely also occur on lands with wilderness characteristics and would benefit from the restrictions on human disturbance. This alternative would be more beneficial for special status wildlife than the No Action Alternative.

Impacts from Alternative B

Under Alternative B, a total of 47,611 acres of the planning area would be managed as lands with wilderness characteristics, including 0 acres of aplomado falcon habitat. Impacts of this alternative on special status wildlife would be identical to that described for Alternative A for the falcon because the amount of falcon habitat impacted would be the same and less beneficial for other special status animal species that may have habitat in the lands with wilderness characteristics areas because the overall amount of habitat impacted would be less.

Impacts from Alternative C

Under Alternative C, a total of 35,715 acres of the planning area would be managed as lands with wilderness characteristics. Aplomado falcon habitat would not be included in lands with wilderness characteristics areas under this alternative and would not benefit.

Impacts from Alternative D

Under Alternative D, a total of 4,348 acres of the planning area would be managed as lands with wilderness characteristics. Aplomado falcon habitat would not be included in lands with wilderness characteristics areas under this alternative and would not benefit.

Impacts of Visual Resources Management Actions on Special Status Wildlife

Impacts from Management Common to All Alternatives

The impacts to special status wildlife from visual resources decisions are primarily associated with limitations on surface disturbance that is intended to reduce impacts on areas with high visual resource values. VRM Class I and II designations are the most restrictive of surface-disturbing activities, and would therefore be the most beneficial to special status wildlife and their habitats. In areas designated as VRM Class I or II, surface-disturbing activities are generally prohibited or limited. Table 4-58 shows the proposed VRM classes in acres for each alternative.

Table 4-58. Proposed VRM Classes in Acres

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Class III	402,725	367,205	294,177	549,329	546,205
Class IV	2,330,462	2,783,514	2,131,501	2,166,266	2,189,116

Under all alternatives, artificial lighting would continue to be used throughout the planning area, resulting in temporary and local impacts on special status wildlife. Artificial night lighting affects animal foraging behavior, reproduction, movement, and species interactions (such as predator) (Longcore and Rich 2004, 2005).

Impacts from the No Action Alternative

The No Action Alternative would designate 50,671 acres (or 1.8% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit special status wildlife in the ways described in Impacts from Management Common to All Alternatives.

Impacts from Alternative A

Alternative A would designate 273,710 acres (or 9.8% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit special status wildlife in the ways described in Impacts from Management Common to All Alternatives more than the No Action Alternative.

Impacts from Alternative B

Alternative B would designate 357,802 acres (or 12.9% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit special status wildlife in the ways described in Impacts from Management Common to All Alternatives more than the No Action Alternative. Because of the large area designated as Class I or II, this alternative is the most beneficial for special status wildlife when compare to all other alternatives.

Impacts from Alternative C

Alternative C would designate 67,962 acres (or 2.4% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit special status wildlife in the ways described in Impacts from Management Common to All Alternatives more than the No Action Alternative.

Impacts from Alternative D

Alternative D would designate 48,263 acres (or 1.7% of the planning area) as VRM Class I or II. Surface-disturbing activities would be prohibited or limited in this area, which would benefit special status wildlife in the ways described in Impacts from Management Common to All Alternatives less than the No Action Alternative.

Impacts of Minerals Management Actions on Special Status Wildlife

Impacts from Management Common to All Alternatives

Minerals designation definitions are given in Section 3.3.1, Minerals. The impact analysis below is based on the following assumptions in addition to those previously listed in this section.

Acres designated as open could be impacted by minerals development. Impacts from minerals development include habitat removal, crushing, or trampling of individuals, habitat fragmentation, displacement from breeding locations or other sensitive habitats, increased fugitive dust, changes in habitat structure or composition due to the introduction and spread of invasive and weedy plant species, increased potential for ingestion of toxic substances, and increased energy expenditure due to aversion of increased human noise and activity. These impacts can harm special status animal individuals, as well as decrease the health and abundance of populations.

Acres designated as open with moderate constraints would apply restrictive lease stipulations on minerals development, including actions required to mitigate negative impacts such as those listed above. Negative impacts associated with minerals development could occur in these areas, but mitigative and avoidance actions would be stipulated to lessen and mitigate for those impacts.

Acres designated as closed, withdrawn, or open with major constraints would be beneficial for special status wildlife because it would avoid all negative impacts associated with minerals management actions. This is because no minerals exploration or development could take place on areas that are closed or withdrawn. Areas that would be open with major constraints would be subject to NSO, meaning that habitat would not be removed and surface-disturbing activities would not occur.

Table 4-59 displays acres of special status animal habitat impacted by minerals management decisions.

Table 4-59. Minerals Management Decisions (Acres/% of habitat) by Alternative on BLM-administered Surface Lands

Species	Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Leasable Minerals						
Aplomado falcon grasslands habitat	Closed and open with major constraints designations	7,994/8%	86,220/85%	100,008/99%	0/0%	0/0%
	Open with moderate constraints	91,451/91%	13,807/14%	22/<1%	81,741/81%	81,650/81%
	Open designations	1,562/1%	980/1%	977/1%	19,248/19%	19,346/19%
Aplomado falcon grasslands boundary habitat – Level 1	Closed designations	0/0%	54,141/55%	98,351/99%	0/0%	0/0%
	Open with moderate constraints	98,540/100%	44,390/45%	0/0%	97,332/99%	97,345/99%
	Open designations	0/0%	10/<1%	10/<1%	1,166/1%	1,166/1%
Aplomado falcon grasslands boundary habitat – Level 2	Closed designations	0/0%	125,049/99%	125,258/99%	0/0%	0/0%
	Open with moderate constraints	125,284/100%	209/<1%	0/0%	125,239/99%	125,252/99%
	Open designations	0/0%	26/<1%	26/<1%	0/0%	0/0%
Aplomado falcon grasslands boundary habitat – Level 3	Closed designations	16,529/95%	17,092/99%	17,310/100%	0/0%	0/0%
	Open with moderate constraints	781/5%	218/1%	0/0%	17,310/100%	17,310/100%
	Open designations	0/0%	0/0%	0/0%	0/0%	0/0%
Suitable LPC habitat	Closed and open with major constraints designations	107,772/35%	107,810/35%	274,038/91%	109,096/36%	57,029/19%
	Open with moderate constraints	178,196/60%	178,792/59%	8,933/3%	177,438/59%	219,112/72%
	Open designations	14,596/4%	14,073/4%	14,073/4%	14,073/4%	24,451/8%
LPC isolated population area	Closed and open with major constraints designations	5,197/<1%	5,479/<1%	329,784/52%	5,924/1%	5,924/1%
	Open with moderate constraints	624,515/99%	624,252/99%	299,947/47%	431,126/68%	314,610/50%
	Open designations	0/0%	0/0%	0/0%	192,662/30%	309,197/50%
LPC timing restriction area	Closed and open with major constraints designations	133,841/32%	133,869/33%	395,616/97%	135,160/33%	55,309/13%
	Open with moderate constraints	254,044/62%	261,748/64%	0/0%	253,314/62%	340,302/83%
	Open designations	18,753/4%	11,045/3%	11,045/3%	18,165/4%	11,050/3%
DSL habitat	Open with major constraints designations	10,074/5%	81/<1%	0/0%	37,922/19%	191/<1%
	Open with moderate constraints	156,623/80%	155,949/80%	0/0%	155,947/80%	193,681/98%
	Closed	29,607/15%	40,277/20%	196,307/100%	2,435/1%	2,435/1%

Species	Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Salable Minerals						
Aplomado falcon grasslands habitat	Closed designation	0/0%	81,804/81%	99,766/99%	200/<1%	200/<1%
	Open with special terms and conditions	0/0%	18,223/18%	264/<1%	81,776/81%	81,524/80%
	Open designation	101,000/99%	980/1%	977/1%	19,026/18%	19,277/19%
Aplomado falcon grasslands boundary habitat – Level 1	Closed designation	0/0%	1,263/1%	98,303/99%	97,191/99%	97,351/99%
	Open with standard terms and conditions	98,539/99%	97,132/99%	75/<1%	0/0%	0/0%
	Open designation	0/0%	145/<1%	162/<1%	1,347/1%	1,189/1%
Aplomado falcon grasslands boundary habitat – Level 2	Closed designation	0/0%	125,163/99%	119,982/96%	200/<1%	200/<1%
	Open with standard terms and conditions	0/0%	95/<1%	5,276/4%	125,033/99%	125,068/99%
	Open designation	125,277/99%	26/<1%	26/<1%	44/<1%	10/<1%
Aplomado falcon grasslands boundary habitat – Level 3	Closed designation	0/0%	17,310/100%	17,310/100%	0/0%	0/0%
	Open with standard terms and conditions	0/0%	0/0%	0/0%	17,310/100%	17,310/100%
	Open designation	17,310/100%	0/0%	0/0%	0/0%	0/0%
Suitable LPC habitat	Closed designation	55,929/18%	112,068/37%	267,442/89%	112,699/37%	62,945/20%
	Open with special terms and conditions	0/0%	174,698/58%	19,340/6%	173,853/57%	213,178/70%
	Open designation	244,651/81%	13,858/5%	13,829/5%	14,040/4%	24,467/8%
LPC isolated population area	Closed designation	4,810/<1%	9,748/2%	275,960/44%	9,527/1%	9,527/1%
	Open with special terms and conditions	0/0%	619,944/98%	353,762/56%	425,476/67%	310,068/49%
	Open designations	624,866/99%	39/<1%	8/<1%	194,724/31%	310,131/50%
LPC timing restriction area	Closed designation	54,208/13%	135,948/33%	395,597/97%	136,578/33%	59,034/14%
	Open with special terms and conditions	0/0%	259,876/64%	248/<1%	258,993/64%	336,577/83%
	Open designations	352,423/86%	10,838/3%	10,816/3%	11,089/3%	11,048/2%
DSL habitat	Closed designation	2,546/1%	43,316/22%	141,169/72%	43,915/22%	8,479/4%
	Open with special terms and conditions	0/0%%	152,988/78%	55,134/28%	151,968/78%	187,508/96%
	Open designation	193,748/99%	3/<1%	4/<1%	424/<1%	318/<1%

Species	Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Locatable Minerals						
Aplomado falcon grasslands habitat	Withdrawn	0/0%	101/<1%	101/<1%	0/0%	0/0%
	Open designation	101,006/99%	100,900/99%	100,900/99%	101,001/99%	101,001/99%
Aplomado falcon grasslands boundary habitat – Level 1	Withdrawn	0/0%	7/<1%	7/<1%	0/0%	0/0%
	Open designation	98,540/100%	98,533/99%	98,533/99%	98,540/100%	98,540/100%
Aplomado falcon grasslands boundary habitat – Level 2	Withdrawn	0/0%	145/<1%	145/<1%	0/0%	0/0%
	Open designation	125,284/100%	125,133/99%	125,133/99%	125,278/99%	125,278/99%
Aplomado falcon grasslands boundary habitat – Level 3	Withdrawn	0/0%	0/0%	0/0%	0/0%	0/0%
	Open designation	17,310/100%	17,310/100%	17,310/100%	17,310/100%	17,310/100%
Suitable LPC habitat	Withdrawn	0/0%	109,096/36%	265,257/88%	57,036/19%	57,036/19%
	Open designation	300,581/99%	191,474/64%	35,306/12%	243,529/81%	243,556/81%
LPC isolated population area	Withdrawn	0/0%	6,774/1%	273,832/43%	5,924/1%	5,924/1%
	Open designation	629,727/99%	622,953/99%	355,893/57%	623,804/99%	623,764/99%
LPC timing restriction area	Withdrawn	0/0%	135,164/33%	395,602/97%	55,315/14%	55,315/14%
	Open designation	406,639/99%	271,496/67%	11,055/3%	351,346/86%	351,346/86%
DSL habitat	Withdrawn	0/0%	40,357/21%	196,307/100%	2,626/1%	2,626/1%
	Open designation	196,307/100%	155,949/79%	0/0%	193,680/99%	193,680/99%

Table 4-59 displays acres of known habitat for three special status animal species; however, areas open to minerals development could also impact special status species for which habitat is not defined and/or known.

Impacts from Management Common to All Action Alternatives

Under all action alternatives, 99%–100% (101,007–241,135 acres) of aplomado falcon habitat, including grasslands habitat and grasslands boundary levels I, II, and III habitats, would be open to locatable minerals development on BLM lands, causing potential for adverse impacts described in management common to all alternatives.

Impacts from the No Action Alternative

Leasable Minerals

Under the No Action Alternative, approximately 8% (7,994 acres) would be closed or open with major constraints, 91% (91,451 acres) would be open with moderate constraints, and 1% (1,562 acres) of aplomado falcon grassland habitat (91,451 acres) would be open to leasable mineral development on BLM lands. Aplomado falcon grassland boundary habitat level 1 would have 0% (0 acres) closed, 100% (98,540 acres) open with moderate constraints, and 0% (0 acres) open to leasable mineral development on BLM lands. Aplomado falcon grassland boundary habitat level 2 would have 0% (0 acres) closed, 100% (125,284 acres) open with moderate constraints, and 0% (0 acres) open to leasable mineral development on BLM lands. Aplomado falcon grassland boundary habitat level 3 would have 95% (16,529 acres) closed, 5% (781 acres) open with moderate constraints, and 0% (0 acres) open to leasable mineral development on BLM lands. The No Action Alternative would be the least beneficial for this species and its habitat because the majority of the habitat would not be protected by closed or open with major constraints designations.

Under the No Action Alternative, 35% (107,772 acres) of suitable LPC habitat would be subject to closure or open with major constraints, 60% (178,196 acres) open with moderate constraints, and 4% (14,596 acres) open to leasable minerals on BLM lands. Also, under the No Action Alternative <1% (5,197 acres) of the LPC isolated population area would be subject to closure or open with major constraints designation, 99% (624,515 acres) open with moderate constraints, and 0 acres open to leasable minerals on BLM lands under the No Action Alternative. In addition, the No Action Alternative would subject 32% (133,841 acres) of LPC timing restriction areas to closure or open with major constraints, 62% (254,044 acres) open with moderate constraints, and 4% (18,753 acres) open to leasable minerals on BLM lands. This alternative would be the least beneficial for this species and its habitat because it would leave the largest percentage of habitat open to the surface-disturbing effects of development.

Under the No Action Alternative, 5% (10,074 acres) of DSL habitat would be subject to NSO, and 80% (156,623 acres) would be open with moderate constraints to leasable mineral development on BLM lands. The least amount of habitat would remain open under this alternative, and so would be the most beneficial for the species in that respect; however, it also designates the least amount of habitat as closed or subject to NSO.

Salable Minerals

Under the No Action Alternative, aplomado falcon grassland habitat would have 0% (0 acres) closed, 0% (0 acres) open with standard terms and conditions, and 99% (101,000 acres) would be open to salable mineral development on BLM lands. Aplomado falcon grassland boundary habitat level I would have 0% (0 acres) closed, 99% (98,539 acres) open with standard terms and conditions, and 0% (0 acres) open to salable mineral development on BLM lands. Aplomado grassland boundary habitat level II would have 0% (0 acres) closed, 0% (0 acres) open with standard terms and conditions and 99% (125,227 acres) open to salable mineral development on BLM lands. Aplomado grassland boundary habitat level III would have 0% (0 acres) closed, 0% (0 acres) open with standard terms and conditions and 100% (17,310 acres) open to salable mineral development on BLM lands. This alternative would be the least beneficial for this species and its habitat because the habitat is either open with special terms and conditions or open.

Under the No Action Alternative, 18% (55,929 acres) of suitable LPC habitat would be subject to closure or NSO and 81% (244,651 acres) would be open to salable minerals on BLM lands. Approximately <1% (4,810 acres) of LPC isolated population area would be subject to closure and 99% (624,866 acres) would be open to salable minerals on BLM lands under the No Action Alternative. In addition, the No Action Alternative would subject 13% (54,208 acres) of LPC timing restriction areas to closure and 86% (352,423 acres) open to salable minerals on BLM lands. This alternative would be the least beneficial for this species and its habitat because it would leave the largest percentage of habitat open to the surface-disturbing effects of development.

Under the No Action Alternative, 1% (2,546 acres) of DSL habitat would be closed and 99% (193,748 acres) would be open to salable mineral development on BLM lands. The greatest amount of DSL habitat would remain open under this alternative; therefore, the No Action Alternative would be the least beneficial for the species.

Locatable Minerals

The No Action Alternative would designate 99% (101,006 acres) of aplomado falcon grassland habitat as open and 0% (0 acres) withdrawn. Aplomado falcon grassland boundary habitat level I would have 100% (98,540 acres) open and 0% (0 acres) withdrawn to locatable mineral development on BLM lands. Aplomado falcon grassland boundary habitat level II would have 100% (125,284 acres) open and 0% (0 acres) withdrawn to locatable mineral development on BLM lands. Aplomado falcon grassland boundary habitat level III would have 100% (17,310 acres) open and 0% (0 acres) withdrawn to locatable mineral development on BLM lands. Because of the amount of habitat open to locatable minerals this alternative would be the least beneficial for the species.

The No Action Alternative would designate 99% (300,581 acres) of suitable LPC habitat, 99% (629,727 acres) of LPC isolated population habitat and 99% (406,639 acres) of LPC timing restriction area open to locatable mineral development on BLM lands and 100% (99,529 acres) open to locatable mineral development. Because of the amount of habitat designated as open, this alternative would have more adverse effects on the species than all other alternatives.

The No Action Alternative would designate 100% (196,307 acres) of DSL habitat open to locatable mineral development on BLM lands. Because of the amount of habitat designated as open, this alternative would have more adverse effects on the species than all other alternatives.

Impacts from Alternative A

Leasable Minerals

Under Alternative A, aplomado falcon grassland habitat would have 85% (86,220 acres) closed or subject to NSO, 14% (13,807 acres) open with moderate constraints, and 1% (980 acres) open to leasable mineral development on BLM lands. Aplomado falcon grasslands boundary habitat level I would have 55% (54,141 acres) closed, 45% (44,390 acres) open with moderate constraints, and <1% (10 acres) open to leasable mineral development on BLM lands. Aplomado falcon grasslands boundary habitat level II would have 99% (125,049 acres) closed, <1% (209 acres) open with moderate constraints, and <1% (26 acres) open to leasable mineral development on BLM lands. Aplomado falcon grasslands boundary habitat level III would have 99% (17,092 acres) closed, 1% (218 acres) open with moderate constraints, and 0% (0 acres) open to leasable mineral development on BLM lands. Along with Alternative B, this alternative would be the most beneficial for this species and its habitat because of the closure and NSO stipulations on BLM surface lands. The impacts to the species on subsurface lands would be the same as the No Action Alternative.

Under Alternative A, 35% (107,810 acres) of suitable LPC habitat, <1% (5,479 acres) of LPC isolated population area and 33% (133,869 acres) of LPC timing area would be subject to closure or NSO. Alternative A would designate 59% (178,792 acres) of suitable LPC habitat, 99% (624,252 acres) of LPC isolated population area, and 64% (261,748 acres) of the LPC timing restriction area as open with moderate constraints. In addition, 4% (14,073 acres) of suitable LPC habitat, 0% (0 acres) LPC isolated population areas and 3% (11,045 acres) of the LPC timing restriction area would be open to leasable mineral development on BLM lands under Alternative A. Because of the amount of habitat closed or subject to NSO stipulations, this alternative would avoid the same negative impacts on the species and its habitat as the No Action Alternative on BLM surface lands. The impacts to the species on subsurface lands would be the same as the No Action Alternative.

Under Alternative A, <1% (81 acres) of DSL habitat would be subject to NSO, 80% (155,949 acres) open with moderate constraints, and 20% (40,277 acres) would be closed to leasable mineral development on BLM surface lands. Because of the amount of habitat closed or subject to NSO stipulations, this alternative would avoid more negative impacts on the species and its habitat than the No Action Alternative on BLM lands.

Salable Minerals

Under Alternative A, aplomado falcon grasslands habitat would have 81% (81,804 acres) closed, 18% (18,223 acres) open with special terms and conditions, and 1% (980 acres) open to salable minerals development on BLM lands. Aplomado falcon grasslands boundary habitat level I would have 1% (1,263 acres) closed, 99% (97,132 acres) open with special terms and conditions, and <1% (145 acres) open to salable minerals development on BLM lands. Aplomado falcon grassland boundary habitat level II would have 99% (125,163 acres) closed, <1% (95 acres) open with special terms and conditions, and <1% (26 acres) open to salable minerals development on BLM lands. Aplomado falcon grasslands boundary habitat level III would have 100% (17,310 acres) closed, 0% (0 acres) open with special terms and conditions, and 0% (0 acres) open to salable minerals development on BLM lands. Along with Alternative B, this alternative would avoid the most negative impacts to this species and its habitat because of the amount of habitat open to salable leasing on surface lands, and would be more beneficial than the No Action Alternative.

Under Alternative A, 37% (112,068 acres) of suitable LPC habitat, 2% (9,748 acres) of LPC isolated population area and 33% (135,948 acres) of LPC timing restriction area would be subject to closure. Alternative A would designate 58% (174,698 acres) of suitable LPC habitat, 98% (619,944 acres) of LPC isolated population area and 64% (259,876 acres) of the LPC timing restriction area as open with special terms and conditions. In addition, 5% (13,858 acres) of suitable LPC habitat, <1% (39 acres) of LPC isolated population area, and 3% (10,838 acres) of the LPC timing restriction area would be open to salable mineral development on BLM surface lands. Because of the amount of habitat closed, or open with standard terms and conditions, this alternative would be more beneficial than the No Action Alternative because there is less habitat open.

Under Alternative A, 22% (43,316 acres) of DSL habitat would be closed, 78% (152,991 acres) would be open with special terms and conditions, and <1% (3 acres) would be open to salable mineral development on BLM lands. Because of the amount of habitat open to salable minerals on BLM lands, this alternative would be more beneficial than the No Action Alternative and Alternative D, but less beneficial than all other action alternatives.

Locatable Minerals

Impacts to aplomado falcon grassland habitat and aplomado falcon grasslands boundary habitat level 1, 2 and 3 are discussed in Impacts from Management Common to All Alternatives.

Under Alternative A, 36% (109,096 acres) of suitable LPC habitat, 1% (6,774 acres) of LPC isolated population area, and 33% (135,164 acres) of LPC timing restriction area would be subject to withdrawal. In addition, 64% (191,474 acres) of suitable LPC habitat, 99% (622,953 acres) of LPC isolated population area and 67% (271,496 acres) of the LPC timing restriction area would be open to locatable mineral development on BLM lands. Because of the amount of habitat subject to withdrawal this alternative would be more beneficial than the No Action Alternative, but less beneficial than Alternative B.

Under Alternative A, 21% (40,357 acres) of DSL habitat would be withdrawn and 79% (155,949 acres) would be open to locatable mineral development of BLM lands. Because of the amount of habitat open to locatable minerals development, this alternative would more beneficial than the No Action Alternative, and Alternatives C and D.

Impacts from Alternative B

Leasable Minerals

Under Alternative B, aplomado falcon grassland habitat would have 99 % (100,008 acres) closed or subject to NSO, <1% (22 acres) open with moderate constraints, and 1% (977 acres) open to leasable mineral development on BLM lands. Aplomado falcon grasslands boundary habitat level I would have 99% (98,351 acres) closed, 0% (0 acres) open with moderate constraints, and <1% (10 acres) open to leasable mineral development on BLM lands. Aplomado falcon grasslands boundary habitat level 2 would have 99% (125,258 acres) closed, 0% (0 acres) open with moderate constraints, and <1% (26 acres) open to leasable mineral development on BLM lands. Aplomado falcon grasslands boundary habitat level 3 would have 100% (17,310 acres) closed, 0% (0 acres) open with moderate constraints, and 0% (0 acres) open to leasable mineral development on BLM lands. Along with Alternative A, this alternative would be the most beneficial for this species and its habitat because of the closure and NSO stipulations on BLM surface lands. The impacts to the species on subsurface lands would be the same as the No Action Alternative.

Under Alternative B, 91% (274,038 acres) of suitable LPC habitat, 44% (275,960 acres) of LPC isolated population area, and 97% (395,616 acres) of the LPC timing restriction area would be subject to closure or NSO. Alternative B would designate 3% (8,933 acres) of suitable LPC habitat, 56% (353,762 acres) of LPC isolated population area and 0% (0 acres) of the LPC timing restriction area open with standard terms and conditions. In addition, 4% (14,073 acres) of suitable LPC habitat, 0% (0 acres) of LPC isolated population area, and 3% (11,045 acres) of the LPC timing restriction area would be open to leasable mineral development on BLM lands under Alternative B. Because of the amount of habitat closed or subject to NSO stipulations, this alternative would be more beneficial than Alternative D.

Under Alternative B, 0% (0 acres) of DSL habitat would be subject to NSO, 0% (0 acres) open with moderate constraints, and 100% (196,307 acres) would be closed to leasable mineral development on BLM lands. Because of the amount of habitat closed to leasable minerals, this alternative would be more beneficial than the No Action Alternative, Alternative C and Alternative D.

Salable Minerals

Under Alternative B, aplomado falcon grasslands habitat would have 99% (99,766 acres) closed, <1% (264 acres) open with special terms and conditions, and 1% (977 acres) open to salable minerals development on BLM lands. Aplomado falcon grasslands boundary habitat level I would have 99% (98,303 acres) closed, <1% (75 acres) open with special terms and conditions, and <1% (162 acres) open to salable minerals development on BLM lands. Aplomado falcon grassland boundary habitat level II would have 96% (119,982 acres) closed, 4% (5,276 acres) open with special terms and conditions, and <1% (26 acres) open to salable minerals development on BLM lands. Aplomado falcon grasslands boundary habitat level III would have 100% (17,310 acres) closed, 0% (0 acres) open with special terms and conditions, and 0% (0 acres) open to salable minerals development on BLM lands. Along with Alternative A, this alternative would avoid the most negative impacts to this species and its habitat because of the amount of habitat closed to salable leasing on BLM lands, and would be more beneficial than the No Action Alternative.

Under Alternative B, 89% (267,442 acres) of suitable LPC habitat, 43% (275,960 acres) of LPC isolated population area, and 97% (395,597 acres) of the LPC timing restriction area would be subject to closure. Alternative B would also designate 6% (19,340 acres) of suitable LPC habitat, 56% (353,283 acres) of LPC isolated population area, and <1% (248 acres) of the LPC timing restriction area open with special terms and conditions. In addition, 5% (13,829 acres) of suitable LPC habitat, <1% (488 acres) LPC isolated population area, and 3% (10,816 acres) of the LPC timing restriction area would be open to salable mineral development on BLM lands under Alternative B. Because of the amount of habitat closed, or open with standard terms and conditions, this alternative would be more beneficial for the species than all other alternatives.

Under Alternative B, 72% (141,169 acres) of DSL habitat would be closed, 28% (55,134 acres) would be open with standard terms and conditions, and <1% (4 acres) would be open to salable mineral development on BLM lands. Because of the amount of habitat closed to salable minerals, this alternative would be more beneficial for the species and its habitat than all other alternatives.

Locatable Minerals

Impacts to aplomado falcon grassland habitat and aplomado falcon grasslands boundary habitat levels 1, 2 and 3 are discussed in Impacts from Management Common to All Alternatives.

Under Alternative B, 88% (265,257 acres) of suitable LPC habitat, 43% (273,832 acres) of LPC isolated population area, and 97% (395,602 acres) of the LPC timing area would be subject to withdrawal. In addition, 12% (35,306 acres) of suitable LPC habitat, 57% (355,893 acres) of LPC isolated population area, and 3% (11,055 acres) of the LPC timing restriction area would be open to locatable mineral development on BLM lands under Alternative B. Because of the amount of habitat subject to withdrawal this alternative would have fewer impacts on the species and its habitat than all other alternatives.

Under Alternative B, 100% (196,307 acres) of DSL habitat would be withdrawn and 0% (0 acres) would be open to locatable mineral development on BLM lands. Because of the amount of habitat closed to locatable minerals, this alternative would be more beneficial for the species and its habitat than all other alternatives.

Impacts from Alternative C

Leasable Minerals

Under Alternative B, aplomado falcon grassland habitat would have 0% (0 acres) closed or subject to NSO, 81% (81,741 acres) open with moderate constraints, and 19% (19,248 acres) open to leasable mineral development on BLM lands. Aplomado falcon grasslands boundary habitat level I would have 0% (0 acres) closed, 99% (97,332 acres) open with moderate constraints, and 1% (1,166 acres) open to leasable mineral development on BLM lands. Aplomado falcon grasslands boundary habitat level II would have 0% (0 acres) closed, 99% (125,239 acres) open with moderate constraints, and 0% (0 acres) open to leasable mineral development on BLM lands. Aplomado falcon grasslands boundary habitat level III would have 0% (0 acres) closed, 100% (17,310 acres) open with moderate constraints, and 0% (0 acres) open to leasable mineral development on BLM lands. Other than the No Action Alternative, this alternative would allow the greatest amount of habitat to be open to leasable minerals with moderate constraints, leading to greater impacts on the species than Alternatives A and B.

Under Alternative C, 36% (109,096 acres) of suitable LPC habitat, 1% (5,924 acres) of LPC isolated population area, and 33% (135,160 acres) of LPC timing restriction area would be subject to closure or NSO stipulations. Alternative C would designate, 59% (177,438 acres) of suitable LPC habitat, 68% (431,126 acres) of LPC isolated population area, and 62% (253,314 acres) of the LPC timing restriction area as open with moderate constraints. In addition, 4% (14,073 acres) of suitable LPC habitat, 30% (192,662 acres) of LPC isolated population area, and 4% (18,165 acres) of the LPC timing restriction areas would be open to leasable mineral development on BLM lands under Alternative C. Because of the amount of habitat closed or subject to NSO stipulations, this alternative would be more beneficial than the No Action Alternative and Alternative D.

Under Alternative C, 19% (37,922 acres) of DSL habitat would be subject to NSO, 80% (155,947 acres) open with moderate constraints, and 1% (2,435 acres) would be closed to leasable mineral development on BLM lands. Because of the amount of habitat closed to leasable minerals, this alternative and Alternative D would be the least beneficial than all other alternatives.

Salable Minerals

Under Alternative B, aplomado falcon grasslands habitat would have <1% (200 acres) closed, 81% (81,776 acres) open with special terms and conditions, and 18% (19,026 acres) open to salable minerals development on BLM lands. Aplomado falcon grasslands boundary habitat level 1 would have 99% (97,191 acres) closed, 0% (0 acres) open with standard terms and conditions, and 1% (1,347 acres) open to salable minerals development on BLM lands. Aplomado falcon grassland boundary habitat level 2 would have <1% (200 acres) closed, 99% (125,033 acres) open with special terms and conditions, and <1% (44 acres) open to salable minerals development on BLM lands. Aplomado falcon grasslands boundary habitat level 3 would have 0% (0 acres) closed, 100% (17,310 acres) open with standard terms and conditions, and 0% (0 acres) open to salable minerals development on BLM lands. When compared to all other alternatives, this alternative would have the most negative impacts to this species and its habitat because of the amount of habitat open with standard terms and conditions to salable leasing, except for the aplomado falcon grasslands boundary habitat level I which has the majority of the habitat closed to salable leasing.

Under Alternative C, 37% (112,699 acres) of suitable LPC habitat, 1% (9,527 acres) of LPC isolated population area, and 33% (136,578 acres) of LPC timing restriction area would be subject to closure. Alternative C would designate 57% (173,853 acres) of suitable LPC habitat, 67% (425,476 acres) of the LPC isolated population area, and 64% (258,993 acres) of the LPC timing area as open with standard terms and conditions. In addition, 4% (14,040 acres) of suitable LPC habitat, 31% (194,724 acres) of the LPC isolated population area, and 3% (11,089 acres) or the LPC timing restriction area would be open to salable mineral development on BLM lands. Because of the amount of habitat closed or open with standard terms and conditions, this alternative would be more beneficial than all other alternatives except for Alternative B.

Under Alternative C, 22% (43,915 acres) of DSL habitat would be closed, 78% (151,968 acres) would be open with special terms and conditions, and <1% (424 acres) would be open to salable mineral development on BLM lands. Because of the amount of habitat closed to salable minerals, this alternative would be more beneficial than all other action alternatives except for Alternative B.

Locatable Minerals

Impacts to aplomado falcon grassland habitat and aplomado falcon grasslands boundary habitat level I, II and II are discussed in Impacts from Management Common to All Alternatives.

Alternative C would recommend 19% (57,036 acres) of suitable LPC habitat, 1% (5,924 acres) of the LPC isolated population area and 14% (55,315 acres) of the LPC timing restriction area for withdrawal from locatable development. Under Alternative C, 981% (243,529 acres) of suitable LPC habitat, 99% (623,804 acres) of LPC isolated population area, and 86% (351,346 acres) of the LPC timing restriction area would be open to locatable mineral development on BLM lands. Because of the amount of habitat recommended for withdrawal from locatable mineral development, along with Alternative D, this alternative would have more negative impacts on the species and its habitat than all other alternatives except the No Action Alternative.

Under Alternative C, 1% (2,626 acres) of DSL habitat would be recommended for withdrawal and 99% (193,680 acres) would be open to locatable minerals. Because of the amount of habitat withdrawn to locatable minerals, along with Alternative D, this alternative would have more negative impacts on the species and its habitat than all other alternatives except the No Action Alternative.

Impacts from Alternative D

Leasable Minerals

Impacts of leasable minerals on aplomado falcon grassland habitat and aplomado falcon grasslands boundary habitat level I, II and III under Alternative D would be identical to Alternative C because the management actions would be the same.

Under Alternative D, 19% (57,029 acres) of suitable LPC habitat, 1% (5,924 acres) of LPC isolated population area, and 13% (55,309 acres) of the LPC timing restriction area would be subject to closure or NSO stipulations. Alternative D would designate 72% (219,112 acres) of suitable LPC habitat, 50% (309,197 acres) of LPC isolated population area, and 83% (340,302 acres) of the LPC timing restriction areas would be open with moderate constraints. In addition, and 8% (24,451 acres) of suitable LPC habitat, 50% (309,197 acres) of LPC isolated population area, and 3% (11,050 acres) of the LPC timing restriction area would be open to leasable mineral development on BLM lands. Because little habitat would be closed or subject to NSO stipulations for mineral development, this alternative would have more negative impacts on the species than all other alternatives.

Under Alternative D, <1% (191 acres) of DSL habitat would be subject to NSO, 98% (193,681 acres) open with moderate constraints, and 1% (2,435 acres) would be closed to leasable mineral development. Because no or very little habitat would be closed or subject to NSO stipulations for development, this alternative would have more negative impacts on the species than all other alternatives.

Salable Minerals

Impacts of salable minerals on aplomado falcon grassland habitat and aplomado falcon grasslands boundary habitat level I, II and III under Alternative D would be identical to Alternative C because the management actions would be the same.

Under Alternative D, 20% (62,945 acres) of suitable LPC habitat, 1% (9,527 acres) of LPC isolated population area, and 14% (59,034 acres) of the LPC timing restriction area would be subject to closure. Alternative D would designate 70% (213,178 acres) of suitable LPC habitat, 49% (310,068 acres) of LPC isolated population area and 83% (336,577 acres) of the LPC timing restriction area as open with special terms and conditions. In addition, 8% (24,467 acres) of suitable LPC habitat, 50% (310,131 acres) of LPC isolated population areas, and 2% (11,048 acres) of the LPC timing restriction areas would be open to salable mineral development on BLM lands under Alternative D. Because no or very little habitat would be closed or open with special terms and conditions for mineral development, this alternative would have more negative impacts on the species than all other alternatives.

Under Alternative C, 4% (8,479 acres) of DSL habitat would be closed, 96% (187,508 acres) would be open with special terms and conditions, and <1% (318 acres) would be open to salable mineral development. Because a minimal amount of DSL habitat would be closed for salable mineral development, this alternative would have more adverse impacts on the species than all other alternatives.

Locatable Minerals

Impacts to aplomado falcon grassland habitat and aplomado falcon grasslands boundary habitat levels 1 through 3 are discussed in Impacts from Management Common to All Alternatives.

Impacts of locatable minerals on LPC, DSL, and their habitats under Alternative D would be identical to Alternative C because the management actions would be the same.

Impacts of Land Use Authorizations Management Actions on Special Status Wildlife

Impacts from Management Common to All

All action alternatives would designate “exclusion” and “avoidance” areas for ROWs. ROWs would be prohibited in exclusion areas and would be avoided when possible in avoidance areas. Exclusion areas would result in beneficial impacts to most special status animal species because the negative impacts of habitat fragmentation, surface disturbance, weed invasion, and displacement due to human noise and activity would be avoided. Avoidance areas would often result in beneficial impacts, as described for exclusion areas; however, some ROW would be approved in these areas and some special status animal species would be impacted.

Table 4-60 displays the amount of aplomado falcon, LPC, and DSL habitat that would be open, avoided, or excluded from ROW development under each alternative.

Table 4-60. Land Use Authorizations Management Decisions on BLM-administered Lands

Species	Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Aplomado falcon grassland	Open	58,006/57%	951/1%	954/1%	6,364/6%	6,865/7%
	Avoid	0/0%	1,149/1%	22/<1%	51,623/51%	51,122/51%
	Exclude	0/0%	55,903/55%	57,030/56%	0/0%	0/0%
Aplomado falcon grassland boundary – Level 1	Open	57,887/59%	2/<1%	2/<1%	57,060/58%	57,083/58%
	Avoid	0/0%	4,796/5%	0/0%	785/<1%	762/<1%
	Exclude	0/0%	53,089/54%	57,885/59%	0/0%	0/0%
Aplomado falcon grassland boundary – Level 2	Open	93,186/74%	1/<1%	1/<1%	2/<1%	5,612/4%
	Avoid	0/0%	1/<1%	0/0%	93,139/74%	87,529/70%
	Exclude	0/0%	93,183/74%	93,185/74%	0/0%	0/0%
Aplomado falcon grassland boundary – Level 3	Open	11,007/64%	0/0%	0/0%	156/1%	156/1%
	Avoid	0/0%	0/0%	0/0%	10,850/63%	10,850/63%
	Exclude	0/0%	11,007/64%	11,007/64%	0/0%	0/0%
Suitable LPC habitat	Open	201,572/67%	1,319//<1%	1,319/<1%	148,951/50%	148,953/50%
	Avoid	3,582/1%	151,443/50%	18,356/6%	3,802//1%	50,371/17%
	Exclude	0/0%	52,385/17%	185,466/62%	52,385/17%	5,823/2%
LPC isolated population area	Open	517,052/82%	68/<1%	70/<1%	506,772/80%	507,990/81%
	Avoid	4,811/1%	515,037/82%	291,645/46%	9,174/1%	7,965/1%
	Exclude	0/0%	6,774/1%	230,157/37%	5,924/1%	5,924/1%
LPC timing restrictions	Open	275,073/68%	0/0%	9/<1%	205,223/50%	205,224/50%
	Avoid	1,894/<1%	206,638/51%	3,426/1%	1,407/<1%	67,617/17%
	Exclude	0/0%	70,337/17%	273,531/67%	70,337/17%	4,134/1%
DSL habitat	Open	161,944/82%	0/0%	0/0%	125,178/64%	125,179/64%
	Avoid	111/<1%	128,736/66%	51,075/26%	3,551/2%	36,684/19%
	Exclude	0/0%	33,328/17%	110,986/57%	33,328/17%	201/<1%

Table 4-61 displays the amount of acres of habitat that would be avoided, or excluded from ROW development under each alternative

Table 4-61. Lands Use Authorizations by Alternative on BLM-administered Lands (acres)

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,051,927	98,544	757,380	1,610,692	1,749,782
Avoid	30,965	629,149	413,654	313,619	270,360
Exclude	7,056	662,038	918,701	165,378	69,540

Impacts from the No Action Alternative

Under the No Action Alternative 7,056 acres of BLM lands would be excluded from ROW development, which could prevent negative impacts to special status wildlife in the ways described in Impacts from Management Common to All Action Alternatives. ROW development would be avoided on 38,965 acres, which would avoid some of the negative impacts on special status wildlife. However, 2,051,927 acres would be open to ROW development which would lead to adverse impacts on special status species.

Impacts from Alternative A

Among others, Alternative A would designate the following areas for exclusion: habitat for federally listed/proposed threatened and endangered species, designated and proposed critical habitat for federally threatened and endangered species, wetland and riparian areas, lands with wilderness characteristics (described above). Alternative A would designate the following areas for ROW avoidance: BLM sensitive plant and animal species habitat, federal candidate species habitat, and open sand dunes. Federally listed species would benefit from the inclusion of their habitats in exclusion zones, and BLM sensitive animal species would benefit from the inclusion of their habitats in avoidance zones. This alternative would be more beneficial for special status wildlife than the No Action Alternative because of the greater amount of habitat avoided or excluded from ROW development.

Impacts from Alternative B

The nature of impacts from exclusion and avoidance areas would be similar under Alternative B to those described for Alternative A because the management actions would be the same. This alternative would be more beneficial for special status wildlife than the No Action Alternative because of the greater amount of habitat avoided or excluded from ROW development.

Impacts from Alternative C

Additionally, lands with wilderness characteristics would constitute exclusions areas only for pipeline and power line projects, and wetland and riparian areas would constitute exclusion areas only for roads. Under Alternative B, the following would be designated as avoidance areas: habitat for federally listed/proposed threatened and endangered species, designated and proposed critical habitat for federally threatened and endangered species, BLM sensitive plant and animal species habitat, federal candidate species habitat, and open sand dunes. Wetland and riparian areas would be avoidance areas for pipelines and power lines. Lands with wilderness characteristics would be avoidance areas for roads and sites. This alternative would be more beneficial for special status wildlife than the No Action Alternative because of the greater amount of habitat avoided or excluded from ROW development.

Impacts from Alternative D

This management action would have the greatest potential to result in the negative impacts described in Impacts of Special Status Species Management Actions on Special Status Wildlife. Also, all of the habitat types and designations listed under other alternatives as exclusion or avoidance areas would be avoidance areas under this alternative, resulting in fewer beneficial impacts to special status animal species than all other action alternatives. However, this alternative would still be more beneficial for special status wildlife than the No Action Alternative because of the greater amount of habitat avoided or excluded from ROW development.

Impacts of Renewable Energy Management Actions on Special Status Wildlife

Impacts from Management Common to All

Renewable energy management actions consist of high-level actions that would dictate the permitting, constructing, and maintaining wind, solar, and geothermal energy projects. Impacts on special status wildlife from renewable energy projects include short- and long-term displacement due to habitat removal and surface disturbance; habitat fragmentation, especially from linear aspects of projects such as power lines and pipelines; disruption of breeding and other sensitive activities due to human noise and disturbance; and reduction of available foraging habitat and available prey. Each of these impacts could result in decreased health of the individual and/or of the population.

Table 4-62 presents the planning area BLM-administered lands open, avoided, and withdrawn to renewable energy (geothermal, solar, and wind) under each alternative.

Table 4-62. Renewable Energy Management Decisions on BLM-administered Lands

Species	Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Geothermal and Solar						
Aplomado falcon grasslands (geothermal)	Open	44,221/44%	980/1%	980/1%	19,795/20%	19,518/19%
	Close	56,785/56%	100,027/99%	100,017/99%	81,199/80%	81,449/81%
Aplomado falcon grasslands boundary – Level 1 (geothermal)	Open	40,656/41%	10/<1%	10/<1%	97,329/99%	97,345/99%
	Close	57,885/59%	98,531/100%	98,516/99%	1,172/1%	1,130/1%
Aplomado falcon grasslands boundary – Level 2 (geothermal)	Open	35,498/28%	26/0%	26/0%	657/<1%	1,188/<1%
	Close	89,786/72%	125,258/100%	125,242/100%	124,603/99%	124,024/99%
Aplomado falcon grasslands boundary – Level 3 (geothermal)	Open	6,303/36%	0/0%	0/0%	0/0%	0/0%
	Close	11,007/64%	0/100%	0/100%	0/100%	0/100%
Aplomado falcon grasslands (solar)	Variance	1,220/1%	4,646/5%	4,646/5%	4,748/5%	4,847/5%
	Exclude	57,266/57%	53,839/53%	53,839/53%	53,718/53%	53,621/53%
Aplomado falcon grasslands boundary – Level 1 (solar)	Variance	4/<1%	4,871/5%	4,871/5%	8,671/9%	8,671/9%
	Exclude	57,885/59%	53,016/54%	53,016/54%	49,174/50%	49,175/50%
Aplomado falcon grasslands boundary – Level 2 (solar)	Variance	3,402/3%	2,441/2%	2,441/2%	2,524/2%	2,522/2%
	Exclude	89,786/72%	90,745/72%	90,745/72%	90,620/72%	90,622/72%
Aplomado falcon grasslands boundary – Level 3 (solar)	Variance	0/0%	405/2%	405/2%	405/2%	405/2%
	Exclude	11,007/64%	10,602/61%	10,602/61%	10,601/61%	10,601/61%
Suitable LPC habitat (geothermal)	Open	96,450/32%	188,319/63%	22,741/8%	187,687/62%	188,312/63%
	Close	204,142/68%	112,273/37%	277,850/92%	112,904/38%	112,280/37%
LPC isolated population area (geothermal)	Open	160,644/26%	616,470/98%	294,947/47%	614,612/98%	13,266/2%
	Close	469,086/74%	13,261/2%	334,740/53%	15,107/2%	616,462/98%
LPC timing restriction (geothermal)	Open	129,668/32%	270,711/67%	11,045/3%	270,077/66%	135,955/33%
	Close	276,994/68%	135,950/33%	395,576/97%	136,581/34%	270,704/67%
Suitable LPC habitat (solar)	Variance	1,023/<1%	150,719/50%	139,962/47%	150,088/50%	150,088/50%
	Exclude	204,146/68%	54,428/18%	65,180/22%	55,053/18%	55,053/18%
LPC isolated population area (solar)	Variance	53,760/9%	509,381/81%	485,316/77%	507,535/81%	507,534/81%
	Exclude	469,086/74%	13,258/2%	37,318/6%	15,098/2%	15,105/2%
LPC timing restriction (solar)	Variance	0/0%	206,990/51%	197,411/49%	206,359/51%	206,359/51%
	Exclude	276,994/68%	69,986/17%	79,559/20%	70,610/17%	70,614/17%

Species	Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
DSL habitat(geothermal)	Open	34,824/18%	152,991/78%	243/<1%	152,389/78%	152,984/78%
	Close	161,483/82%	43,316/22%	196,062/99%	43,915/22%	43,323/22%
DSL habitat(solar)	Variance	584/<1%	125,787/64%	122,653/62%	125,188/64%	125,188/64%
	Exclude	161,486/82%	36,277/18%	39,409/20%	36,869/19%	36,876/19%
Wind						
Aplomado falcon grasslands	Open	44/<1%	977/<1%	977/<1%	973/<1%	4,658/5%
	Avoid	57,962/57%	22/<1%	22/<1%	57,014/56%	0/0%
	Exclude	0/0%	57,007	57,007	0/0%	53,327/53%
Aplomado falcon grasslands boundary – Level 1	Open	45,406/46%	2/<1%	2/<1%	2/<1%	8,661/9%
	Avoid	12,481/13%	0/0%	0/0%	57,843/59%	49,176/50%
	Exclude	0/0%	57,885/59%	57,885/59%	0/0%	0/0%
Aplomado falcon grasslands boundary – Level 2	Open	28,140/22%	1/<1%	1/<1%	1/<1%	2,520/2%
	Avoid	65,045/52%	0/0%	0/0%	93,140/74%	90,620/72%
	Exclude	0/0%	93,185/74%	93,185/74%	0/0%	0/0%
Aplomado falcon grasslands boundary – Level 3	Open	6,829/39%	0/0%	0/0%	0/0%	405/2%
	Avoid	4,178/24%	0/0%	0/0%	11,007/64%	10,601/61%
	Exclude	0/0%	11,007/64%	11,007/64%	0/0%	0/0%
Suitable LPC habitat	Open	200,804/67%	1,333/<1%	1,319/<1%	1,320/<1%	1,319/<1%
	Avoid	4,361/1%	151,427/50%	20,280/7%	150,810/50%	197,381/55%
	Exclude	0/0%	52,385/17%	183,542/61%	53,009/18%	6,447/2%
LPC isolated population area	Open	499,585/72%	153/<1%	202/<1%	167,424/27%	167,427/27%
	Avoid	23,073/4%	516,350/82%	298,171/47%	349,300/55%	349,305/55%
	Exclude	0/0%	6,774/1%	224,901/36%	6,548/1%	6,548/1%
LPC timing restrictions	Open	267,458/66%	387/<1%	0/0%	2/<1%	0/0%
	Avoid	9,536/2%	205,250/50%	821/<1%	206,606/51%	272,217/67%
	Exclude	0/0%	70,337/17%	276,148/68%	70,961/17%	4,758/1%
DSL habitat	Open	148,895/76%	36/<1%	870/<1%	0/0%	0/0%
	Avoid	13,172/7%	128,699/66%	48,284	128,138/65%	161,271/82%
	Exclude	0/0%	33,328/17%	112,907	33,920/17%	793/<1%

In addition to the impacts described above, wind energy projects can also directly impact bird and bat species by collision with turbine blades (Arnett et al. 2007). Of avian species, songbird and raptor mortality has been most often documented at wind farms, and due to the timing of mortality most are thought to be killed while on their migration route (Arnett et al. 2007). Special status songbird and raptor species could be at risk for turbine collision if a wind farm is built in the planning area. Migrating bats have also been killed by wind turbine due to both collision and barotrauma, and bursting of lung capillaries due to extreme pressure changes (Baerwald et al. 2008). The majority of bat species killed at wind farms are not special status species; although there is still a risk of collision for high-flying special status bat species, such as the big free-tailed bat, long-legged myotis, and western small-footed myotis. In general, the presence of a wind farm raises the potential of mortality for many special status bird and bat species.

The LPC is thought to be especially sensitive to habitat loss, fragmentation, and the presence of vertical structures, as would occur with wind energy and associated power lines and roads (Woodward et al. 2001; Pruett et al. 2009). Habitat fragmentation is especially detrimental to the LPC because the barriers to movement prevent genetic mixing among populations, which can lead to inbreeding and the extirpation of local populations (Pruett et al. 2014). For these reasons, the LPC would be negatively impacted by wind energy development within its habitat.

Impacts from the No Action Alternative

Table 4-62 displays special status wildlife habitat that would be open/variance, avoided, and closed/excluded from renewable resources development under the No Action Alternative. This alternative would open approximately 18% to 44% of aplomado falcon grasslands habitat, including aplomado falcon grasslands boundary level 1 through 3 habitats, LPC habitat, including LPC isolated population area habitat, and LPC timing restriction area, as well as DSL habitat to geothermal and solar development, making it somewhat beneficial for those species by avoiding potential adverse impacts from development. However, most habitat for LPC and dunes sagebrush lizard would remain open to wind development, increasing potential for adverse impacts to these species from wind farms, as described in Impacts from Management Common to All Alternatives.

Under this alternative, restrictions would be placed on where wind energy projects could be permitted, such as along the face of the Guadalupe Mountains, in grassland areas in the northwestern portion of the planning area, within cave/karst occurrences, and in ACECs. Wind energy projects in proposed critical habitat for federally threatened and endangered species would be considered if the applicant can demonstrate to no negative impacts on avian and bat species. Due to these restrictions, impacts that could result from renewable energy development, such as those described in management common to all alternatives, would be avoided in certain parts of the planning area. Special status wildlife occupying those areas would benefit from these restrictions. The aplomado falcon occurs in the grasslands in the northwestern portion of the project area, and as such collision and surface disturbance impacts on that species would be avoided. However, the short- and long-term negative impacts associated with renewable energy development could occur throughout the remainder of the planning area, including in LPC habitat.

Impacts from Alternative A

Alternative A would exclude wind and solar and close lands to geothermal development from the following areas (among others): lands with wilderness characteristics, LPC habitat areas, wetlands and riparian areas, along the face of the Guadalupe Mountains, grassland areas in the northwestern portion of the planning area (aplomado falcon grasslands), designated and proposed critical habitat for federally threatened and endangered species, and habitat for federally listed and proposed threatened and endangered species for which critical habitat has not be designated. Special status animal species occupying these areas would benefit because the impacts associated with renewable energy development (as described in management common to all alternatives) would not occur.

Table 4-62 displays special status wildlife habitat that would be open/variance, avoided, and closed/excluded from renewable resources development under Alternative A. This alternative would close approximately 99% aplomado falcon and 37% LPC habitat from geothermal and 100 % of both habitats from wind energy development. It would also exclude 22% of the DSL habitat from geothermal and solar development and exclude 100% from wind development. When compared to the No Action Alternative, this alternative would be less beneficial to special status wildlife because less land would be closed or excluded to renewable energy development. However, specific project proposals would undergo environmental review and impacts to special status species would be avoided.

Impacts from Alternative B

The management actions under Alternative B are identical to Alternative A except that wind l development would be avoided (not excluded) in habitat for federally listed and proposed threatened and endangered species for which critical habitat has not be designated. Avoidance means that development could occur if no other option is feasible, and so these types of projects could occur within this habitat designation. This alternative would result in more negative impacts, as described in management common to all alternatives, to federally threatened and endangered species and other special status species inhabiting those areas.

Table 4-62 displays special status wildlife habitat that would be managed as open/variance, avoid, closed, or excluded from renewable resources development under Alternative B. This alternative would close or exclude more aplomado falcon, LPC, and DSL habitat from solar and geothermal development than the No Action Alternative, making it more beneficial for these species. It would close more aplomado falcon, LPC, and DSL habitat from wind development than the No Action Alternative, making it more beneficial for these species in that respect by avoiding the potential adverse impacts of wind development.

Impacts from Alternative C

The management actions under Alternative C are identical to Alternative B except that wind development would be avoided (not excluded) in the grassland areas in the northwestern portion of the planning area. By not excluding this area from wind development, the aplomado falcon, Sprague’s pipit, and other grassland special status animal species could be negatively impacted. Site-specific analysis would be conducted for proposed wind projects thereby identifying impacts to special status species.

Table 4-62 displays special status wildlife habitat that would be managed as open/variance, avoid, closed, or exclude from renewable resources development under Alternative C. This alternative would close or exclude less aplomado falcon, LPC, and DSL habitat from solar and geothermal development than the No Action Alternative, making it less beneficial for these species. More aplomado falcon, LPC, and DSL habitat would be managed as an avoidance area for wind development than the No Action Alternative, making it more beneficial for these species in that respect by avoiding the potential adverse impacts of wind development.

Impacts from Alternative D

The management actions under Alternative D are identical to Alternative B except that wind development would be open in the Chaves City and Bootheel areas, which are located in the grasslands in the northwestern portion of the planning area. Approximately 145,700 acres would be managed as an avoidance area for wind development. By not excluding this area from wind development, the aplomado falcon and other grassland special status animal species could be negatively impacted. Site-specific analysis would be conducted for proposed wind projects thereby identifying impacts to special status species.

Table 4-62 displays special status wildlife habitat that would be managed as open/variance, avoid, closed, or exclude from renewable resources development under Alternative D. This alternative would exclude or close less aplomado falcon, LPC, and DSL habitat from solar and geothermal development than the No Action Alternative, making it less beneficial for these species. More aplomado falcon, LPC, and DSL habitat would be managed as an avoidance area for wind development than the No Action Alternative, making it more beneficial for these species in that respect by avoiding the potential adverse impacts of wind development.

Impacts of Livestock Grazing Management Actions on Special Status Wildlife

Impacts from Management Common to All

Under all alternatives, livestock grazing would be continued in various portions of the planning area, with associated negative impacts on grassland special status wildlife. Livestock grazing can directly affect special status wildlife by competing for forage, or indirectly, through habitat degradation by the spread of invasive weeds, promoting the spread of mesquite, reducing local biodiversity or shifting species composition, and lowering local population densities for some species (Belsky et al. 1999; Drewa et al. 2001; Fleischner 1994). Cattle disperse honey mesquite seeds far from their source, contributing to an ongoing trend of mesquite encroachment on grasslands habitat (Drewa et al. 2001). Mesquite trees grow in dense stands, out-competing most other vegetation. Mesquite encroachment reduces the availability of habitat for special status wildlife that occur in grasslands, such as Baird's sparrow (*Ammodramus bairdii*), burrowing owl, mountain plover (*Charadrius montanus*), Sprague's pipit, black-tailed prairie dog, black-footed ferret (*Mustela nigripes*), and swift fox. Other detrimental impacts from grazing could include loss of forage biodiversity, lowering of plant and animal population densities, disruption of some ecosystem functions (such as increased fire, changes in soil composition), changes to community organization, and changes to the physical characteristics of both terrestrial and aquatic habitats (Chaneton and Lavado 1996; Fleischner 1994; Olff and Ritchie 1998).

Impacts from the No Action Alternative

Livestock grazing would continue to be allowed on nearly all of the surface area of all proposed ACECs, with continued adverse impacts on associated special status wildlife. Approximately 2,086,107 acres would remain open for grazing, and 5,226 acres would be closed. The impacts of grazing, as described in management common to all alternatives would continue on the lands open for grazing.

Impacts from Alternative A

Under Alternative A, 493,120 acres of BLM-administered land would be closed to livestock grazing, which is significantly greater than the No Action Alternative. The entire Birds of Prey ACEC (349,335 acres) would be closed to grazing. In areas closed to livestock grazing, special status wildlife inhabiting grassland habitat would benefit as more herbaceous food would become available from the removal of livestock competition. Without cattle in closed areas, the spread of mesquite would be reduced. Where feasible, grasses such as black grama (*Bouteloua eriopoda*) may be allowed to grow sufficiently for fire to occur as a natural disturbance, promoting the persistence of grasslands, with long-term benefits to various special status birds such as Baird's sparrow, Sprague's pipit, ferruginous hawk, and burrowing owl. Most of the closure to livestock grazing would be in the southern portion of the planning area, all increased forage/cover would be allocated to watershed and wildlife use, benefiting herbivorous special status wildlife.

Impacts from Alternative B

Under Alternative B, 153,583 acres of BLM-administered land would be closed to livestock grazing, primarily in the western and southern portions of the planning area, which is significantly greater than the No Action Alternative. In both areas, the absence of livestock grazing would result in long-term benefits for special status grassland species, such as the aplomado falcon and others mentioned above, because less mesquite encroachment and associated changes would take place over time. Furthermore, other negative impacts of grazing described in management common to all alternatives would be avoided. This alternative would close the most special status animal habitat to grazing and would therefore be the most beneficial for the resource.

Impacts from Alternative C

Under Alternative C, the acreage of lands closed to livestock grazing would be 8,115 acres, which is significantly greater than the No Action Alternative. The impacts resulting from livestock grazing as described in management common to all alternatives would continue to be a negatively impact habitat of grassland special status species. All increased vegetation from restoration efforts would be allocated to livestock. However, all increased forage/cover would be allocated to watershed and wildlife resources, partially mitigating for impacts due to forage competition with livestock.

Impacts from Alternative D

Under Alternative D, livestock grazing would be closed on 3,594 acres of BLM-administered lands, resulting in more negative impacts of grazing than any other action alternative, as described in management common to all alternatives. It is still, however, almost twice as much land closed to grazing as the No Action Alternative. This alternative would open more area to grazing than all other alternatives except the No Action Alternative.

Impacts of Travel Management Actions on Special Status Wildlife

Impacts of travel management on special status wildlife would be very similar to the impacts described for special status plants in Impacts of Travel Management Actions on Special Status Plants. This is because impacts are primarily based on acres of OHV use designations. Impacts from OHV on special status wildlife species are mostly associated with unrestricted cross-country use and use with open OHV areas. Potential direct and indirect, and short- and long-term impacts could occur in all habitat types where OHV use is unrestricted (open). Impacts include short-term adverse impacts to air quality from dust production, short- and long-term loss of vegetation cover from damage by vehicles and soil disturbance, mortality by collision, loss and disturbance of nests for ground-nesting avian species, habitat fragmentation, degradation of habitat through introduction of invasive and exotic weed species and associated impacts to habitat quality and quantity of available habitat, and displacement due to human noise and activity. Restricting OHVs to designated or existing routes would avoid the negative impacts of vegetation and habitat loss, but all other impacts would occur. The scale of these impacts would be considerably less, however, because they would only occur adjacent to OHV routes. Closure to OHV use would be beneficial for special status animal species that inhabit the closed areas, and constitutes a beneficial impact on special status wildlife. As noted in the Special Status Species Plants section, the No Action Alternative would designate the greatest closure to OHV use compared to all other action alternative.

Impacts of Special Designations Management Actions on Special Status Wildlife

Impacts of ACEC management on special status wildlife would be very similar to the impacts described for special status plants in Impacts of ACEC Management Actions on Special Status Plants. This is because impacts are primarily based on acres of ACEC designations. ACEC management decisions would generally reduce long-term impacts to the special status wildlife species that occur inside their boundaries. Impacts on special status wildlife vary among alternatives based on the acreage of areas designated as ACECs. ACECs are designated to protect identified relevant and important values, such as cultural resources, scenic qualities, and natural systems. Each ACEC is prescribed various levels of limitations on activities such as oil and gas leasing, ROWs, renewables development, livestock grazing, and travel. See Section 2.27, Special Designations for details on ACECs by alternative. ACEC designation would reduce impacts on special status plant species and habitats by limiting human activity and associated surface disturbances and thereby preserving habitat.

Four proposed ACECs overlap with the known distribution of special status wildlife in the planning area: Birds of Prey Grasslands, Boot Hill District, Laguna Plata, and Salt Playa. Other unknown and/or undefined special status wildlife habitats may occur in other proposed ACECs. For this reason, the total amount proposed under each alternative as well as acres of known special status wildlife habitat are reported for each alternative. Table 4-63 lists the total amount of area and known special status wildlife species habitats proposed for ACEC designation by alternative.

Table 4-63. Total ACEC Designations on BLM-administered Lands (acres)

Species	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
LPC	0	3,623	23,161	0	0
Total ACEC designations	***13,435***	***495,042***	***561,433***	***98,562***	***28,894***

Specific special status wildlife benefitting from the designation of each ACEC are:

- aplomado falcon in the Birds of Prey Grasslands ACEC;
- western snowy plover (*Charadrius alexandrinus nivosus*), DSL, LPC in the Laguna Plata ACEC;
- cave myotis in the Seven Rivers Hill ACEC;
- gray-banded kingsnake (*Lampropeltis alterna*) and banded rock rattlesnake (*Crotalus lepidus*) in the Serpentine Bends ACEC; and
- barking treefrog (*Hyla gratiosa*), western river cooter (*Pseudemys concinna*), plainbelly water snake (*Nerodia erythrogaster*), bald eagle, peregrine falcon, ferruginous hawk, yellow-billed cuckoo, and Bell's vireo in the Carlsbad Chihuahuan Desert Rivers ACEC.

Alternative B would be the most beneficial for special status wildlife because it would restrict surface-disturbing activities in more special status species habitat and more overall acres than all other alternatives.

Decisions to designate RNAs, WSAs, and WSRs would also benefit the special status wildlife that inhabits each particular area. This is because these designations generally reduce long-term impacts to special status wildlife that occur within their boundaries. WSAs are established to provide for the protection of wilderness character and for the use and enjoyment of visitors in a manner that leaves it unimpaired for future use. By definition, no surface disturbance, permanent new development, or ROWs would be allowed in the WSAs; the lands would be closed to oil, has, and mineral leasing.

4.2.6 Wildland Fire and Fuels Management

This section addresses the impacts to wildland fire and fuels management from management actions discussed in Chapter 2. Existing conditions are described in Section 3.2.7. Current management of the CFO fire management program follows guidance in the following documents:

- 2014 CFO FMP (BLM 2014c);
- *Fire and Fuels Management Plan Amendment and Environmental Assessment for Public Land in New Mexico and Texas* (BLM 2004a); and
- *Special Status Species Record of Decision and Approved Resource Management Plan Amendment* (BLM 2008b).

The CFO's fire program objectives are to concentrate fire suppression efforts in areas containing high resource or human values, as well as those with intermingled land ownership patterns, and to use prescribed fire and other fuel treatments to meet the objectives of other programs.

4.2.6.1 Analysis Methods

4.2.6.1.1 Indicators

Due to a lack of quantitative data relating to fire management, no quantitative indicators are assessed below. Instead qualitative assessments are made using the best available information and management plans that guide the management of fire across the planning area.

4.2.6.1.2 Methods and Assumptions

Impacts to wildland fire and fuels management from management actions in the following areas are analyzed in detail below:

- Wildland fire and fuels management
- Livestock grazing
- Travel management and recreation
- Minerals

Impacts from cultural resource actions on wildland fire and fuels management are largely associated with fire suppression tactics and therefore are similar across all alternatives. The FMPs state that fire suppression activities in cultural sensitive areas would be restricted to designated routes to protect the cultural resource values. It is not expected that cultural resource actions would impact fire management or fire risk differently under any alternative; therefore, it is not analyzed in detail here.

4.2.6.2 Direct and Indirect Impacts of Wildland Fire and Fuels Management Actions

The CFO FMP (BLM 2014c) provides fire management direction that is common to all alternatives being considered in this RMP/EIS. Under all alternatives, the CFO would use the above documents, including the 2014 FPM, which has a primary focus of improving the planning area's Fire Regime Condition Class (FRCC) and moving lands towards a more DPC. This plan is reviewed annually by the CFO and updated as necessary. The CFO is divided into four different fire management units based on location and vegetation type: Eastern Sandhill Country, Western Foothills, Pecos River Corridor, and Guadalupe Escarpment. There are currently no defined management goals for any of these areas; however, general objectives exist that are common to all areas. These objectives include controlling fires during the first burning period, suppressing all unplanned ignitions in areas where there is oil and gas infrastructure, managing using the full range of management response for all fires outside oil and gas fields, limiting the area burned of a single grazing allotment to no more than 25% to prevent economic hardship on the livestock operator, and protecting private property and infrastructure, including fences, utilities, oil and gas facilities, and livestock.

The CFO has a prescribed fire program in place that focuses on reduction of hazardous fuels within the wildland-urban interface (WUI), reduction of juniper encroachment and desert succulents, saltcedar control, and restoration of healthy watersheds. This program also aims to use prescribed fire to reduce FRCC 2 and 3 towards FRCC 1 and maintain areas previously treated by the Restore New Mexico program. Under all alternatives, the CFO may decide to use prescribed fire within the different management areas for restoration purposes during years of ample precipitation and sufficient vegetation. Fire planning documents state that prescribed fires may be used to annually treat up to 20,000 acres within the Eastern Sandhill Country and Western Foothills units, 1,500 acres within the Pecos River Corridor unit, and 15,000 acres within the Guadalupe Escarpment unit as stipulated in the 2014 FMP. The CFO may also use other non-fire treatment methods (mechanical removal, chemical and biological treatments, manual removal, seeding) to aid in restoration to the DPC and reduce the possibility of catastrophic wildfire. The ability of the CFO to implement fuel treatments over a maximum number of acres per year would aid with a general transition to a FRCC 1 and desired plant communities. Landscape-level fuel treatments require a long-term commitment to implement, monitor, and maintain the effectiveness of the treatments. Implementation of treatments depend on a number of factors such as climate (droughts), invasive species, catastrophic wildfire, percent slope (Map 2-63), and changes in threatened and endangered species habitat that may reduce the CFO's potential to achieve acreage goals. In light of these factors, improvements to the FRCC and desired plant communities may take several generations for actual accomplishments to be realized.

Effects on air quality, soils, vegetation, and other natural resources from wildland fire management are discussed under those sections.

4.2.6.2.1 Impacts of Livestock Grazing Actions on Wildland Fire and Fuels Management

Livestock grazing actions that would have impacts on wildland fire and fuels management are primarily the number of acres that are open or closed to livestock grazing. Impacts from grazing management include both beneficial and adverse impacts to the management of fire. Beneficial impacts include short-term reduction of the risk of large wildfires through the removal of the continuous fine fuel structure (Nader et al. 2007) (i.e., large expanses of grassland) and increases in water availability due to the presence of stock tanks and ponds. Strategically targeting grazing can be another beneficial impact, as areas can be determined where a reduction of fine fuels are needed, which can help decrease wildland fire size (Launchbaugh et al. 2008). Adverse impacts associated with grazing management on fire management include long-term alteration to the vegetative community, including decreased species composition and increased fuel loading and structure, both of which impact the potential to restore site conditions to a FRCC of 1 (Drewa et al. 2001; Strand et al. 2014).

Table 4-64 outlines acreages open and closed to grazing under each alternative. Increased acres open to grazing may reduce fuel loads available to carry fire. If not properly managed, grazing can continue to exacerbate the departure of the historical fire regime and limit the ability for areas to be restored to the desired vegetative communities. As areas are closed to grazing, the grassland vegetation remains intact, supporting a more natural fire regime and helping to move grasslands or other desired vegetation towards an FRCC of 1.

Table 4-64. Proposed Livestock Grazing Acres Open and Closed under Each Alternative (BLM-administered lands only)

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,086,107	1,598,198	1,937,725	2,083,232	2,087,759
Closed	5,226	493,120	153,583	8,115	3,594
Total	***2,091,333***	***2,091,318***	***2,091,308***	***2,091,347***	***2,091,353***

4.2.6.2.2 Impacts of Travel Management and Recreation Actions on Wildland Fire and Fuels Management

Travel management and recreation actions that would have impacts on wildland fire and fuels management include restrictions on OHV use, camping locations, and campfires. OHV use and recreation both create a risk of human-caused fire to occur with the CFO planning area. Although spark arrestors are required for OHVs, fires can be ignited from sparks from other vehicle exhaust systems and heat from motors when vehicles are idle, as well as from unattended campfires. These risks significantly increase when travel and recreation occurs off designated routes. Most of the planning area will be OHV limited under all alternatives, eliminating most permitted cross-country travel (Table 4-65). Cross-country travel is more likely to bring heat and sparks from exhaust systems in direct contact with vegetation than travel on designated routes, which are typically devoid of vegetation. The No Action Alternative offers the most protection through OHV closures in approximately 3% of the planning area.

Table 4-65. Proposed Travel Management Decisions (acres) by Alternative (BLM-administered lands only)

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
OHV limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737
Total	***2,091,273***	***2,091,326***	***2,091,327***	***2,091,320***	***2,091,321***

Recreation decisions impacting fire management include restrictions on campfires and dispersed camping in SRMAs. Restrictions on where and when camping and campfires may occur can help decrease the risk of human-caused wildfires and increase the potential to restore areas to desired vegetative communities and FRCC 1. This could be achieved through restricting these activities in areas with the greatest risk of catastrophic fire behavior and/or during seasons when fire risk is elevated.

Impacts of Special Designation Decisions on Wildland Fire and Fuels Management

Under all management alternatives special designations, including ACECs, WSRs, and WSAs, would be managed to protect natural resources and hazards, which would generally protect and benefit wildland fire and fuels management by retaining vegetation in its most natural state. In some areas restrictions on the type or timing of vegetation management practices would be in place. Management practices could include mechanical extraction and prescribed burning, which are used to aid in returning the site to a DPC and FRCC. Procedures for management of both prescribed fire and wildfire in specially designated areas are outlined in detail in the 2014 CFO FMP and would not be managed differently under this RMP under an alternative (BLM 2014c). Fire suppression activities would be managed in accordance with travel prescriptions within special designations.

Grazing continues to be permitted in many sensitive areas (known threatened and endangered species habitat), as well as riparian and spring areas where acquisitions are completed. Special designation areas would also limit cross-country OHV travel and limit all vehicles to designated routes, which would have a positive impact because it would limit the number of human-caused ignitions. Camping and campfire restrictions are implemented at the field office level and not by ACEC. The overall impacts of OHV restrictions and camping/campfires are discussed under the Impacts of Travel Management and Recreation Actions on Wildland Fire and Fuels Management section above. Limiting unauthorized fire starts along with proper management would aid in returning these areas towards the DPC and FRCC by reducing the potential for uncharacteristically severe wildfire.

The overall acreage of ACECs proposed under each alternative can be found in Table 4-66 below. Overall, the action alternatives with the largest acreage within the ACECs would provide the greatest benefit to wildland fire and fuels management due to the decreased human and OHV use activities in these areas, which would reduce the chance for human ignitions. The No Action Alternative, which contains the fewest ACECs would have the greatest adverse impact to wildland fire and fuels management as a result of increased potential for human ignition.

Table 4-66. Acreage of Proposed ACECs under Each Alternative

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
13,435	495,042	561,441	98,562	28,894

Impacts of Minerals Actions on Wildland Fire and Fuels Management

Impacts from mineral actions on wildland fire and fuels management are largely associated with potential increased risk of human-caused fires because of mineral development. As mineral actions increase, vehicle traffic and number of workers in the area also increase, which can lead to an increased potential for wildfire ignitions resulting from equipment-related fires and careless human actions like improper disposal of cigarettes. Furthermore, mineral actions that increase road construction may make areas of the planning area more accessible to general visitor traffic, indirectly increasing potential human ignition sources in the area. The potential for a failure of a well or pipeline resulting in an ignition is also a possibility, as more infrastructure is developed within the planning area. The impacts associated with the mineral actions are best compared by showing the relative differences in acreage of lands open for mineral development activity under each alternative.

Table 4-67 below outlines the acreages open to mineral leasing or development under each alternative. The action alternatives that open the greatest number of acres to mineral management are likely to have the greatest adverse impacts on wildland fire and fuels management due to the increased potential for human- or equipment-related ignitions associated with those actions. Roadside fires will increase due to more vehicle traffic (water haulers, pickups) resulting in an increase in blown tires, hot exhaust pipes, etc. There is an increase in tank battery fires that spread to the wildland. There is also likely to be an increase in fires resulting from flares. Power lines arcing during high wind events or being clipped by traffic could also result in a number of fires each year. Conversely, those alternatives that close the greatest number of acres to mineral leasing or development reduce the potential human ignition sources, thereby causing the fewest impacts to wildland fire and fuels management.

Table 4-67. Acreage Open to Mineral Development by Alternative (BLM-administered surface lands only)

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Leasable minerals management decisions – open with standard terms and open with moderate constraints	2,555,280 (92%)	1,942,451 (70%)	1,539.240 (55%)	1,537,155 (91%)	2,629,316 (94%)
Salable minerals management decisions – open with standard terms and open with special terms and conditions	2,637,465 (95%)	2,222,256 (85%)	1,847,388 (84%)	2,536,717 (91%)	2,630,945 (94%)
Locatable minerals management decisions - open	2,751,856 (99%)	2,403,114 (86%)	2,110,098 (76%)	2,651,855 (95%)	2,661,705 (96%)

4.2.7 Cultural Resources

This section addresses the impacts to cultural resources from management actions discussed in Chapter 2. Existing conditions concerning cultural resources are described in Section 3.2.8.

4.2.7.1 Analysis Methods

4.2.7.1.1 Indicators

In the context of cultural resources, integrity refers to the ability of a site or property to convey its significance. In the planning area, most cultural resources are important for their traditional, scientific, and historic values. The great majority of sites are prehistoric and historic archaeological sites. Integrity of such sites is primarily related to the condition of their intact cultural deposits and constructed features. Archaeological data consist of both "objects" (including artifacts, architecture, features, etc.) and the horizontal and vertical relationships between these objects. The ability to interpret and understand the past is based on recovering not only the material culture of the past in the form of artifacts, buildings, and the built environment, but the spatial relationships between different aspects of material culture as well. Actions that result in surface or subsurface disturbance have a high potential to alter the locational relationships of artifacts and features relative to each other and would thus have an adverse effect on those resources. Actions that limit or eliminate surface- or subsurface-disturbing activities would protect the integrity of cultural resources, thus having a beneficial impact to those resources. Similarly, actions that increase human activity in or access to areas where cultural resources exist also increase the risk to such resources from looting, vandalism, or inadvertent damage. Conversely, actions that reduce or eliminate human activity in or access to an area with cultural resources reduce the risk to such resources from these same impacts.

For the purpose of this analysis, the indicator used to assess impacts to cultural resources from management actions is the number of acres of direct surface and subsurface disturbance to areas with high potential or sensitivity for cultural resources. This indicator provides a relative comparison of risk to sites from different management actions and is not used to estimate specific numbers of sites that could be affected.

4.2.7.1.2 Methods and Assumptions

Methods

Impacts to cultural resources are difficult to quantify with precision because the management actions being analyzed would be applied at the landscape scale; they do not identify specific projects or the exact locations where impacts would occur. Analysis of impacts to cultural resources was performed by reviewing reports of cultural resource investigations that have been completed in the project area, primarily the Class I investigation that was performed specifically for this RMP (Railey 2013).

One component of the Class I investigation performed by Railey (2013) included developing sensitivity maps for cultural resources. The purpose of these maps is to aid the CFO in assessing the expected time and labor investments for Section 106 undertakings and making land management decisions. The maps were designed to differentiate areas of high, medium, and low sensitivity for cultural resources throughout the CFO planning area. Four variables were selected to develop the sensitivity maps: 1) geographic areas (as defined by Railey 2013), 2) terrain slope, 3) vegetation zones, and 4) major rivers and streams (for a complete discussion of sensitivity maps, please refer to Railey 2013:195–211). All of these variables have been shown to have a strong correspondence to the presence or absence of cultural resources; that is, past humans selected lands to use or not use based on a number of environmental factors related to such things as availability of natural resources, steepness of terrain, etc. This map created by modeling these variables was overlain in GIS software with areas corresponding to specific proposed management decisions under each alternative to calculate the acreage where said decisions place cultural resource sites at risk for adverse effects. The resulting acreage is then used in the analysis below as a relative comparison between the different alternatives. Actions affecting areas of high cultural resource sensitivity pose more risk to cultural resources than those affecting other areas of lesser sensitivity. As such, the relative acreage of high sensitivity areas affected by the actions of a given resource program become the key factor in comparing the risk of one alternative over another. This is not to say, however, that individual cultural resource sites located in areas of moderate or low sensitivity are less valuable as TCPs, scientific, or historical resources than sites located high sensitivity areas. Rather, because the actions being assessed in this EIS are programmatic in nature, a programmatic level of analysis that considers cultural resources as a whole rather than as individual resources is appropriate. Therefore, the analysis presented below focuses on comparing relative risk by alternative to areas of high cultural resource sensitivity.

This approach to impact analysis provides only a high-level look at relative risks to cultural resources and is not a substitute for intensive pedestrian inventory for cultural resources. That is, this analysis itself is not appropriate for approving specific undertakings in specific locations. Rather, it is to be used for making programmatic level decisions and to form the basis off of which more project-specific assessments are to occur. These more specific assessments occur under the requirements of the NHPA (Public Law [PL] 89-665; 54 United States Code [USC] 300101 *et seq.*, as amended), BLM standards, and the Protocol Agreement between the BLM and the New Mexico SHPO (BLM 2014) and provide a much more thorough consideration of cultural resources that could be affected by actions on BLM-administered lands or actions approved by the BLM that affect resources on other lands.

Beyond the sensitivity mapping, the analysis below includes professional judgment regarding the relative risk to cultural resources posed by specific management actions. Such judgment was applied for management actions where acreage calculations are an inappropriate measure of risk. Examples of such actions include air quality measures, health and safety measures, and administrative measures.

Assumptions

The following assumptions were used during analysis of impacts to cultural resources:

- The sensitivity model used in this analysis adequately represents the density of cultural resources in the planning area and can be compared to proposed management decisions to produce a quantifiable assessment of potential risks to cultural resources at the landscape scale.
- Management actions and land use allocations that restrict surface or subsurface development and disturbance generally prevent, reduce, or eliminate impacts to the integrity of cultural resources.
- Cultural resources are fragile and irreplaceable. In general, impacts to cultural resources from surface disturbance or physical alteration are long-term and irreparable.
- The requirements of the NHPA (PL 89-665; 54 USC 300101 *et seq.*, as amended) and its implementing regulations typically referred to as the Section 106 process, BLM standards, and the Protocol Agreement between the BLM and the New Mexico SHPO (BLM 2014) to identify historic properties, evaluate them for adverse effects, and resolve any adverse effects to historic properties (i.e., those resources determined eligible for the National Register of Historic Places [NRHP]) or those defined as TCPs or sacred sites would be applied at a project-level (site-specific) basis for all lands administered by the CFO. Under these laws, policies, and agreements, pre-development investigations to identify cultural resources in project areas would be conducted and, if necessary, measures developed to avoid historic properties or otherwise minimize or mitigate adverse effects to them.
- The Permian Basin Programmatic Agreement would continue to be implemented for oil and gas and other industrial-related developments within the Permian Basin portion of the planning area until the Permian Basin Programmatic Agreement is terminated by its dated expiration or by other means.

4.2.7.2 Direct and Indirect Impacts

Impacts to the cultural resources in the planning area would primarily result from activities associated with direct surface and subsurface disturbance, such as development projects, recreational use/OHV travel, and fire management. However, direct impacts may also result from specific cultural resource management decisions, such as decisions to conduct archaeological excavations or implement interpretive programs. Indirect effects can occur from non-surface-disturbing activities that create visual and/or auditory effects or increase human activity in, and access to, certain areas. Visual and auditory impacts would apply primarily to sites or locations deemed sacred or traditionally important by Native American tribes and used by these groups in such a manner that visual obstructions and/or noise levels would impinge upon that use. These indirect effects can also affect other types of historic properties such as those determined to be eligible for the NRHP under Criteria A, B, or C, but typically not those eligible under Criterion D only.

As discussed above, the primary concern for impacts to cultural resources relates to disturbance of the artifacts, features, and architecture of sites in ways that reduce their integrity, alter their association with traditional values, and reduce the potential to recover data. Consequently, surface and subsurface disturbances have the greatest potential for direct adverse impacts on historic properties. Direct impacts can reduce or eliminate a site’s scientific data potential, disrupt or prevent religious or traditional uses of sites or areas, reduce or eliminate the ability of Native Americans to gather traditional resources in a given area, alter or destroy important architectural features, or impinge upon the ability of the site to reflect its association with important historical events.

In general, impacts on cultural resources from surface and subsurface disturbance are long-term and permanent; once an archaeological site has been impacted, the effect typically cannot be reversed. However, as stated previously, short-term effects from visual or auditory impacts may occur, and can often be mitigated or accommodated. Long-term visual impacts may occur from such things as landscape alteration or the installation of structures.

Direct impacts to cultural resources tend to be adverse, but through the Section 106 process, these adverse effects are resolved and result in an increased understanding of the past. Stabilization of historic properties such as buildings or archaeological sites is considered to be a beneficial effect because the physical deterioration of a site or structure is reduced or arrested. Through archaeological excavation, the important scientific and cultural information contained in a site is recovered. Archaeological data recovery, while directly disturbing the resources of a given site, also leads to an increased understanding of past lifeways and land uses. In addition to deepening the scientific and cultural understanding of past peoples, this information can be used to help predict where as yet identified sites may be located, which aids land managers in such things as targeting specific areas or landscape features for proactive investigation. Interpretive programs are intended to draw visitors to specific sites, which can, in some circumstances, lead to damage to the site in question, but more frequently results in increasing visitor awareness of and appreciation for cultural resources. This in turn leads—in most cases—to increased public stewardship of cultural resource sites.

Indirect impacts to cultural resources reflect greater variation in outcomes. That is, they are not mostly adverse or mostly beneficial in the way that direct impacts to cultural resources tend to be mostly adverse. For example, an auditory intrusion may indirectly adversely affect the use of a sacred or traditional use site, or a transmission line built next to a historic cabin may adversely alter the cabin's setting and feeling without physically disturbing the cabin. Alternatively, excluding livestock grazing or designating a mineral withdrawal in a given area indirectly benefits cultural resources by reducing sources of potential physical harm to those resources.

Impacts to cultural resources may be negligible or non-existent from management decisions related to some resource programs. In particular, management decisions for air quality, backcountry byways, health and safety, soil, and water resources are expected to have little or no direct or indirect effect on cultural resources within the planning area. Those actions, determined through best professional judgment as having little or no potential for impacts on cultural resources, are not discussed further in this analysis. All other management decisions with the potential to impact cultural resources either beneficially or adversely are discussed in subsequent sections of this chapter.

4.2.7.2.1 Impacts Common to All Alternatives

Certain management decisions affecting cultural resources would apply to all alternatives and would impact such resources equally, regardless of the alternative. Table 4-68 summarizes the anticipated impacts to cultural resources that may be anticipated under all alternatives. In many cases, proposed common management actions apply across several resource programs. To the extent such actions may affect cultural resources, they are discussed only once in Table 4-68, under the first resource program to which such actions apply.

As noted above in the Assumptions section, in all cases where surface and/or subsurface disturbance is associated with a given resource program action, the Section 106 process of the NHPA, BLM policies, and the 2014 Protocol Agreement would be followed.

Table 4-68. Impacts Common to All Alternatives

Resource Program	Impact to Cultural Resources
Cultural Resources	Compliance with all existing statutes, regulations, formal agreements, EOs, and policies applicable to cultural resources, including the NHPA, the Native American Graves Protection and Repatriation Act, and existing treaties and trust agreements, would reduce opportunities for short- and long-term, adverse impacts to cultural resources. Requiring cultural resource assessments, which may include field investigations, prior to development at the project-specific level in compliance with Section 106 of the NHPA provides for long-term effects to historic properties by creating opportunities to avoid, minimize, and mitigate adverse effects to individual resources.
Wildland Fire Management	Protection of cultural resources was incorporated into the CFO FMP (BLM 2012), which would be implemented across all alternatives. The plan limits the use of fire retardants in areas of known petroglyph sites, which are susceptible to damage from the chemicals. Mechanical fuels treatments are limited to minimize potential disturbance of cultural resource sites, and decisions regarding response to wildland fire take into account the protection of cultural resources as a decision factor. All of these actions positively impact cultural resources in the long-term by reducing or eliminating unnecessary disturbance of cultural sites.
Land Tenure	Retaining lands not identified for disposal affords the protection of federal laws, such as the NHPA, to cultural resources present on those lands. BLM-administered lands identified for disposal, which are to be transferred to non-federal entities may contain historic properties, but through the Section 106 process, these properties are considered and measures to avoid, minimize, or mitigate any adverse effects would be implemented prior to transfer.
Land Use Authorizations	ROWs would be granted in a manner that is compliant with the NHPA. Through this process, adverse effects are resolved and special stipulations, if necessary, to the ROW are developed. Authorizations of new land uses in previously undisturbed areas would continue across all alternatives per BLM policy and in compliance with the Section 106 process. With each area of new disturbance comes the risk of inadvertent adverse impacts to historic properties not identified during the Section 106 process (e.g., sites that are buried and cannot be identified during pre-construction inventories for cultural resources).
Leasing – All Oil and Gas, Minerals, and Non-Energy Solid Leasables	Leasing, regardless of resource type, poses risk of both direct and indirect impacts to cultural resources. Direct impacts typically occur through physical disturbance of cultural resources during project development. As noted above, these risks are offset by implementation of the Section 106 process. Indirect impacts to cultural resources from leasing decisions typically occur through such actions as vandalism or looting resulting from increased human presence or erosion of sites created by adjacent surface disturbance.
Recreation	Designation and management of SRMAs and other recreation-emphasis areas focuses on managing user behavior in those areas. These designations are intended to direct and focus recreational activity to these areas. On the one hand, this focused activity increases the risk of both direct and indirect adverse impacts to cultural resources—including intentional vandalism and looting, unintentional damage, increased erosion, trampling of artifacts and features, and other effects, particularly along roads and trails in and around designated camping areas. On the other hand, proactive and careful management of the recreation areas—particularly in those areas focused on cultural resources—to educate users and direct activity away from sites reduces risks to cultural resources from user activities and can help to deter intentional and unintentional acts of vandalism. All recreational developments are also subject to the Section 106 process at the project level.

Resource Program	Impact to Cultural Resources
Renewable Energy	Wind energy development would be restricted or excluded in designated archaeological districts and TCPs. Most of the planning area would be excluded from solar energy development based on the decisions from the Solar Programmatic EIS. These actions provide long-term beneficial impacts to cultural resources by eliminating one source of ground-disturbing activity that has the potential to damage cultural resources.
Minerals Allocations	Placement of major constraints—essentially NSO—for minerals development in portions of the planning area would result in long-term benefits for cultural resources in those areas compared to areas with fewer surface occupancy constraints. Beneficial impacts to cultural resources would include a decreased risk of physical disturbance due to surface activities and fewer visual and auditory intrusions.
Special Designations	Designation and management of ACECs and Cultural Resource Management Areas to protect environmental and cultural resources provides long-term beneficial impacts to cultural resources by placing restrictions on ground-disturbing activities and development with the potential to damage such resources. The magnitude of the effects varies by alternative relative to the number of acres on which restrictions are placed; these differences are discussed in more detail, below. Closing WSAs to mineral leasing and managing them for VRM Class I conditions would have long-term indirect benefits on cultural resources by reducing risks of direct physical disturbance of sites but would also restrict opportunities for scientific research into those sites and limit the benefits such research provides to the public and to resource managers.
Travel Management	Cross-country OHV travel would be limited to wildland fire suppression activities, emergency response situations, and activities related to the administration of a BLM permit, such as a group use permit. Cross-country OHV travel for recreation, hunting, and fishing would no longer be permissible. This would have an overall beneficial impact to cultural resources, insofar as it would limit the number of user-created trails passing over or within proximity to archaeological sites and reduce a source of physical disturbance to those sites. However, travel on existing roads also presents risks to cultural resources. Some existing roads have not been inventoried for the presence of cultural resources that may have been affected by their creation or that may be experiencing ongoing impacts. Such impacts may come from vehicles pulling off the side of the road, visitors damaging accessible sites through vandalism or looting, or erosion created by stormwater runoff from the road. Data are lacking to fully quantify the impacts from travel on existing roads, but land managers agree that such ongoing impacts are likely.
Vegetation	Mechanical and chemical treatments would be used to manage vegetation to desirable conditions in the planning area. Such actions increase risk of long-term adverse effects to cultural sites from physical disturbance and chemical damage to artifacts, rock art, and similar cultural materials. However, all proposed mechanical treatments would be subject to Section 106 review prior to implementation. This process would help offset the risk of physical disturbance posed to cultural resources from such treatments.
VRM	Designation and management of WSAs and certain ACECs as VRM Class I would reduce risks of direct and indirect adverse impacts to cultural resources within those areas because surface-disturbing activities are limited. This would result in potential long-term, beneficial impacts to cultural resources.

4.2.7.2.2 Impacts Common to All Action Alternatives

Certain management decisions under consideration are common only to the action alternatives (Alternatives A–D) and not to the No Action Alternative. These decisions have the potential to affect cultural resources in the CFO in the same way, regardless of which action alternative is considered. Table 4-69 summarizes the potential impacts to cultural resources from these common decisions under the action alternatives. As with impacts common to all alternatives, following the Section 106 process, the Protocol Agreement, and standard BLM policies, adverse effects to historic properties from any program action would be resolved at the project level and prior to project implementation.

Table 4-69. Impacts Common to All Action Alternatives

Resource Program	Impact to Cultural Resources
Cave and Karst Resources	See Special Designations.
Land Tenure	Cultural resources are frequently found in conjunction with natural freshwater sources. Additionally, natural waters are often considered sacred by Native American tribes affiliated with the planning area and may be considered TCPs. Closing all BLM springs and seeps to salables and mineral disposal and withdrawal of the same from locatable minerals would provide for long-term benefits to cultural resources. These actions would reduce sources of surface disturbance that can directly and adversely impact cultural resources. Land exchanges (to acquire lands or interest in lands) would prioritize acquiring lands with, among other resources, cultural resources determined to be unique or of traditional or scientific importance. Land exchanges would also prioritize lands needed to protect environmental resources—including cultural resources—on existing BLM-administered lands. Placement of lands under BLM management subjects them to considerations and protections under federal law (e.g., the NHPA). If acquired lands are not already federally owned prior to acquisition, extending federal cultural resource management laws to them creates long-term indirect benefits for cultural resources.
Livestock Grazing	The placement of livestock infrastructure (e.g., water developments, exclosures, etc.) would be avoided in all archaeological districts, thus reducing, though not eliminating, a source of long-term adverse effects to historic properties from surface disturbance. Similarly, new fences would only be allowed in archaeological districts in previously disturbed areas, where the risk of adverse effects to historic properties is low.
Recreation	Prohibitions on camping within 900 feet of any natural water source (excluding the Pecos River) would have long-term beneficial impacts to cultural resources that may be present at such locations, by reducing potential risks from looting, vandalism, and inadvertent damage. Archaeological sites are often found near natural water sources, and so this kind of camping prohibition would be particularly effective in protecting cultural resources. All action alternatives would prohibit rock climbing routes within petroglyph sites, thereby protecting these sites from rock-climbing impacts such as panel damage and destruction. Black River, Hackberry Lake OHV Area, Conoco Lake, and La Cueva Trails would be designated as SRMAs. Non-motorized use would either be closed or restricted to existing routes in all of these areas Such measures reduce risk to cultural resources for long-term direct adverse impacts from surface disturbance, trampling, vandalism, and looting unless existing routes pass through, directly adjacent to, or lead to cultural resource sites.
Renewable Energy	Restrictions would be placed on renewable energy development within established archaeological districts and in close proximity to TCPs. These measures reduce the risk of long-term adverse impacts to cultural resources from surface disturbance or visual or auditory intrusion by minimizing development and aboveground structures.

Resource Program	Impact to Cultural Resources
Special Designations	Management of the Lonesome Ridge ACEC (including, for example, excluding future ROWs; withdrawing from mining claim location and mineral material disposal; limiting motorized vehicle use, oil and gas exploration, and renewable energy development; and managing for VRM Class I objectives) would provide long-term indirect benefits to cultural resources. This management strategy would limit surface-disturbing activities and the introduction of aboveground structures that could directly disturb or indirectly intrude upon cultural sites. Management of 7,086 acres as WSAs (with limitations on surface disturbance, grazing, travel, and similar actions) provide for similar positive effects to cultural resources.
Travel Management	Limiting roads and trails within archaeological districts to previously disturbed areas, as well as restricting travel to existing and designated routes (throughout the planning area and in portions of WSAs not closed to motorized vehicle use) provides for long-term beneficial effects to cultural resources. Cross-country travel would be reduced, and therefore the direct and indirect effects to cultural resources caused by such travel—including direct disturbance, vandalism, and looting—would also be reduced. However, negative impacts to cultural resources also occur from use of existing roads. Portions of the existing road system were not inventoried for cultural resources prior to the creation of the roads. This means that some roads may have been created through or directly adjacent to cultural resource sites, which has either directly physically impacted those sites or has introduced indirect impacts. These indirect impacts occur from vehicles pulling of the roads, increased visitor access that results in looting and vandalism, and erosion caused by the road. Data about the numbers of sites impacted in these ways are too limited to quantify the extent of these impacts.

4.2.7.2.3 Impacts of Cultural Resource Actions on Cultural Resources

Cultural resource program decisions are the same across all alternatives or across all action alternatives.

4.2.7.2.4 Impacts of Land Use Authorizations on Cultural Resources

Many anticipated effects of authorizations on cultural resources are discussed under other categories because the specific action under another categories is the potential impact agent, not the authorization itself. See also the discussion below on special status species under Impacts Common to All Alternatives and Impacts Common to All Action Alternatives and Special Designations decisions and their anticipated impacts on cultural resources.

Under the No Action Alternative risks to cultural resources from land use authorizations would continue at current levels. By comparison to the action alternatives, the No Action Alternative would pose a higher risk to cultural resources by designating substantially more acres to as open to new utility and transportation ROWs (see Table 4-70). The larger the area designated open to ROWs—where surface disturbance could occur—means the more cultural resources are potentially at risk of direct disturbance under the No Action Alternative than under the action alternatives. This risk, however, is offset by implementation of the aforementioned Section 106 process prior to any authorization of surface disturbance under all alternatives, including the No Action.

Table 4-70. Comparison of Acres Designated Open for New ROWs in High Cultural Sensitivity Areas

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
489,016 (40%)	270,993 (22%)	254,144 (21%)	378,909 (31%)	428,177 (35%)

* Percent of all surface and subsurface lands with high cultural resources sensitivity.

Compared to the action alternatives, the No Action Alternative designates the least amount of land as ROW avoidance and exclusion in high cultural resource sensitivity areas (see Table 4-71); it also designates the most land as open for ROWs. Because development of ROWs has the potential to adversely affect cultural resources through direct surface disturbance, the land use authorizations program action under the No Action Alternative would pose the greatest risk to cultural resources among all alternatives. This risk, however, is offset by implementation of the aforementioned Section 106 process prior to any authorization of surface disturbance under all alternatives, including the No Action.

Table 4-71. Comparison of ROW Avoidance and Exclusion Zones in High Cultural Sensitivity Areas

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
18,070 (1%)*	236,068 (196%)	252,957 (21%)	128,151(14%)	78,887(6%)

* Percent of all surface and subsurface lands with high cultural resource sensitivity.

Among the lands designated for avoidance under the No Action Alternative are the Laguna Plata and Maroon Cliffs Archaeological Districts (13,155 acres combined). Additionally, no surface disturbance would be allowed within the Gnome withdrawal (680 acres) under the No Action Alternative. These actions all provide for long-term positive effects to cultural resources by reducing the risk of adverse effects associated with ROW development and use. Under all action alternatives, substantially more acreage would be allocated to ROW avoidance and exclusions zones than under the No Action Alternative. Under action Alternatives A, B, and C, ROW avoidance and exclusion zones would be designated with specific attention paid to TCPs and archaeological districts. ROW avoidance and exclusion zones under Alternative D would not specifically focus on TCPs and archaeological districts.

4.2.7.2.5 Impacts of Livestock Grazing Actions on Cultural Resources

Impacts to cultural resources from grazing typically include long-term direct adverse impacts from trampling of artifacts and features or long-term indirect adverse impacts from increases to or changes in erosion patterns. Alternatives that close more lands in general to grazing and those that close more lands specifically in areas of high cultural resource sensitivity are considered to pose a lower risk to cultural resources and, therefore, provide greater long-term protection.

Under the No Action Alternatives, the grazing status of lands in the planning area would continue under current conditions, and risks to cultural resources from grazing would remain at current levels. Under the action alternatives, the acres of land allocated as open or closed to grazing would vary. In a comparison of all alternatives relative to the acres open to grazing in areas of high cultural resource sensitivity, the No Action Alternative poses the greatest risk of long-term adverse impacts to cultural resources as it would have the largest acreage open to grazing in such sensitivity areas (see Table 4-72). However, Alternative D, followed closely by Alternative C, would have only slightly fewer acres of high cultural resource sensitivity lands open to grazing than the No Action Alternative. Alternative A would leave between 84,000 and nearly 87,000 fewer acres open to grazing than the No Action Alternative and Alternatives C and D, thereby posing a somewhat lower risk to cultural resources from surface disturbance, trampling, and erosion associated with grazing. Alternative A would be the most beneficial to cultural resources overall in that it would have the fewest acres open to grazing and the most acres closed, but individual cultural resources in open grazing areas would still be vulnerable to grazing-related adverse impacts.

Table 4-72. Acres by Grazing Status for Each Alternative in High Cultural Sensitivity Areas

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	504,508 (41%)*	420,562 (34%)	453,764 (67%)	503,684 (41%)	506,854 (41%)
Closed	4,043 (0.3%)	88,295 (7%)	55,084(4%)	5,174 (0.4%)	2,007 (0.2%)

* Percent of all surface and subsurface lands with high cultural resource sensitivity.

4.2.7.2.6 Impacts of Minerals Actions on Cultural Resources

The effects of minerals program decisions on cultural resources primarily result from the surface disturbance associated with minerals development. The amount of estimated surface disturbance associated with minerals development under any given alternative varies depending by the type of mineral (leasable, salable, or locatable) and on the amount of land open or closed to mineral development. It also depends on the amount of land allocated to open status under the different management prescriptions (i.e., open with standard terms and conditions, open with moderate constraints, and open with major constraints). That is, the Section 106 process notwithstanding, lands "open with major constraints" pose a lower risk to cultural resources than lands "open with standard terms and conditions."

As with other impacts analyses, the consideration of acres open or closed to mineral development, as well as estimated acres of surface disturbance under the RFD scenarios for each alternative, are only proxy measures of risk to cultural resources and not accountings of how many cultural sites might actually be affected. To refine the estimation of risk, the analysis below compares the minerals allocations and estimated acres of surface disturbance by alternative relative to areas of high sensitivity for cultural resources.

Leasable Minerals

Table 4-73 provides a comparison of the allocations for leasable minerals in the planning area relative to areas of known or estimated high sensitivity for cultural resources. Alternatives with fewer acres open to minerals leasing provide greater protection to cultural resources by eliminating a source of surface disturbance that could directly and adversely impact such resources.

Table 4-73. Acres of Minerals Allocations for Fluid Leasable Minerals in High Cultural Sensitivity Areas

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open with standard terms and conditions	441,754 (36%)*	337,336 (27%)	316,843 (26%)	401,053 (33%)	481,895 (39%)
Open with moderate constraints (CSU)	150,232 (12%)	131,565 (11%)	74,781 (6%)	182,477 (15%)	119,863 (10%)
Open with major constraints (NSO)	24,006 (2%)	35,827 (3%)	82,645 (7%)	46,219(4%)	29,606 (2%)
Closed	22,191 (2%)	133,421 (11%)	163,873 (13%)	8,395 (0.7%)	6,790 (0.6%)

* Percent of all surface and subsurface lands in the planning area with high cultural resource sensitivity.

The RFD under each alternative should also be considered when assessing the potential impacts to cultural resources. The specific relevance of the RFD to potential effects to cultural resources is tied to the estimated surface and subsurface disturbance under each scenario. That is, simply because one alternative may have more acres allocated to leasable mineral development does not necessarily mean that alternative also has the highest estimated amount of surface and subsurface disturbance, which is the key factor in identifying risks to cultural resources for long-term adverse impacts. Table 4-74 compares the estimated acres of surface and subsurface disturbance in high cultural resource sensitivity areas by alternative for leasable minerals. Alternatives with fewer acres of estimated surface disturbance pose lesser risk to cultural resources from direct physical disturbance than alternatives with more acres of estimated surface and subsurface disturbance. To estimate the acres of surface and subsurface disturbance from leasable minerals in high cultural sensitivity areas, the total estimated acres of disturbance on all lands managed by the BLM under each alternative was multiplied by the percentage of high cultural sensitivity lands that would be open to varying degrees of surface and subsurface disturbance (i.e., open with standard terms and CSU) as shown in Table 4-71, above.

Table 4-74. Estimated Acres Surface Disturbance for Leasable Minerals in High Cultural Sensitivity Areas

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
5,758	3,580	2,670	5,843	6,067

Salable Minerals

Table 4-75 provides a comparison of the allocations for salable minerals in the CFO relative to areas of known or estimated high sensitivity for cultural resources. Alternatives with fewer acres of open allocations in areas of high cultural resource sensitivity pose less risk to cultural resources from direct physical disturbance than alternatives with more acres of open allocations.

Table 4-75. Acres of Minerals Allocations for Salable Minerals in High Cultural Sensitivity Areas

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	601,848 (49%)*	343,375 (28%)	328,701(27%)	415,651 (34%)	492,405 (40%)
Open with special terms and conditions	0 (0%)	162,237 (13%)	104,977 (9%)	164,819 (13%)	108,216 (9%)
Closed	36,198 (3%)	132,486 (11%)	204,416 (17%)	57,649 (5%)	67,489 (5%)

* Percent of all surface and subsurface lands in the planning area with high cultural resource sensitivity.

Locatable Minerals

Table 4-76 provides a comparison of the allocations for locatable minerals in the planning area relative to areas of known or estimated high sensitivity for cultural resources. Alternatives with fewer acres open to mineral entry in areas of high cultural resource sensitivity pose less risk to cultural resources from direct physical disturbance than alternatives with more acres open to entry. Similarly, alternatives with more acres of high cultural resource sensitivity areas recommended for withdrawal from mineral entry (i.e., closed) provide greater protection to individual cultural resources and the broader cultural record by eliminating a source of surface disturbance that could have direct, long-term, adverse effects to cultural resources.

Table 4-76. Acres of Minerals Allocations for Locatable Minerals in High Cultural Sensitivity Areas

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open to mineral entry	623,537 (51%)*	531,565 (43%)	473,320 (38%)	600,291 (49%)	604,602 (49%)
Recommended (or previously recommended) for withdrawal	14,650 (1%)	106,563 (9%)	164,805 (13%)	37,840 (3%)	33,495 (3%)

* Percent of all surface and subsurface lands in the planning area with high cultural resource sensitivity.

4.2.7.2.7 Impacts of Lands with Wilderness Characteristics Actions on Cultural Resources

Table 4-77 provides a comparison of acres that would be managed as lands with wilderness characteristics and under what type of management for each alternative. In general, management that protects wilderness characteristics maintains those characteristics and provides long-term benefits to cultural resources by substantially limiting surface development and other surface-disturbing activities that can result in long-term adverse impacts to cultural resources. When units are managed to emphasize multiple uses while applying some protective management (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics, there would be some long-term benefits to cultural resources as above but it would depend on the prescriptions for the individual units. See Section 4.2.9 Lands with Wilderness Characteristics for details. As such, the greater the number of acres managed to protect wilderness characteristics, the greater the protection afforded to cultural resources. Where lands with wilderness characteristics units are managed to emphasize other multiple uses as a priority over protecting wilderness characteristics, ground-disturbing activities such as minerals development may be allowed and would therefore offer fewer protections to cultural resources.

Table 4-77. Acres of Lands with Wilderness Characteristics by Alternative

Management Level	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Protects wilderness characteristics	0	66,666	47,611	5,119	1,221
Emphasizes other multiple uses while applying some protective management	0	0	18,964	30,595	0
Emphasizes other multiple uses	0	0	0	30,862	65,446

Table 4-78 provides a comparison of acres of lands with wilderness characteristics by alternative in areas of known or predicted high cultural resource sensitivity. The greater the acreage managed to protect wilderness characteristics, the greater the anticipated protection of cultural resources in those areas, because surface disturbance in areas of high cultural sensitivity would be substantially reduced or eliminated.

Table 4-78. Acres of Lands with Wilderness Characteristics in High Cultural Sensitivity Areas

Management Levels	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Protects wilderness characteristics	0	7,750 (0.6%)*	6,302 (0.5%)	2,197 (0.2%)	720 (<0.1%)
Emphasizes other multiple uses while applying some protective management	0	0	0	1,448	0
Emphasizes other multiple uses	0	0		4,833	6,510

* Percent of all surface and subsurface lands in the planning area with high cultural resource sensitivity.

4.2.7.2.8 Impacts of Recreation Actions on Cultural Resources

As discussed above, recreation decisions include the designation of SRMAs and ERMAs, which are managed areas of existing concentrated recreational use and human activity in the planning area. Human activity increases risks to cultural resources from looting, vandalism, and inadvertent damage. Within the planning area, SRMAs and ERMAs are generally not designated in areas of known high cultural resource sensitivity. This is an intentional action on the part the BLM to protect cultural resources. Designation of SRMAs and ERMAs affords increased protection to cultural resources outside these areas by directing recreational use to the SRMA and ERMA locations. Cultural resources within the SRMAs and ERMAs can both benefit and suffer from the designations. Benefits to cultural resources inside SRMAs and ERMAs can come from both active and passive management of those recreation areas to direct activity away from known sites, educate visitors about site stewardship, or control visitor numbers through permitting. However, concentrating activity in specific areas could also pose an increased risk to the cultural resources in those areas; in such cases, the most likely cause of impacts to cultural resources would be from unintentional damage (such as trampling) or vandalism. All formal recreational developments, such as trails or campgrounds, are subject to the Section 106 process at the development level, thereby ensuring the consideration of cultural resources in planning and locating such developments.

Table 4-79 provides a comparison of the high cultural resource sensitivity acres within the planning area that would be designated as SRMAs or ERMAs under the different alternatives. Based on the discussion above, those alternatives with the greatest acreage designated for recreation management would, in general terms, be considered to pose less risk to cultural resources.

Table 4-79. Acres of SRMA and ERMA Designations by Alternative in High Cultural Sensitivity Areas

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
35,025 (3%)*	24,490 (2%)	32,778 (3%)	32,344 (3%)	28,856 (2%)

* Percent of all surface and subsurface lands in the planning area with high cultural resource sensitivity.

4.2.7.2.9 Impacts of Renewable Energy Actions on Cultural Resources

Renewable energy management actions with the potential to impact cultural resources are those that would allow or exclude development. Potential risks to cultural resources from such development includes direct physical impacts from surface disturbance and indirect impacts from visual intrusions created by aboveground structures, particularly wind turbines, which can be seen over longer distances than typical structures associated with solar and geothermal developments.

Table 4-80 provides a comparison of the alternatives by how many acres of high cultural resource sensitivity areas in the planning area would be allocated to the management decisions of open (wind and geothermal) or variance (solar), avoid, and exclude (wind and solar) or closed (geothermal) for renewable energy. Alternatives with greater acreage allocated to the open/variance management category would allow surface disturbance from renewable energy development over a larger area, thereby representing a higher risk to cultural resource from direct impacts.

Table 4-80. Acres of Renewables Management Decisions in High Cultural Sensitivity Areas

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open (Geothermal and Wind) or Variance (Solar)					
Geothermal	177,171 (28%)	430,935 (68%)	354,923 (56%)	489,165 (77%)	542,695 (85%)
Solar	47,674 (4%)*	341,847 (28%)	323,948 (26%)	345,390 (28%)	389,868 (32%)
Wind	234,968 (19%)*	271,632 (22%)	254,581 (21%)	277,331 (23%)	320,066 (26%)
Avoid					
Wind	273,554 (22%)*	96,594 (8%)	65,482 (5%)	179,308 (15%)	159,302 (13%)
Exclude (Wind and Solar) and Close (Geothermal)					
Geothermal	460,893 (72%)	207,139 (32%)	283,128 (44%)	148,883 (33%)	95,369 (15%)
Solar	461,188 (37%)*	166,955 (14%)	184,861 (15%)	163,401 (13%)	118,938 (10%)
Wind	348 (0.03%)*	139,427 (11%)	187,590 (15%)	50,993 (.4%)	28,254 (2%)

* Percent of all surface and subsurface lands in the planning area with high cultural resource sensitivity.

4.2.7.2.10 Impacts of Special Designations Actions on Cultural Resources

In general, special designations include management actions that limit surface disturbance, and, in some cases, specifically target cultural resources for advanced protection measures. As such, they tend to have long-term benefits for cultural resources. The extent of the benefit (or risk) of any alternative is directly related to the specific management prescriptions that would limit surface disturbance or similar activities with the potential to damage cultural resources.

For the purpose of this analysis, specific prescriptions regarding the largest source of risk to cultural resources from long-term direct effects—minerals development—are used as a comparison of potential effects to cultural resources. That is, the acres available and unavailable for minerals development within special designation areas under each alternative are compared. Those special designations with fewer acres open to minerals development or with more of the open acres but having major constraints on surface occupancy are considered less risky to cultural resources. Table 4-81 provides a comparison between the alternatives relative to the acreage that would available or unavailable to minerals development in areas of special designations.

Table 4-81. Minerals Allocations under ACEC Designation by Alternative on all BLM Lands

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Leasable Minerals					
Open with standard terms and conditions	1,438	71,191	61,907	33,947	–
Open with moderate constraints	–	1,389	4,732	19,932	–
Open with major constraints	4,816	22,870	98,534	16,644	9,766
Closed	7,262	399,592	396,260	28,120	19,127
Salable Minerals					
Open with standard terms and conditions	822	71,286	64,536	33,973	
Avoid	–	226,119	198,518	19,766	2,42426,468
Closed	12,694	197,644	298,343	44,905	
Locatable Minerals					
Open with standard terms and conditions	12,534	398,081	406,383	54,689	2,424
Withdrawn	527	96,781	154,868	43,959	26,470

All alternatives, including the No Action Alternative, would manage 7,086 acres as WSAs or under comparable management prescriptions, many of which focus on limiting surface disturbance and other activities that can adversely impact cultural resources. WSAs are closed to leasing under all alternatives. Of the 7,086 acres managed as WSAs, only 348 acres would be located on lands identified as having high cultural resource sensitivity. This is less than 1% of all high sensitivity lands in the CFO.

Table 4-82 provides a comparison between the alternatives of the acreage available or unavailable to minerals development in areas of special designations on lands in the planning area that are identified as having high cultural resource sensitivity. As discussed above, alternatives that exclude or heavily restrict surface disturbance on more acres of land reduce the risk to cultural resources from direct impacts associated with that surface disturbance.

Table 4-82. Minerals Allocations under ACEC Designation by Alternative in High Cultural Sensitivity Areas

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Leasable Minerals					
Open with standard terms and conditions	1,436 (0.1%)*	20,597 (2%)	20,647 (2%)	8,436 (0.7%)	0 (0%)
Open with moderate constraints	0 (0%)	830 (0.07%)	852 (0.07%)	6,449 (0.5%)	0 (0%)
Open with major constraints	4,249 (0.3%)	10,711 (0.9%)	44,054 (4%)	9,944 (4%)	1,485 (0.1%)
Closed	376 (0.03%)	52,998 (4%)	47,746 (4%)	5,743 (0.5%)	3,831 (0.3%)
Salable Minerals					
Open	0 (0%)	20,598(2%)	21,522 (2%)	8,462 (0.7%)	280 (0.02%)
Open with moderate constraints	0 (0%)	24,840 (2%)	19,549 (2%)	6,345 (0.5%)	0 (0%)
Closed	6,061 (0.5%)	39,700 (3%)	72,229 (6%)	15,764 (1%)	5,035 (0.4%)
Locatable Minerals					
Open	71 (<0.001%)	57,555(5%)	56,902 (5%)	12,992 (1%)	0 (0%)
Recommended withdrawal	5,990 (0.5%)	27,561 (2%)	54,698 (4%)	15,686 (1%)	5,036 (0.4%)
Withdrawn/Closed	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

* Percent of all surface and subsurface lands in the planning area with high cultural resource sensitivity.

In addition to comparing prescriptions that affect the risk to cultural resources, it is important to consider other differences between the alternatives as they relate to cultural resources. The No Action Alternative and Alternative A would not designate the Maroon Cliffs ACEC, an area of known concentration of cultural resources. Alternatives B, C, and D would designate an 8,659-acre ACEC for the expressed purpose of managing the land for the protection of cultural resources. Under the No Action Alternative, prescriptions would continue to be placed to limit surface disturbance in the Maroon Cliffs area from leasable, salable, and locatable minerals, renewable energy, and ROWs. Similar prescriptions would be implemented under Alternative A, though restrictions on leasable minerals would be slightly less strict than under the No Action Alternative. Under Alternatives B, C, and D the area would be managed under prescriptions that withdraw locatable minerals development, close salable minerals development, and exclude renewables and ROWs. All of these prescriptions would also limit surface disturbance, thereby benefitting cultural resources by reducing the risk of adverse impacts. Under all three alternatives, leasable minerals developed would remain open with major constraints, and travel would be OHV limited. However, as noted previously, while excluding cross-country travel provides a direct benefit to cultural resources, travel on existing routes still poses risks to such resources.

4.2.7.2.11 Impacts of Travel Management Actions on Cultural Resources

The effects of travel management decisions on cultural resources are primarily the result of whether travel is limited to designated routes or is closed. Cross-country travel places cultural resources at risk of surface damage from user-created trails passing over archaeological sites, features, and/or artifacts; increased erosion, which displaces artifacts and destroys features; and increased potential of vandalism and casual collecting of artifacts. No cross-country travel (i.e., open travel) would be allowed under any alternative. As opposed to cross-country travel, travel limited to designated routes provides greater protections for cultural resources by reducing opportunities for inadvertent damage from vehicles unless the existing or designated route passes through or directly adjacent to a cultural resource site or leads directly to a site. Sites farther from designated or existing routes become more difficult to access when cross-country travel is eliminated. However, sites adjacent to existing roads may still experience impacts from erosion, looting, vandalism, or vehicles parking on the side of the road. However, even if travel is restricted to either designated or existing routes, new routes can still be built under all alternatives, and the associated surface disturbance has the potential to directly impact cultural resources. Closing areas to all travel understandably affords the greatest protection to cultural resources.

Table 4-83 compares the acres by alternative for the different travel management categories across all lands in the planning area.

Table 4-83. Acres of Travel Management Categories by Alternative

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
OHV limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737

As can be seen from Table 4-83, Alternative A, with the most acres closed to travel among the action alternatives, would provide the greatest protection to cultural resources and pose the least risk of long-term adverse impacts. The No Action Alternative would provide the most acres closed to travel and would, therefore, offer the greatest protection to cultural resources.

Table 4-84 compares the acres by alternative for the different travel management categories in areas of the planning area identified as having high cultural resource sensitivity. Alternatives with more acres closed to travel reduce the risk of both direct and indirect adverse impacts to cultural resources from physical disturbance, looting, vandalism, etc.

Table 4-84. Acres of Travel Management Regime by Alternative in High Cultural Sensitivity Areas

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
OHV limited	496,772 (40%)	499,560 (41)	502,633 (41%)	503,067 (41%)	503,067 (41%)
Closed	12,051 (1%)	9,288 (0.8%)	6,215 (0.5%)	5,780 (0.5%)	5,780 (0.5%)

* Percent of all surface and subsurface lands in the planning area with high cultural resource sensitivity.

As can be seen from Table 4-84, all alternatives would limit travel to designated routes across the vast majority of lands deemed to have high cultural resource sensitivity. Alternative A, with the fewest acres open to travel in high cultural resource sensitivity areas, would provide the greatest protection to cultural resources and pose the least risk of long-term adverse impacts among the action alternatives. The No Action Alternative would have the most acres closed to travel in high sensitivity areas and would have a roughly comparable number of acres limited to designated routes as the action alternatives.

4.2.7.2.12 Impacts of Visual Resource Actions on Cultural Resources

Impacts to cultural resources from VRM decisions are effectively related to the degree to which VRM classifications prohibit or limit other actions that cause surface disturbance or similar activities with the potential for long-term adverse impacts to cultural resources. On a related, but somewhat less frequent basis, the degree to which VRM classification management prohibits or limits aboveground structures that could cause adverse visual intrusions on cultural resources, particularly TCPs and sacred use sites, is also a measure of potential impacts to cultural resources.

Management for VRM Class I conditions is generally the most restrictive relative to developments and actions that could impact cultural resources in that actions that alter the landscape in notable ways are restricted. VRM Class II conditions allow for greater landscape alteration but still provide restrictions on activities with the potential to adversely impact cultural resources. Other VRM classes allow for greater levels of landscape alteration and are, therefore, less beneficial to cultural resources. However, it is inappropriate to assume that management for lesser VRM conditions automatically places cultural resources at risk of adverse impacts; management for those conditions does not directly mandate or dictate the frequency or extent of those activities that could impact cultural resources. That is, alternatives that would manage an area at a lower VRM classification only allow landscape altering activities to occur. The actual number or size of any such alterations would be a function of land use applications submitted to the BLM for those lower VRM areas. As such, this analysis only compares the relative degree to which cultural resources would benefit from VRM Class I and II management (see Table 4-85).

Table 4-85. Acres by VRM Management Class for Each Alternative

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Total	***50,671***	***273,710***	***357,802***	***67,962***	***48,263***

Table 4-86 compares the acres by alternative for VRM Class I and II management categories in areas of high cultural resource sensitivity. As can be seen from Table 4-86, Alternative B would provide the greatest long-term protection to cultural resources by managing the most land in high cultural sensitivity areas for visual resources in a way that prohibits or limits surface-disturbing activities that could otherwise adversely impact such resources. The No Action Alternative would manage the least amount of land in high cultural resource sensitivity areas under these VRM management conditions, thereby providing the least indirect benefit to cultural resources.

Table 4-86. Acres by VRM Management Class for Each Alternative in High Cultural Sensitivity Areas

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	348 (0.03%)*	2,545 (0.2%)	4,988 (0.4%)	348 (0.03%)	348 (0.03%)
Class II	20,920 (2%)	56,545 (5%)	79,140 (6%)	26,826 (2%)	19,187 (2%)
Total	***21,268 (2%)***	***59,090 (5%)***	***84,128 (7%)***	***27,174(2%)***	***19,535 (2%)***

* Percent of all surface and subsurface lands in the planning area with high cultural resource sensitivity.

4.2.8 Paleontological Resources

This section discusses impacts to paleontological resources from management decisions proposed in Chapter 2. Existing conditions concerning paleontological resources are described in Section 3.2.9. Actions proposed under each of the alternatives for other resources and resources uses that have the potential to impact paleontological resources are analyzed below. Analysis of potential projects is based on professional judgment regarding approximate project locations, general locality conditions, and design features commonly applied to such projects. The analysis contained below does not definitively determine the outcomes resulting from implementation of any site-specific projects.

4.2.8.1 Analysis Methods

4.2.8.1.1 Indicators

The term paleontological resource refers not only to the condition of individual fossils but also to the relationship between fossils and their stratigraphic context (i.e., their association with the geologic layer in which they became fossilized). Fossil integrity is important for the accurate taxonomic classification of individual specimens, including identification of the genus or species represented. Contextual integrity is critical for proper age assessments of fossil localities. Physical disturbance that results in destruction of fossils or removal from their stratigraphic context diminishes or destroys the scientific, educational, and recreational value of paleontological resources. The specific quantity of paleontological resources impacted or protected would be a useful indicator for the analysis contained in this section, yet data at the appropriate scale are not readily available for all known localities within the region and not obtainable for unknown paleontological resources (i.e., those yet to be discovered, including those in the subsurface).

The Potential Fossil Yield Classification (PFYC) system, as described in Section 3.2.9 is a useful tool for analyzing potential impacts to paleontological resources at the land use planning level. The BLM has classified all 23 mapped geologic units within the planning area according to the PFYC (see Table S.18 in Appendix S). Although this geologic map is at a larger scale (1:500,000) than most spatial data, it is currently the best available source of mapped bedrock geology for the planning area and is suitable for landscape-scale analyses. The acreage, summarized for PFYC Classes 2, 3, and 4, is provided Table 4-87.

Table 4-87. Acres of BLM-administered Surface Underlain by PFYC Classes 2–4 Based on Mapped Geologic Units

PFYC	Class 2	Class 3	Class 4
Acres	2,146,228	631,245	6,751

Acres of land that could be impacted by individual resource management decisions and associated uses were used as an indicator to assess each alternative’s potential impact to paleontological resources. Where applicable, specifically for leasable minerals and ACECs, the spatial footprints of use allocations and management actions that may impact fossil resources were digitally intersected with the PFYC spatial dataset. For those resource uses (leasable minerals and ACECs), acres of impact by PFYC Class were used as impact indicators because these decisions have the greatest potential to impact paleontological resources.

4.2.8.1.2 Methods and Assumption

Paleontological resources are considered to be a surface resource, and impacts to these non-renewable resources from surface and subsurface disturbance are permanent. Adverse effects on paleontological resources occur if an action or development causes direct or indirect damage to or destroys important paleontological resources that could yield information important to prehistory or that embody the distinctive characteristics of a type of organism, environment, period of time, or geographic region. If unmitigated, adverse impacts would result from disturbances of paleontologically sensitive geologic units and from actions that increase access to areas containing scientifically important fossils, thus increasing the potential for unauthorized collection and vandalism.

Important paleontological resources are almost always contained in the bedrock rather than in well-developed soil horizons or more recent alluvial material. Adverse effects on paleontological resources from surface-disturbing activities occur primarily at the time of initial surface disturbance. Therefore, the analysis method uses estimated acreage (or mileage) of surface disturbance to quantify impacts to paleontological resources, except for leasable minerals and proposed ACECs. For those resource uses, spatial allocations are compared with mapped PFYC data to quantify impacts to Classes 2, 3, and 4 areas in the planning area. Currently, there are no PFYC Class 5 geologic units in the planning area.

Proactive paleontological resources management can offset or reduce the risk of impacts to the resources through appropriate mitigation (e.g., pre-project assessments, surveys, construction monitoring, and fossil collection), as well as increase public benefit. In addition, inventories required before surface disturbance in paleontologically sensitive areas would result in the identification and evaluation of previously undiscovered paleontological resources. The BLM would then manage these resources using scientific expertise and principles, which would include avoidance and/or collection prior to surface-disturbing activities.

Regardless of the management actions, important paleontological resources would continue to be found in the planning area, either in areas of natural erosion and exposure or through mitigation of surface-disturbing activities.

4.2.8.2 Direct and Indirect Impacts

Impacts analyzed here include direct and indirect impacts of the proposed management actions. Impacts to paleontological resources result from natural weathering and erosion and from surface disturbance caused by people or animals. Where applicable, the short- or long-term nature of these impacts is described. Short-term effects would occur at the time of disturbance and up to 5 years following disturbance, before full revegetation and soil stabilization. Long-term effects could occur beyond 5 years as a result of erosion that might be associated with altered drainage patterns or reclamation efforts that are not effective in soil and landscape stabilization. This erosion could lead to accelerated exposure and subsequent damage to or loss of fossils and their geographic and stratigraphic contexts.

In general, for project areas that are underlain by paleontologically sensitive geologic units, the greater the amount of ground disturbance (depth and lateral extent), the higher the potential for adverse impacts to paleontological resources. For project areas that are directly underlain by geologic units with low paleontological sensitivity, there is little potential for impacts on paleontological resources unless highly sensitive geologic units are underlying the low sensitive unit are also impacted.

Alternatives that include actions that would affect the bedrock could directly affect paleontological resources by physically altering, damaging, or destroying paleontological resources or their contextual settings. Alternatives that would increase or make access easier also could have an increased risk of indirect effects, including vandalism, theft of materials, and inadvertent physical damage to paleontological resources or their settings. Finally, disposing of lands containing paleontological resources would remove those resources from public ownership, which would mean the loss of any federal legal protections for those resources and the loss of opportunities for public collecting or education. Conversely, actions that result in data collection and preservation of paleontological resources through research or applied mitigation efforts impact paleontological resources in a positive way, as associated data would be available into perpetuity for further research and education. Acquiring lands with paleontological resources also would be beneficial to the public by providing important protections for paleontological resources and increasing opportunities for education and casual collecting. Surface disturbance would be expected to result in short- and long-term adverse effects on paleontological resources.

Impacts result from activities planned or authorized by the BLM and occur at the same time and place as a surface-disturbing action. Direct adverse impacts on paleontological resources primarily concern the potential physical damage, destruction, or other loss of non-renewable paleontological resources and the contextual information associated with these resources. Ground disturbance has the potential to adversely impact an unknown quantity of fossils that may occur on or underneath the surface in areas containing paleontologically sensitive geologic units. Without mitigation, these fossils, as well as the paleontological data they could provide, could be destroyed, rendering them permanently unavailable for future scientific research or public education, including display. It is likely that some paleontological resources would be destroyed during surface-disturbing activities because they would not be seen or recovered. This would primarily be a function of the large size of machinery being used, the larger volume of material being disturbed or removed, and the relatively small size of many fossils. Beneficial impacts to paleontological resources occur when disturbance results in the discovery of paleontological resources that would not have otherwise been discovered and mitigation salvage measures are implemented. These newly discovered paleontological resources then become available for scientific analysis and permanent preservation in a public repository; positive impacts may include advances in scientific knowledge, contributions to public education and interpretation, and community involvement and partnerships. Increased public access via roads and trails to a previously inaccessible area increases the risk of unauthorized paleontological resource collecting or vandalism.

Proactive paleontological resources management can offset or reduce the risk of impacts to the resources through appropriate mitigation (e.g., pre-project assessments, surveys, construction monitoring, and fossil collection), as well as increase public benefit. Pre-authorization investigations, including pedestrian surveys, can only use surface observations of proposed disturbance areas; therefore, all potential impacts to subsurface resources are not known prior to disturbance. While subsurface impacts are similar, some actions (e.g., major transmission lines, buried gas pipelines, and road construction) require substantial subsurface excavations that may further impact buried paleontological resources due to the depth of disturbance.

Management actions related to air quality, health and safety, and noxious weeds would not impact (i.e., remove paleontological resources from their stratigraphic context) or increase the risk of impact (i.e., disturb paleontologically sensitive geologic units or increase access to these units); therefore, these resources are not further analyzed. While many of the actions designed to maintain and manage cave and karst resources, vegetation and riparian resources, cultural resources, soils, special status species, water resources, and wildlife and fish would not impact paleontological resources, the management of ground disturbance would indirectly reduce impact or impact risk to paleontological resources by preserving fossils in their stratigraphic context and limiting access to paleontologically sensitive areas. Although resource management decisions vary between alternatives (see each respective resource section), these resources or resource uses are not further analyzed as the decreased risk of impact (e.g., acres closed to disturbance) is not substantially different between alternatives. In addition, management actions (e.g., no surface disturbance, no access) that reduce or limit access or activities associated with paleontological research are not considered to be an impact to paleontological resources, instead it is considered to be an impact to the research or researcher and is not analyzed in the following sections.

Impacts or risk of impact from the proposed management actions of land tenure, land use authorizations, livestock grazing, mineral allocations (leasable, salable, locatable), lands with wilderness characteristics, recreation, renewable energy, special designations (ACECs, WSRs, WSAs, backcountry byways), travel management, and VRM on paleontological resources under each alternative are summarized in the following sections. While in most cases the types of projected impacts to paleontological resources under the alternatives are similar, the intensity of these effects would vary by alternative based the amount (e.g., area, length, volume) of paleontologically sensitive geologic units that could be impacted. Some impacts are expressed qualitatively because the analyses of these management actions do not reflect specific actions that are quantifiable at this time. Quantitative analyses are included where possible based on estimates of reasonably foreseeable actions described below. In most cases, subsequent site-specific analyses would be required to implement resource management decisions. These analyses would address potential site-specific impacts on a variety of resources, including (if appropriate) paleontological resources. More detailed or locality-specific studies and appropriate environmental documents would be prepared in compliance with NEPA and its implementing regulations, as well as BLM policy, as required.

4.2.8.2.1 Impacts of Livestock Grazing Actions on Paleontological Resources

Actions related to livestock grazing under all alternatives could have long-term direct and indirect adverse impacts on paleontological resources. If grazing occurs in areas containing occurrences of surface fossils, livestock could adversely affect paleontological resources. This is because damage or destruction of surface fossils is known to occur directly as a result of trampling by livestock where animals range across exposures of fossiliferous geologic units. In addition, the potential for adverse indirect impacts may increase in areas where animals congregate (e.g., fences, water sources, salt blocks, bedding areas, and along animal trails). Indirect adverse impacts to paleontological resources may result if grazing locations are modified (e.g., due to land closures), as changes in movement patterns may result in the development of new or modified travel routes across previously undisturbed land. Managing livestock grazing to improve or maintain desired range conditions would maintain vegetative cover and soil stability, and thereby prevent the indirect exposure and deterioration of paleontological resources.

While the types of adverse impacts to paleontological resources from livestock grazing management actions (e.g., grazing and associated improvements) are the same, the magnitude varies between alternatives as the total acres of BLM-administered land open to grazing varies (see Table 4-88).

Table 4-88. Acres Open to Proposed Livestock Grazing Actions by Alternative

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open (acres)	2,086,107	1,598,198	1,937,725	2,083,232	2,087,759
% Open	***99.7%***	***76.4%***	***92.7%***	***99.6%***	***99.8.0%***

In addition to impacts from livestock, range improvements requiring surface disturbance (e.g., new fences, stock ponds) could directly damage or displace paleontological resources if they are located in areas underlain by potentially fossiliferous geologic units, as with any type of surface disturbance (e.g., construction).

Generally, through mitigation, those areas where improvements are planned and have the potential to contain or are known to contain paleontological resources could be protected from damage by placing rangeland fences and other proposed improvements away from fossil localities or exposures of paleontologically sensitive geologic units. Inventory and mitigation procedures in these areas would protect most paleontological resources from substantial damage. In addition, the documentation and collection of surface fossils and associated data, and the transfer of all collected fossils to a public museum for curation and permanent storage would be beneficial to paleontological resources.

4.2.8.2.2 Impacts of Recreation Actions on Paleontological Resources

The primary framework for recreation management in the planning area is under SRMAs and ERMAs. RAMPs would be prepared for all designated SRMAs to address levels and types of management actions necessary to achieve the recreation objectives. Areas outside the SRMAs and ERMAs, while not specifically emphasized, are available for recreation as long as the activities are not in conflict with the primary uses of these lands.

The management goals and objectives for recreation would have both adverse and beneficial long-term effects (or risk of impact) on paleontological resources. Promoting and managing recreation throughout the planning area could increase incidental or purposeful disturbance of paleontological resources. Unauthorized disturbance would result in displacement or loss of the paleontological resource involved. Displacement of paleontological resources adversely affects the potential to understand the context of the locality and limits the ability to extrapolate data. Facilitating use of recreation would result in increased surface-disturbing and disruptive recreational activity and the loss of vegetative cover, which would increase the potential to expose and destroy paleontological resources.

Direct impacts on paleontological resources resulting from recreation decisions would be related to the level of surface disturbance associated with recreational development, such as the construction of recreational facilities including roads, and with the degree of increased human activity in paleontologically sensitive areas/geologic units. Potential long- and short-term indirect impacts would also result from increased levels of unauthorized collecting and associated vandalism that could accompany increased human activity. Management actions for recreation also have the potential to benefit paleontological resources. By implementing public education and environmental awareness programs, such as the BLM's “Tread Lightly and Leave No Trace Program,” newly added recreational activities in the CFO planning area would theoretically reduce illegal fossil collection, vandalism, or accidental destruction.

In addition, regulated recreational use of areas tends to provide better protection to paleontological resources than does unregulated use. Although collecting common invertebrate and plant fossils for personal, non-commercial use is an accepted, low-impact use of public lands, which could foster a greater overall appreciation for paleontological resources and their scientific significance, developed recreation sites (SRMAs and ERMAs) are closed to recreational fossil collection (see 43 CFR 8365.1-5(b)). This closure would reduce potential adverse impacts on paleontological resources that could occur as a result of extensive repeated use at these localized locations.

Under the No Action Alternative, a Cave Resources SRMA covering 8,626 acres is designated, which provides some protection to the paleontological resources known to occur in these areas. However, under all action alternatives this area would be designated as part of the Cave Resources ACEC (19,625 acres), which would add additional protection through management prescriptions and decreased encouraged recreation use, thereby limiting the amount of indirect and direct impacts from increased access.

While the Hackberry lake SRMA designation would occur under all alternatives, under the No Action Alternative it would be slightly larger, incorporating a known paleontological site, which may be left open to additional surface disturbance as compared to the action alternatives.

There are differences in total SRMA and ERMA acreage totals between alternatives (Table 4-89); however, since the overall surface acreage is being used as the indicator of impact to paleontological resources in this section, differences by individual SRMA or ERMA are not critical to this discussion. The greatest overlap between known paleontological resource locations and recreation is at the Pecos River ERMA and Hackberry Lake SRMA, specifically along the Pecos River trails and within the Dunes RMZ. While the outline of the Hackberry Lake SRMA varies between the No Action Alternative and all of the action alternatives, the Pecos River trails and Dunes RMZ have management common to all alternatives to ensure protection of paleontological resources.

Table 4-89. Proposed Acres within Recreation Management Areas on BLM lands Summarized by Alternative

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
ERMAs*	-	2,975	26,564	17,302	9,456
SRMAs	69,469	49,991	49,988	49,669	49,673
Total ERMAs and SRMAs	69,469	52,966	76,552	63,971	59,129
Approx. % CFO acres within ERMAs or SRMAs	3.3%	2.5%	3.6%	3.1%	2.8%

*Under the No Action Alternative all areas that would not be designated as SRMAs are considered ERMAs, which includes most of the planning area.

Management of individual resources/resource use within the SRMAs and ERMAs vary by alternative; this is specifically evident in the management of leasable minerals (Table 4-90). Details about others are not specifically provided here because they are covered in detail within their respective sections (see Minerals – Locatable, Minerals – Salable, VRM, Renewable Energy, Grazing, and Travel).

Table 4-90. Acres and Percent of ERMAs and SRMAs Open to Leasable Minerals by Alternative

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Leasable: open with standard terms and conditions	1,477/2%	1,533/3.0%	4,596/8.7%	1,544/2.3%	1,533/2.6%
Leasable: open with moderate constraints (CSU)	48,450/71%	39,851/75%	45,791/60%	49,769/74%	45,529/77%
Leasable: open with major constraints (NSO)	6,006/9.0%%	9,483/18.0%	19,389/25.3%	14,219/21.2%	11,863/16.20%
Leasable: closed	13,534/20%	2,099/4.0%	6,776/9.0%	1,439/2.1%	204/0.34%

4.2.8.2.3 Impacts of Travel Management Actions on Paleontological Resources

All BLM-administered lands would have travel management designations of open, limited to designated routes, OHV limited, or closed. Open areas, characterized by unrestricted motorized travel, would show impacts to the integrity of paleontological resources as cross-country motorized vehicle use, in particular, is known to impact soils through compaction, vegetation removal, and accelerated erosion. When exposed geologic units contain paleontological resources, vehicle use can damage or destroy the paleontological resources through direct impact and cause their displacement, damage, and accelerated weathering due to exposure.

The impacts to areas where travel is limited to designated and existing routes depend on the existing conditions, as most unimproved two-track roads and vehicle routes in the planning area have not been examined for the presence of paleontological resources. Therefore, the use of these unimproved routes could disturb or displace paleontological resources within the roadways. Travel on or use of improved routes would not directly impact paleontological resources because these routes have previously been stabilized (e.g., capped) and paleontological resources are likely not exposed.

Closed areas, assuming compliance and enforcement, would have a very low potential for motorized vehicle effects. In addition, if locations within closed areas are required for necessary tasks, because these are typically casual one-time use by OHVs, there would be very little increase in erosion, which typically is the result of repeated travel. If a vehicle drives directly on paleontological resources they could be damaged or destroyed, but this would be an extremely rare occurrence.

Generally, creation, substantial improvement or maintenance work, and reclamation of travel infrastructure such as roads, trails, and trailheads would be associated with construction-related surface disturbance that could adversely affect paleontological resources by directly exposing or moving paleontological resources from their stratigraphic context or by damaging the paleontological resource itself. In addition, the designation of new routes for motorized and non-motorized travel would facilitate access to areas that were previously prohibited, remote, or inaccessible. This would also increase the potential for adverse direct impacts on surface fossils in paleontologically sensitive geologic units. The overall increase in public access to BLM-administered lands associated with travel decisions would increase the potential for adverse effects, such as unauthorized fossil collecting (poaching), vandalism, and inadvertent physical damage, on previously remote paleontological resources.

Because the acres by designation type vary by alternative the magnitude of impact or impact risk varies as well Table 4-91.

Table 4-91. Proposed Acres per Travel Management Decisions by Alternative

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Limited to designated	-	–	–	–	–
OHV limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737

As with other management actions, potential adverse impacts could be offset through mitigation identified at the project implementation level. Regardless of the specific methods, mitigation in and of itself would be a beneficial impact because it would result in the authorized and scientific collection of paleontological resources that may otherwise never have been discovered and their preservation in a public museum where they would be available for scientific research and education.

4.2.8.2.4 Impacts of Land Use Authorizations Actions on Paleontological Resources

Land use authorizations, specifically major (intrastate pipeline or transmission) and minor (roads, power lines, and pipelines for oil and gas fields) ROWs, are subject to project-specific NEPA compliance, including an assessment of potential impacts to paleontological resources, prior to authorization. Direct impacts to paleontological resources would primarily occur as a result of surface and subsurface disturbance during active construction, as well as from erosion until disturbed areas are reclaimed and stabilized. Pre-authorization investigations, including pedestrian surveys, can only use surface observations of proposed disturbance areas; therefore, all potential impacts to subsurface resources are not known prior to disturbance. The types of subsurface impacts are similar for all ROWs, although major transmission lines, interstate pipelines, and road construction in particular require substantial subsurface excavations that may further impact buried paleontological resources due to the depth of disturbance. In addition, surficial pipelines would have a lower impact or risk of impact to paleontological resources because the volume of disturbed sediment or bedrock would be lower than for a buried line. The collocation of ROWs would decrease the risk of impact to paleontological resources because the overall amount and locations of disturbance access to previously remote or inaccessible areas would be less. The risk of adverse indirect impacts on paleontological resources would occur from the ongoing operations and presence of access infrastructure on BLM-administered lands by increasing access to lands that were previously inaccessible or remote, thus increasing the likelihood of unauthorized fossil collecting and vandalism.

The types of impacts from land use authorization actions, as outlined above, are similar among all alternatives. Management decisions that vary between alternatives include denoting areas where development has the potential to occur and exclusion areas where development would not be authorized, as well as specifics on buffers, surficial pipelines conditions, and corridors; however, a summary of acres open and closed is not available at this time. While a quantitative analysis is not possible, generally the risk of direct adverse impacts increases with the total amount (i.e., combination of surficial acreage and the subsurficial volume) of paleontologically sensitive geologic units disturbed (PFYC Class 3 and 4), and the risk of indirect adverse impacts would increase with additional access to previously remote (or inaccessible) areas. Impacts and impact risk would be offset by assessment and mitigation, if deemed necessary at the project implementation level. Beneficial impacts vary ultimately with the number of paleontological resources documented, collected, and made available to the public for future research, education, and display that may not be recovered without disturbance.

4.2.8.2.5 Impacts of Visual Resource Actions on Paleontological Resources

Where VRM Class I and II areas (Table 4-92) contain paleontological sensitive geologic units, VRM decisions that control and limit surface disturbance would directly affect the risk of impacts to paleontological resources. In locations where surface-disturbing activities are reduced, controlled, or eliminated, VRM decisions would directly reduce the risk of removing paleontological resources from stratigraphic context and direct physical damage to or destruction of these resources. Indirect beneficial impacts would include a reduction in the risk of vandalism and looting that result from improved access.

Table 4-92. Amount of VRM Class I and II by Alternative on BLM-administered Lands Only

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
% Class I and II	2%	10%	13%	2%	2%
Total	***2,783,858***	***2,783,514***	***2,783,481***	***2,783,558***	***2,783,585***

4.2.8.2.6 Impacts of Minerals Actions on Paleontological Resources

Management actions related to mineral development would provide for a variety of mineral exploration and development activities for leasable (e.g., fluids – oil and gas; solids – potash and sodium), locatable (e.g., gypsum, copper, gold, uranium), and salable minerals (e.g., building stone, sand, gravel). Total acres per mineral category are provided in Table 4-93. In addition, due to the high frequency of leasable exploration and development, the leasable mineral category is analyzed quantitatively using the PFYC and a summary of the acres open and closed to leasable mineral actions by PFYC designation and alternative is provided in Table 4-94.

Mineral exploration (e.g., geophysical surveys) and development (e.g., grading, excavations, trenching) activities typically involve large amounts of surface and subsurface disturbance; therefore, the risk of impacts to paleontological resources increases with the acres open to surface disturbance, as well as by the estimated depth of the action. This is because surface-disturbing activities associated with mineral exploration could damage or destroy surface and subsurface paleontological resources, as well as remove them from their stratigraphic context. In addition, after initial exploration and development, the ongoing operations of facilities and presence of associated infrastructure (e.g., access roads) would have adverse impacts on paleontological resources by increasing access to lands that were previously inaccessible through new road development, thus increasing the likelihood of unauthorized fossil collecting and vandalism. These impacts are most likely to occur in paleontologically sensitive units, which are designated as PFYC Class 3, 4, and 5. Therefore, the sensitivities of geologic units and surface acreage eligible for minerals exploration and development are of critical consideration when analyzing potential impacts to paleontological resources. Because the acres by designation type vary by alternative, the magnitude of impact or impact risk varies as well (see Table 4-93 and Table 4-94).

Table 4-93. Acres and Percent of Total Acres Open to Salable and Locatable Mineral Development

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Salable					
Open	2,637,465	1,160,064	1,121,118	1,784,431	2,028,324
Avoid (open with special terms and conditions)	–	1,062,192	726,270	752,286	602,621
% Open	95%	42%	40%	64%	73%
% Open with special terms and conditions)	0%	38%	26%	27%	22%
Locatable					
Open to mineral entry	2,751,856	2,403,114	2,110,098	2,651,855	2,661,705
% Open	99%	86%	76%	95%	96%

Table 4-94. Acres Open to Leasable Mineral Development

Management Decision	PFYC	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Closed	Class 2	117,201	353,980	39,446	39,446	35,637
	Class 3	57,190	407,417	415,198	49,056	49,050
	Class 4	0	0	527	0	0
Open	Class 2	1,123,089	924,706	871,375	1,259,322	1,453,137
	Class 3	470,987	213,380	213,389	486,609	539,048
	Class 4	603	472	588	603	603
Open with major constraints (NSO)	Class 2	51,949	79,782	161,421	157,248	69,399
	Class 3	2,126	139	0	550	139
	Class 4	603	472	588	603	603
Open with moderate constraints (CSU)	Class 2	853,990	787,708	446,121	690,057	587,944
	Class 3	100,942	10,334	2,675	94,970	42,991
	Class 4	1,403	1,606	963	1,349	700

4.2.8.2.7 Impacts of Special Designation Actions on Paleontological Resources

Management of special designations would have beneficial impacts on paleontological resources by reducing the risk of surface disturbance. For the purpose of this analysis, special designations fall into four categories: ACECs, WSRs, WSAs, and backcountry byways, and where applicable individual areas are discussed.

To the extent that special designations in paleontologically sensitive areas result in restricted public access and use, and prohibit surface-disturbing actions, paleontological resources would be less likely to be unlawfully collected or vandalized, or damaged or destroyed by vehicular traffic or construction. Therefore, in this general sense, special designations represent a beneficial impact on paleontological resources because they lessen the probability of removing them from stratigraphic context. If public access to special designation areas such as ACECs, WSRs, and backcountry byways is encouraged and surface-disturbing actions are permitted, adverse direct and indirect impacts to paleontological resources could occur.

Special designations vary by alternative, and therefore acres or miles managed for reduced surface disturbance and increased access varies (Table 4-95).

Table 4-95. Acres or Miles Managed as Special Designations under Each Alternative

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
ACEC (acres)	13,435	495,042	561,433	98,562	28,894
WSR (miles)	0	11.89	3.67	3.67	3.67
WSA (acres)	7,086	7,086	7,086	7,086	7,086
Backcountry byways (miles)	55	64.5	64.5	55	55

ACECs

Of the 16 proposed ACECs, three—Boothill, Gypsum Soils, and Chihuahuan Desert Rivers (which overlies Gypsum Soils)—include paleontological resources as a relevant and important value. Even though the Cave Resources area does not include paleontological resources as a relevant and important value, they are known to occur within these locations. In addition, six ACECs (Birds of Prey, Laguna Plata, Lonesome Ridge, Maroon Cliffs, Salt Playa, and Six Shooter Canyon) are underlain by moderate to highly sensitive (PFYC Class 3 and 4) geologic units.

The special management actions specifically associated with the Cave Resources ACEC would protect paleontological resources from development and deterioration and ensure their availability for scientific research and education. A management decision to designate Cave Resources as an ACEC would help preserve the integrity of the fossil deposits, while a decision not to designate would remove protection, potentially exposing the fossils to damage and loss.

As described in the impacts of mineral actions on paleontological resources section lands that are open to mineral development and therefore surface disturbance are more likely to incur impacts to paleontological resources. Table 4-96 shows the number of acres and the associated percentage of lands within ACECs that are open to mineral development.

Table 4-96. Acres and Percent of Acres by Mineral Management Decisions within the ACECs by Alternative

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Leasable					
Open	1,438/10.6%	71,191/14.3%	61,907/11.0%	33,947/34.4%	–
Open with moderate constraints (CSU)	–	1,389 0.28%	4,732/0.84%	19,932/29%	–
Open with major constraints (NSO)	4,735/35.2%	22,870/4.6%	98,534/17.5%	16,562/16.8%	9,766/33.8%
Closed	7,262/53.7%	399,592/80.7%	396,260/70.5%	28,120/28.5%	19,127/66.2%
Salable					
Open	822	71,286/14.4%	64,536/11.4%	33,973/34.4%	–
Avoid (open with moderate constraints)	–	226,119/45.6%	198,518/35.3%	19,766/20%	2,424/8.4%
Closed	12,613 (93.9%)	197,644/40%	298,343/53.1%	44,824/45.5%	26,468/91.6%
Locatable					
Open	1	398,081/80.4%	406,383/82.1%	54,689/55.4%/	2,424/8.4%
Withdrawn	13,434	96,781/19.5%	154,915/27.6%	43,878/44.5%	26,470/91.6%

WSRs

No WSRs are recommended suitable under the No Action Alternative, two are recommended under Alternative A, and one is recommended under Alternatives B, C, and D.

Recommended suitable only under Alternative A, the Delaware River area is the only WSR that includes paleontological resources as an outstandingly remarkable value. The special management actions of resource use (e.g., mineral allocations, travel, VRM, ROW) within the Delaware River WSR would reduce the potential for surface disturbance. In areas underlain by paleontologically sensitive geologic units, reductions in surface disturbance would decrease the risk of impacts to paleontological resources because they would be less likely to be removed from their stratigraphic context. Under all other alternatives, the Delaware River would not be recommended suitable as a WSR, thereby not limiting surface disturbance in the immediate area or adding further protection for in situ paleontological resources.

The Black River area would be recommended suitable under all action alternatives. Management decisions for the Black River area would reduce surface disturbance and help preserve paleontological resources, while a decision not to designate would remove protection, potentially exposing the fossils to damage and loss.

An increased risk of negative impacts to paleontological resources could occur within designated areas due to increased access and use. However, this would be offset by paleontological resource management actions.

WSAs

Under the No Action Alternative, all four WSAs (McKittrick, Mudgetts, Lonesome Ridge, and Devil's Den) would be managed according to BLM Manual 6330-Management of Wilderness Study Areas until they are either designated or officially removed from interim management. As such they would be closed to most surface-disturbing activities and paleontological resources would not be impacted.

Management to preserve wilderness values would reduce the potential for surface disturbance, and in areas underlain by paleontologically sensitive geologic units, reductions in surface disturbance would decrease the risk of impacts to paleontological resources because they would less likely to be removed from their stratigraphic context.

Under the No Action Alternative, if the WSA status is removed, the lands would still be managed as open with major constraints or closed to mineral development, excluded from renewable energy development and be categorized as ROWs avoidance areas as per management prescribed in the Carlsbad RMP (1988) and the Carlsbad RMP Amendment; while under all action alternatives except for Alternative D they would receive the same protections as under the No Action Alternative. Under Alternative D they would still be managed as open with major constraints to oil and gas development and excluded from renewable energy development but would be open with moderate constraints for salables and open to locatable development. These actions would increase the potential for surface disturbance as compared to the No Action Alternative and Alternatives A-C and increase the risk of impacts to paleontological resources.

Backcountry Byways

The Guadalupe Backcountry Byway would be managed under all alternatives per the 1995 Guadalupe Backcountry Byway Plan (BLM 1995); under the action alternatives, additional actions would be taken to promote education, safety, and impact prevention, including visual resources. Under Alternatives A and B, the Dark Canyon Road Loop would be proposed; while not proposed under the other alternatives, this area would have similar management decisions.

For both backcountry byways, management to preserve the visual and educational values would reduce the potential for surface disturbance, and in areas underlain by paleontologically sensitive geologic units, reductions in surface disturbance would decrease the risk of impacts to paleontological resources because they would less likely to be removed from their stratigraphic context.

An increased risk of negative impacts to paleontological resources could occur within designated areas due to increased access and use, which could occur with the continued development and promotion of the Guadalupe Backcountry Byway under All Alternatives and for the proposed Dark Canyon Road Backcountry Byway specifically under Alternatives A and B. However, this would be offset by paleontological resource management, public education, and appropriate signage.

Impacts of Renewable Energy Actions on Paleontological Resources

Commercial renewable energy (e.g., wind and solar) development and associated access could have direct and indirect adverse impacts on paleontological resources. Surface- and subsurface-disturbing activities (e.g., clearing, grading, and excavations) associated with exploration and development of renewable energy projects could directly damage or destroy surface and subsurface fossils. The ongoing operations of commercial renewable energy facilities would increase the risk of indirect adverse impacts on paleontological resources by increasing access to lands that were previously inaccessible, and thus increasing the likelihood of unauthorized fossil collecting and vandalism. The effects of both wind energy and solar development are covered in detail in their respective Programmatic EISs (BLM 2005; BLM and U.S. Department of Energy 2010) and include details about direct and indirect impacts resulting from initial site characterization, facility construction, operations, and decommissioning.

Although paleontological resources vary in occurrence and density by site, impacts on these resources can be offset through project specific assessment and mitigation identified during the project implementation phase, because these actions would ensure that potential impacts are identified and addressed.

The types of impacts from renewable energy management actions, as described above, are similar between alternatives. However, the risk of direct adverse impacts increases with the total amount (e.g., combination of surficial acreage and the subsurficial volume) of disturbance and the risk of indirect adverse impacts increase with access to previously inaccessible areas. Surficial acreage by alternative and management type is provided in Table 4-97. Indirect beneficial impacts to paleontological resources vary ultimately with the number of new paleontological resources documented, collected, and available to the public for future research, education, and display.

Table 4-97. Proposed Acreage for Combined Renewables (including geothermal, solar, and wind) Management Actions by Alternative on BLM-administered Lands Only

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Geothermal: open	964,322	1,788,890	1,411,281	2,175,070	2,319,907
Solar: variance	271,316	1,323,157	1,257,870	1,356,451	1,460,801
Wind: open	1,134,948	800,762	760,560	1,002,986	1,092,311
Wind: avoid	949,539	624,734	418,812	883,051	926,749
Geothermal: close	1,819,929	995,285	1,372,791	608,850	464,187
Solar: exclude	1,820,409	768,020	833,305	734,636	630,302
Wind: exclude	7,056	666,783	912,860	206,184	73,143

Impacts of Land Tenure Actions on Paleontological Resources

Fossil resources belong to the surface land owner because they are considered part of the surface estate (BLM Manual 8720). When lands containing fossil deposits leave federal ownership, through sale or exchange, any protections afforded them by federal laws and regulations are dissolved. Disposal of BLM-administered surface through sales, exchanges, or any other title transfer with known or previously undocumented paleontological resources to private ownership would have long-term indirect and cumulative adverse impacts to paleontological resources because of the lack of protective measures for privately owned land, as well as by removing scientifically significant fossils from the public domain, thus rendering them permanently unavailable for scientific research and education.

Conversely, acquiring lands in the planning area would have a beneficial effect on paleontological resources because of the protective measures offered under federal ownership. Lands could be acquired through direct purchase, legislative mandates, donations, condemnations, or exchanges. Resource values could be included in the identification of desired parcels, so important paleontological resources could be targeted for acquisition. If resources were present and paleontological resources were thus brought under BLM management, these actions would have potential direct, long-term beneficial effects on paleontological resources. In addition, land acquisitions by the BLM could affect paleontological resources by increasing public access to areas that contain paleontologically sensitive geologic units and areas that contain fossil localities. Public access to these areas could result in an adverse impact by increasing the risk of unauthorized collection or vandalism of paleontological resources. However, a simultaneous beneficial effect would be the opportunity for the BLM to establish stewardship of paleontological resources on these newly acquired lands. This stewardship could include access to these lands by permitted paleontological researchers and the resulting associated educational benefits, including interpretive opportunities and the permanent storage of scientifically significant fossils collected in public museums.

According to general guidance for land tenure transactions acquiring land with known paleontological importance is a priority for acquisition in all of the action alternatives, but not under the No Action Alternative. Criteria for consideration when contemplating disposal of public land are identified in the action alternatives. While the types of impacts from land tenure actions are the same among all alternatives, the magnitude of the negative impacts vary inversely, as a result of the total surficial acreages available for disposal (Table 4-98). The No Action Alternative has the highest potential for adverse impacts based on acreage allotted for disposal. Beneficial impacts vary directly by the acres available for acquisition, as long as paleontological resource on the acquired lands are managed and protected in proportion to the risk of increased access to these areas. At present, there are no acquisitions pending specifically for paleontological values. Based on current information, all action alternatives have nearly equal negative and positive impacts.

Table 4-98. Proposed Acreage for Disposal under Land Tenure Management Actions by Alternative

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
218,318	18,703	26,125	31,536	51,579

As noted above for all of the action alternatives, paleontological resources are included as one of the potential benefits of land acquisition. Although paleontological resources are not specifically listed as a characteristic of lands to be retained under any alternative, any proposal would be analyzed through the NEPA process and include a review of paleontological resources. If it is determined after a standard paleontological resource evaluation that paleontological resources are present, the parcels could be on a case-by-case bases removed from the disposal or considered for other protective actions.

Impacts of Lands with Wilderness Characteristics Actions on Paleontological Resources

Prescriptions for lands with wilderness characteristics that manage to protect wilderness characteristics would generally have long-term beneficial impacts on paleontological resources that occur within their boundaries because these lands would be managed to protect their wilderness values by reducing the potential for surface disturbance, which would also preserve paleontological resources. Decisions under this management would include being closed or NSO to mineral leasing, closed to salables, and recommended for withdrawal for mineral entry.

When units are managed to emphasize multiple uses while applying some protective management (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics, there would be some long-term benefits to paleontological resources, but it would depend on the prescriptions for the individual units. See Section 4.2.9 Lands with Wilderness Characteristics for details. Where lands with wilderness characteristics units are managed to emphasize other multiple uses as a priority over protecting wilderness characteristics, ground-disturbing activities such as minerals development may still be allowed and would offer less protection to paleontological resources.

Impacts to paleontological resources vary among alternatives based on the acreage managed for wilderness characteristics as summarized in Table 4-99.

Table 4-99. Acres of Lands Managed for Wilderness Characteristics by Alternative

Management Level	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Protects wilderness characteristics	0	66,666	47,611	5,119	1,221
Emphasizes other multiple uses while applying some protective management	0	0	18,964	30,595	0
Emphasizes other multiple uses	0	0	0	30,862	65,446

4.2.9 Lands with Wilderness Characteristics

This section analyzes impacts to lands with wilderness characteristics from management actions of other resources and resource uses discussed in Chapter 2. Existing conditions concerning lands with wilderness characteristics are described in Section 3.2.10.

4.2.9.1 Analysis Methods

4.2.9.1.1 Indicators

For the purposes of this broad-scale analysis, the primary indicator of impacts to lands with wilderness characteristics is the number of acres of land where development or management actions would eliminate one or more values (roadless, naturalness, outstanding opportunities for solitude/primitive recreation) so that the area or a portion of the area no longer has wilderness characteristics. Ways in which development or management actions could adversely affect lands with wilderness characteristics include the following:

- Size
  - Are there potential roads or other human-made features that reduce the size of lands with wilderness characteristics parcel to fewer than 5,000 acres? Exceptions include if the parcel is adjacent to an existing land with wilderness characteristics, WSA, or wilderness unit or if the area is an island.
- Naturalness quality
  - Would human features be introduced into the environment?
  - Would disturbance of the natural ecosystem and key features of the area occur?
- Outstanding opportunities for solitude or primitive and unconfined recreation
  - Would any development or management actions reduce outstanding opportunities for solitude through introduction of human features, increased human activity, or noise?
  - Would any development or management actions reduce outstanding opportunities for primitive and unconfined recreation?

4.2.9.1.2 Methods and Assumptions

In the RMP and alternatives where some lands with wilderness characteristics would not be protected or where surface disturbance would occur, the wilderness characteristics of these areas may be at some risk of irreparable damage during the life of the plan, depending upon the specific resource use or other actions proposed by the RMP or alternative.

Adverse effects on the size, naturalness, and opportunities for solitude or primitive and unconfined recreation for identified lands with wilderness characteristics under all action alternatives primarily occur as a result of activities that cause surface disturbance. To assess effects on the wilderness character for each parcel, the analysis assumes that for any areas containing wilderness characteristics that are open to activities that cause surface disturbance, that surface disturbance would occur in that area sometime during the life of the plan. The analysis also assumes that the more surface disturbance that occurs within lands with wilderness characteristics parcel, the more the wilderness characteristics within a given lands with wilderness characteristics parcel are adversely affected under a particular alternative.

For mineral and renewable energy development, the more acres for which mineral and renewable energy development is open within lands with wilderness characteristics parcels, the fewer acres within those lands that retain wilderness character. In areas where mineral or renewable energy development would be allowed, the likelihood of surface disturbance affecting wilderness characteristics would be greater in areas where mineral or renewable leasing is open than in areas where leasing is open with moderate or major constraints. Areas that are closed to mineral or renewable leasing or withdrawn from leasing would have little or no adverse effect on the wilderness characteristics within lands with wilderness characteristics parcels.

Surface disturbance through mineral development, renewable energy development, utility corridors, and OHV use can affect the size of lands with wilderness characteristics parcel in multiple ways. One way is through the development of roads through an area. BLM criteria for lands with wilderness characteristics specifically exclude certain types of maintained roads to be included as part of an area considered for wilderness character. Mineral and renewable energy development in an area would require maintained roads to transport equipment, people, and structures to facilitate development. In addition, mineral development, renewable energy development, and OHV use would introduce human-made features into the environment, such as oil derricks, wind turbines, pipelines, and motorized vehicles.

Surface disturbance through mineral development, renewable energy development, utility corridors, and OHV use can affect the naturalness characteristic in several ways. One way in which surface disturbance can affect naturalness is through increased soil erosion, which can increase sedimentation in streams. Increased sedimentation in streams would modify riparian habitat for fish and wildlife and degrade karst resources. Surface disturbance can also modify vegetation types, which changes habitat for fish and wildlife, including sensitive, threatened, or endangered species. Vegetation modification can also reduce scenic quality. Finally, surface disturbance caused by introduction of oil and gas, renewable energy, or transmission line infrastructure would modify naturalness by introducing human objects into the natural environment. In some areas, grazing would require human structures such as watering tanks to facilitate grazing. The introduction of human structures to facilitate grazing on lands with wilderness characteristics would reduce the naturalness characteristic in those areas.

Surface disturbance through mineral development, renewable energy development, utility corridors, and OHV use would also affect opportunities for solitude or primitive and unconfined recreation. Opportunities for solitude can be affected by visual intrusion of human-made features or human-caused noise in the area. Noise from compressor stations, heavy equipment, or OHVs, as well as visual intrusions from solar panels, wind turbines, storage tanks, and transmission lines, would reduce opportunities for solitude on lands with wilderness characteristics.

In addition, the noise and presence of human structures and vehicles caused by mineral development, renewable energy development, utility corridors, and OHV use would conflict with primitive forms of recreation. The presence of human-caused noise and human structures reduces the size of areas in which hikers, hunters, and other primitive recreation users could recreate free from the hindrances caused by human development. The introduction of motorized vehicles to lands with wilderness characteristics would also increase the amount of non-primitive recreation occurring in the area.

With all action alternatives, lands with wilderness characteristics units would benefit from the special management attention they would receive as lands with wilderness characteristics, including exclusion from energy development and cross-country OHV use. Decisions that would generally have a positive impact on lands with wilderness characteristics include those involving soil, watershed, and vegetation (including riparian and upland vegetation) management using non-motorized methods. Protecting sensitive soils and watersheds and conducting vegetation treatments through non-motorized means would restore areas to resemble more natural ecosystems in the long term, which is important to protecting the naturalness of an area.

4.2.9.2 Direct and Indirect Impacts

4.2.9.2.1 Impacts of Actions on Lands with Wilderness Characteristics

Unit 801 (Adjacent to Lonesome Ridge WSA)

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 801 (82 acres[1]) would be open with major constraints to leasable minerals on 81 acres and closed on 1 acre. Salable minerals would be closed in the entire area, and locatable minerals would be open on 41 acres and recommended for withdrawn on the remainder. Geothermal and solar energy development would be excluded from the area, and most of the area (81 acres) would be an avoidance area for wind energy development, with the remainder excluded. The No Action Alternative would maintain 41 acres as an avoidance area and 41 acres as open for ROWs. In all, 81 acres would be designated as OHV limited, and grazing would be open on the entire area. Half of the area (41 acres) would be managed as VRM Class I, and the remainder would be managed as VRM Class II. Because much of the area would be open for locatable mineral development, wind energy development and OHV travel, there would be increased potential for road development, surface

[1] GIS acreage calculations may vary from inventory by an acre or two due to GIS technology. The GIS generated numbers are used for consistency.

disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed.

Alternatives A through D

Under Alternatives through D, Unit 801 would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 801 (82 acres) would be closed to leasable and salable minerals, and locatable minerals would be recommended for withdrawal for the entire area. Geothermal, solar, and wind energy development would be excluded from the area. Under these alternatives, Unit 801 would be managed as excluded for ROWs. OHV travel would be closed on the entire area, and grazing would be open on the entire area. The area would be managed as VRM Class I except under Alternative B where 41 acres would be managed as VRM I and 41 acres would be managed as VRM II. Because much of the area would be closed for mineral development, renewable energy development and ROW development, and limited to existing trails for OHV travel, fire suppression, and geophysical exploration, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A through D would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Unit 803A (Lechuguilla South)

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 803A (1,139 acres) would be closed to leasable and salable minerals on the entire area, and locatable minerals would be recommended for withdrawal for the area. Geothermal and solar energy development would be excluded from the area, and the area would be an avoidance area for wind energy development. The area would be maintained as an avoidance area for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. The lands with wilderness characteristics parcel would be managed as VRM Class II. Because much of the area would be closed for mineral development, geothermal, and solar renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. There would be some increased potential for surface disturbance and visual intrusions from wind energy development, but as an avoidance area, the potential for development is low. Because the effects from development would be reduced under the No Action Alternative, the area would maintain the wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternatives A through D

Under Alternatives A through D, Unit 803A (1,139 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 803A would be closed to leasable and salable minerals, and locatable minerals would be recommended for withdrawal for the entire area. Under these alternatives, Unit 803A would be managed as an exclusion area for solar development on 1,130 acres, and the entire area would be managed as an exclusion area for wind energy development. Under these alternatives, Unit 803A would be managed as excluded for ROWs. The entire area would be OHV limited, and grazing would be open on1,130 acres. Under Alternative B, the area would be managed as VRM Class I, and for Alternatives A, C, and D, the area would be managed as VRM Class II. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A through D would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Unit 810 (Texas Hill North)

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 810 (18,381 acres) would be open with standard terms and conditions to leasable minerals development on 5,303 acres. The remainder would be open with moderate constraints (11,355) or major constraints (1,724 acres) to leasable minerals development. Salable minerals development would be open with standard terms and conditions on 16,657 acres. The remainder (1,724 acres) would be closed to salable mineral development. Locatable minerals development would be open for the entire area. Solar energy development would be excluded from 14,509 acres (79%), and the remainder would be open (3,873 acres). Approximately 15,997 acres would be an avoidance area for wind energy development, and 2,399 acres would be open to wind energy development. The No Action Alternative would maintain 1,724 acres as an avoidance area and 16,657 acres as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. Approximately 15,897 acres of the lands with wilderness characteristics parcel would be managed as VRM Class III and the rest (2,484 acres) managed as VRM Class IV. Because much of the area would be open for mineral development, and renewable energy development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area’s wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed.

Alternatives A and B

Under Alternatives A and B, Unit 810 (18,381 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 810 would be closed to leasable and salable minerals, and locatable minerals would be recommended for withdrawal for the entire area. Solar and wind energy development would be excluded from the area. Under these alternatives, Unit 810 would be managed as excluded for ROWs. The entire area would be OHV limited. Grazing would be open on 5,301 acres and the closed on the remainder. Under both alternatives, the area would be managed as VRM Class II. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A and B would maintain the area’s wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative C

Under Alternative C, Unit 810 (18,381 acres) would be managed to emphasize other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics. Under Alternative C, lands with wilderness characteristics within Unit 810 would be open with standard terms and conditions to leasable and salable minerals on 5,301 acres (29%). The remainder (13,078 acres) would be open with moderate constraints for leasable mineral development and salable mineral development. Under Alternative C, locatable minerals development would be open for the entire area. For renewable energy development, the BLM would manage 5,301 acres (29%) as open to wind energy development and variance for solar energy development under Alternative C. The remainder (13,078 acres) would be excluded from or closed to renewable energy development. The entire area would be OHV limited, and grazing would be open on the entire area. Under Alternative C, BLM would designate 5,301 acres as open for ROWs and the remainder (13,078 acres) would be managed as an avoidance area for ROWs. Approximately 15,970 acres of the lands with wilderness characteristics parcel would be managed as VRM Class III and the rest (2,410 acres) managed as VRM Class IV under Alternative C. Because portions of the area under Alternative C would be open for mineral development and renewable energy development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area’s wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Because Alternative C would apply management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics, portions of the parcel would retain wilderness character, compared with the No Action Alternative. Those portions of the unit that are open for mineral and renewable energy development under Alternative C would not retain wilderness qualities. However, Alternative C would apply management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics.

Alternative D

Under Alternative D, Unit 810 (18,381 acres) would be managed to emphasize other multiple uses as a priority over protecting wilderness characteristics. Under Alternative D, leasable, salable, and locatable minerals development would be open with standard terms and conditions for the entire area. Under Alternative D, 13,080 acres of Unit 810 would be managed as an avoidance area for wind energy development. The remainder (5,301 acres) would be managed as open for wind. The entire area would be managed as a variance area for solar energy development under Alternative D. Under Alternative D, Unit 810 would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. Approximately 15,970 acres of the lands with wilderness characteristics parcel would be managed as VRM Class III and the rest (2,410 acres) managed as VRM Class IV under Alternative D. Because portions of the area under Alternative D would be open for mineral development and renewable energy development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area’s wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Because Alternative D would emphasize other multiple uses as a priority over protecting wilderness characteristics, and mineral and renewable energy development offers little protection to wilderness character, those portions of the unit that are open for mineral and renewable energy development under Alternative D would not retain wilderness qualities if those areas are developed.

Unit 810A

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 810A (1,007 acres) would be open to leasable, salable, and locatable minerals on the entire area. Solar energy development would be excluded from 990 acres (98%), and the remainder would be variance (17 acres). The entire area would be an avoidance area for wind energy development. Wind energy development would be open on 190 acres (19%), and the remainder would be avoidance area (817 acres). The entire area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. The entire area would be managed as VRM Class III. Because much of the area would be open for mineral development, renewable energy development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area’s wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternatives A and B

Under Alternatives A and B, Unit 810A (1,007 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 810A would be closed to leasable and salable minerals, and locatable minerals would be recommended for withdrawal for the entire area. The entire area would be excluded from solar and wind energy development. Under these alternatives, Unit 810A would be managed as excluded for ROWs. The entire area would be OHV limited. Grazing would be open on the entire area under Alternative B and closed on the entire area under Alternative A. Under both alternatives, the area would be managed as VRM Class I. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A and B would maintain the area’s wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative C

Under Alternative C, Unit 810A (1,007 acres) would be managed to emphasize other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics. Lands with wilderness characteristics within Unit 810A would be managed as open with moderate constraints (CSU) for leasable mineral development and salable mineral development on the entire area, and open to locatable development on the entire area. The entire area would be excluded from solar development and wind energy development. Under Alternative C, Unit 810A would be managed as an avoidance area for ROWs. The entire area would be OHV limited, grazing would be managed as open. The entire area would be managed as VRM Class III. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under this alternative, compared with the No Action Alternative, Alternative C would maintain the area’s wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative D

Under Alternative D, Unit 810A (1,007 acres) would be managed to emphasize other multiple uses as a priority over protecting wilderness characteristics. Lands with wilderness characteristics within Unit 810A would be open to leasable, salable, and locatable mineral development on the entire area. For renewable energy development, the BLM would manage the entire area as excluded to solar development and avoidance area for wind energy development on 8,500 acres under Alternative D. The area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. Under Alternative D, the lands with wilderness characteristics parcel would be managed as VRM Class III on the entire area. Because the area under Alternative D would be open for leasable and locatable mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area’s wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Similar to the No Action Alternative, Alternative D offers little protection from wilderness character, and the parcel would not retain its wilderness qualities if developed.

Unit 810B (Texas Hill South)

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Within Unit 810B (6,730 acres) leasable mineral development would be open with standard terms and conditions on 783 acres within, with the remainder (5,948 acres) open with moderate constraints. The entire area would be open with standard terms and conditions for salable mineral development. The entire area would also be open for locatable mineral development. Solar energy development would be excluded from 5,655 acres (84%), and the remainder would be variance (1,075 acres). The entire area would be an avoidance area for wind energy development. The entire area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. Approximately 4,649 acres of the lands with wilderness characteristics parcel would be managed as VRM Class III and the rest (2,081 acres) managed as VRM Class IV. Because much of the area would be open for mineral development, renewable energy development, OHV travel, fire suppression, and geophysical exploration, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area’s wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternatives A and B

Under Alternatives A and B, Unit 810B (6,730 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 810B would be closed to leasable and salable minerals, and locatable minerals would be recommended for withdrawal for the entire area. The entire area would be excluded from solar and wind energy development. Under these alternatives, Unit 810B would be managed as excluded for ROWs. The entire area would be OHV limited. Grazing would be open on 780 acres and closed on the remainder because of the Guadalupe Habitat Management Area. Under both alternatives, the area would be managed as VRM Class II. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A and B would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternatives C and D

Under Alternatives C and D, Unit 810B (6,730 acres) would be managed to emphasize other multiple uses as a priority over protecting wilderness characteristics. Under Alternative C, lands with wilderness characteristics within Unit 810B would be open to leasable and salable minerals with standard terms and conditions on 780 acres (12%). The remainder (5,948 acres) would be open with moderate constraints for leasable mineral development and salable mineral development. Under Alternative C, locatable minerals development would be open for the entire area. Under Alternative D, leasable, salable, and locatable minerals development would be open with standard terms and conditions for the entire area. For renewable energy development, 780 acres (12%) would be managed as open to wind and solar energy development under Alternative C. The remainder (5,947 acres) would be excluded or closed to renewable energy development. Under Alternative D, renewable energy development would be open for wind energy development on 780 acres. The remainder (5,948 acres) would be managed as an exclusion area for wind energy development. Under Alternative D, all of Unit 810B would be managed as variance for solar energy development. Under Alternative C, BLM would designate 780 acres as open for ROWs and the remainder (5,948 acres) as an avoidance area for ROWs. Alternative D would designate the area as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. For both alternatives, approximately 5,832 acres of the lands with wilderness characteristics parcel would be managed as VRM Class III and the rest (897 acres) managed as VRM Class IV. Because portions of the area under both alternatives would be open for mineral development and renewable energy development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Because Alternatives C and D would emphasize other multiple uses as a priority over protecting wilderness characteristics, those portions of the unit that are open for mineral and renewable energy development under Alternatives C and D would not retain wilderness qualities if those areas are developed.

Unit 813

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 813 (8,504 acres) would be open with standard terms and conditions to leasable and locatable minerals. Salable minerals would be open with moderate constraints. Geothermal, wind and solar energy development would be closed or excluded from the area. The area would be managed as open for ROWs and OHV limited. Fire suppression, geophysical exploration, and grazing would be open on the entire area. A total of 2,632 acres would be managed as VRM Class III, and the remainder (5,868 acres) would be managed as VRM Class IV. Because portions of the area would be open for mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed.

Alternatives A and B

Under Alternatives A and B, Unit 813 (8,504 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 813 would be closed to leasable mineral development, managed as open with moderate constraints for salable minerals, and recommended for withdrawal from locatable development. The area would be excluded from solar and wind energy development. Under these alternatives, Unit 813 would be managed as excluded for ROWs. The entire area would be OHV limited. Grazing would be closed under Alternative A (due to the Guadalupe Habitat Management Area) and open to grazing under Alternative B. Under both alternatives, the area would be managed as VRM Class I. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A and B would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative C

Under Alternative C, Unit 813 (8,504 acres) would be managed to emphasize other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics. Lands with wilderness characteristics within Unit 813 would be managed as open with major constraints (NSO) for leasable mineral development on 8,503 acres, managed as open with moderate constraints to salable minerals on 8,500 acres, and open to locatable development on 8,501 acres. The entire area would be excluded from solar development and avoided for wind energy development on 8,500 acres. Under Alternative C, Unit 813 would be managed as an avoidance area for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. The area would be managed as VRM Class III on 8,501 acres. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under this alternative, compared with the No Action Alternative, Alternative C would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative D

Under Alternative D, Unit 813 (8,504 acres) would be managed to emphasize other multiple uses as a priority over protecting wilderness characteristics. Lands with wilderness characteristics within Unit 813 would be open to leasable, salable, and locatable mineral development on 8,501 acres. For renewable energy development, the BLM would manage the entire area as excluded to solar development and avoidance area for wind energy development on 8,500 acres under Alternative D. The area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. For Alternative D, the lands with wilderness characteristics parcel would be managed as VRM Class III (2,632 acres) and VRM IV (5,869 acres). Because portions of the area under Alternative D would be open for leasable and locatable mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Similar to the No Action Alternative, Alternative D offers little protection from wilderness character, and the parcel would not retain its wilderness qualities if developed.

Unit 815 (Slaughter and Double Canyons)

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 815 (3,989 acres) would be open with standard terms and conditions to leasable and salable minerals on 1,033 acres (26%). Leasable minerals would be open with major constraints, and salable minerals would be closed on the remainder (2,957 acres). Locatable minerals would be open on the entire area. Geothermal and solar energy development would be closed or excluded from the area, and the area would be an avoidance area for wind energy development. The area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. A total of 2,956 acres would be managed as VRM Class II, and the remainder would be managed as VRM Class III. Because portions of the area would be open for mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed.

Alternatives A through C

Under Alternatives A through C, Unit 815 (3,989 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 815 would be closed to leasable mineral development under Alternatives A and B. Under Alternative C, leasable mineral development would be open with major constraints for all of Unit 815. Unit 815 would be closed to salable minerals and locatable minerals would be recommended for withdrawal for the entire area under Alternatives A through C. Locatable minerals would be recommended for withdrawal for the entire area under Alternatives A through C. Solar and wind energy development would be excluded from or closed within the area. Under these alternatives, Unit 815 would be managed as excluded for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. Under Alternatives A through C, all of the area would be managed as VRM Class II. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A through C would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative D

Under Alternative D, Unit 815 (3,989 acres) would be managed to emphasize other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics. Lands with wilderness characteristics within Unit 815 would be open to leasable minerals with major constraints, closed to salable mineral development, and open for locatable mineral development. For renewable energy development, the BLM would manage the area as excluded for solar development and avoidance for wind energy development under Alternative D. The area would be managed as an avoidance area for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. For Alternative D, the lands with wilderness characteristics parcel would be managed as VRM Class III. Because portions of the area under Alternative D would be open for leasable and locatable mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Similar to the No Action Alternative, Alternative D offers little protection from wilderness character, and the parcel would not retain its wilderness qualities if developed. However, Alternative D would apply management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics.

Unit 902 (Big Ox Yoke)

No Action Alternative

Under the No Action Alternative, no lands within the CFO planning area would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 902 (9,834 acres) would be open to leasable, salable, and locatable minerals on the entire area. Solar energy development would be excluded from 9,824 acres (99%), and the remainder would be managed as variance (9 acres). Approximately 9,456 acres would be an avoidance area, and 377 acres would be open for wind energy development. The area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. The area would also be managed as VRM Class VI. Because much of the area would be open for mineral development, ROWs, and portions of the area would be open for renewable energy development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed.

Alternatives A and B

Under Alternative A and B, Unit 902 (9,834 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 902 would be closed to leasable and salable minerals, and locatable minerals would be recommended for withdrawal for the entire area under Alternative A. Leasable minerals would be closed, salable minerals would be open with moderate constraints, and locatable minerals would be open for the entire area under Alternative B. Solar and wind energy development would be excluded from the area. Under these alternatives, Unit 902 would be managed as excluded for ROWs. The entire area would be OHV limited. Grazing would be closed on all but two acres under Alternative A and the entire area would be open under Alternative B. Under both alternatives, the entire area would be managed as VRM Class I. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A and B would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative C

Under Alternative C, Unit 902 (9,834 acres) would not be managed toto emphasize other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics. For this alternative, Lands with wilderness characteristics within Unit 902 would be open with moderate constraints for leasable mineral development, open with special terms and conditions for salable mineral development, and open for locatable mineral development. For renewable energy development, the BLM would designate the area as an exclusion area for solar and an avoidance area for wind energy development under Alternative C. The area would be managed as an exclusion area for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. For Alternative C, the lands with wilderness characteristics parcel would be managed as VRM Class III. Compared with the No Action Alternative, Alternative C would have reduced adverse effects on wilderness character. Because portions of the area under Alternative C would be open for leasable, salable, and locatable mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed. However, Alternative C would apply management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics.

Alternative D

Under Alternative D, Unit 902 (9,834 acres) would be managed to emphasize other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics. Lands with wilderness characteristics within Unit 902 would be open with standard terms and conditions to leasable mineral development, salable mineral development, and locatable mineral development. For renewable energy development, the BLM would manage the area as an exclusion area for solar development and an avoidance area for wind development. The area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. For Alternative D, the lands with wilderness characteristics parcel would be managed for VRM Class III. Because all of the area under Alternative D would be open for leasable, salable, and locatable mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Similar to the No Action Alternative, Alternative D offers little protection for wilderness character, and the parcel would not retain its wilderness qualities if developed. However, Alternative D would apply management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics.

Unit 909 (Salt House Draw)

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 909 (9,130 acres) would be open to leasable, salable, and locatable minerals on the entire area. Solar energy development would be excluded, respectively, from 6,697 acres (73%), and the remainder would be managed as variance (2,433 acres). Approximately 184 acres would be an avoidance area, and 8,946 acres would be open for wind energy development. The area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. The area would also be managed as VRM Class IV. Because much of the area would be open for mineral development, and portions of the area open for renewable energy development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed.

Alternatives A and B

Under Alternatives A and B, Unit 909 (9,130 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 909 would be closed to leasable mineral development under Alternatives A and B. Salable minerals would be closed for the entire area under Alternative A. Under Alternative B, the entire area would be open with moderate constraints for salable mineral development. Under Alternative A, the entire area would be recommended for withdrawal from locatable mineral development. Under Alternative B, the entire area would be open for locatable mineral development.

Under Alternatives A and B, Unit 909 would be excluded from wind and solar development. Under these alternatives, Unit 909 would be managed as excluded for ROWs. The entire area would be OHV limited. Grazing would be open on all but 10 acres under Alternative A, and the entire area would be open under Alternative B. Under Alternative A, the entire area would be managed as VRM Class II. The entire area would be managed as VRM Class I under Alternative B. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A and B would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative C

Under Alternative C, Unit 909 (9,130 acres) would be managed to emphasize other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics. For this alternative, Lands with wilderness characteristics within Unit 909 would be open with moderate constraints for leasable mineral development and open with special terms and conditions for salable mineral development. Alternative C would also be open for locatable mineral development. For renewable energy development, the BLM would manage the area as an exclusion area for solar and wind energy development. The area would be managed as an avoidance area for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. Under Alternative C, Unit 909 would be managed as VRM Class III. Because portions of the area under Alternative C would be open for leasable, salable, and locatable mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed.

Alternative D

Under Alternative D, Unit 909 (9,130 acres) would be managed to emphasize other multiple uses as a priority over protecting wilderness characteristics. Lands with wilderness characteristics within Unit 909 would be open with standard terms and conditions for leasable, salable, and locatable mineral development. For renewable energy development, the BLM would designate the area as an exclusion area for solar energy development and an avoidance area for wind energy development under Alternative D. The area would be managed as an avoidance area for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. For Alternative D, 792 acres of the lands with wilderness characteristics parcel would be managed as VRM Class III and 8,337 acres managed as VRM Class IV. Because all of the area under Alternative D would be open for leasable, salable, and locatable mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Similar to the No Action Alternative, Alternative D offers little protection from wilderness character, and the parcel would not retain its wilderness qualities if developed.

Unit 922 (Thurman Draw)

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 922 (5,750 acres) would be open with standard terms and conditions to leasable and salable minerals on 1,386 acres (24%). Leasable minerals would be open with major constraints, and salable minerals would be closed on the remainder (4,364 acres). Locatable minerals would be open on the entire area. Geothermal and solar energy development would be closed and excluded from the area, and the area would be an avoidance area for wind energy development. The area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. Approximately 4,364 acres would be managed as VRM Class II, and the remainder would be managed as VRM Class III. Because portions of the area would be open for mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed.

Alternatives A and B

Under Alternatives A and B, Unit 922 (5,750 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 922 would be closed to leasable and salable minerals, and locatable minerals would be recommended for withdrawal. Solar and wind energy development would be excluded from the area. Under these alternatives, Unit 922 would be managed as an exclusion area for ROWs. The entire area would be OHV limited, and grazing would be open. Under both alternatives, the area would be managed as VRM Class II. Because the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A and B would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternatives C and D

Under Alternatives C and D, Unit 922 (5,750 acres) would be managed to emphasize other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics. Under Alternative C, lands with wilderness characteristics within Unit 922 would be open with moderate constraints to leasable and open with special terms and conditions to salable minerals on 1,385 acres (24%). The remainder (4,365 acres) would be open with major constraints for leasable mineral development and closed to salable mineral development. The entire area would be open for locatable mineral development under Alternative C. Under Alternative D, leasable minerals development would be open with moderate constraints on 1,385 acres (24%). The remainder of the area would be open with major constraints to leasable minerals (4,365 acres). Unit 922 would be open to salable minerals development with special terms and conditions on 1,370 acres (24%). The remainder of the area would be closed to salable minerals development (4,366 acres) or open with standard terms and conditions (15 acres). The entire area would be open for locatable mineral development under Alternative D.

For renewable energy development, the BLM would be an avoidance area on 1,385 acres (12%) for wind energy development under Alternative C. The remainder (4,366 acres) would be excluded from wind energy development. Unit 922 would be excluded from solar energy development under Alternative C. Under Alternative D, all of Unit 922 would be an avoidance area for wind energy development and excluded from solar energy development. Under Alternative C, the BLM would manage 1,385 acres as an avoidance area for ROWs and the remainder (4,366 acres) as an exclusion area for ROWs. Alternative D would manage all of the area as an avoidance area for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area under Alternatives C and D. Under Alternative C, approximately 4,364 acres of the lands with wilderness characteristics parcel would be managed as VRM Class II and the rest (1,386 acres) managed as VRM Class III. Alternative D would designate the entire area as VRM Class III.

Similar to the No Action Alternative, because much of the area under both alternatives would be open for mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed. However, both alternatives would apply management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics.

Unit 125

No Action Alternative

Under the No Action Alternative, no lands within the CFO would be managed to maintain wilderness characteristics. Lands with wilderness characteristics within Unit 125 (2,120 acres) would be open with standard terms and conditions to leasable, salable, and locatable mineral development. The entire area would be avoidance area for wind energy development, and would be excluded from solar energy development. The area would be managed as open for ROWs and OHV limited. Fire suppression, geophysical exploration, and grazing would be open on the entire area. The entire area would be managed as VRM Class IV. Because the area would be open for mineral development, fire suppression, and geophysical exploration, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Therefore, the parcel would not retain its wilderness qualities if developed.

Alternatives A and B

Under Alternatives A and B, Unit 125 (2,120 acres) would be managed to protect its wilderness characteristics as a priority over multiple uses. Lands with wilderness characteristics within Unit 125 would be closed to leasable and salable mineral development, and recommended for withdrawal from locatable development. The entire area would be excluded from wind energy development, and variance for solar energy development. Under these alternatives, Unit 125 would be managed as excluded for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. Under both alternatives, the area would be managed as VRM Class I. Because the area would be closed for mineral development, wind energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under these alternatives, compared with the No Action Alternative, Alternatives A and B would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative C

Under Alternative C, Unit 125 (2,120 acres) would be managed to emphasize other multiple uses while applying management restrictions (conditions of use, mitigation measures) to reduce impacts to wilderness characteristics. Lands with wilderness characteristics within Unit 125 would be managed as open with moderate constraints (CSU) for leasable and salable mineral development on the entire area, and open to locatable development on the entire area. The entire area would be excluded from wind energy development and variance for solar energy development on the entire area. Under Alternative C, Unit 125 would be managed as an avoidance area for ROWs. The entire area would be OHV limited, and grazing would be managed as open. The area would be managed as VRM Class III on 8,501 acres. Because much of the area would be closed for mineral development, renewable energy development, and ROW development, and OHV limited, there would be reduced potential for road development, surface disturbance, visual intrusions, and noise intrusions. Because these effects would be reduced under this alternative, compared with the No Action Alternative, Alternative C would maintain the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Alternative D

Under Alternative D, Unit 125 (2,120 acres) would be managed to emphasize other multiple uses as a priority over protecting wilderness characteristics. Lands with wilderness characteristics within Unit 125 would be open to leasable, salable, and locatable mineral development on the entire area. For renewable energy development, the BLM would manage the entire area as variance for solar development and open for wind energy development on the entire area. The area would be managed as open for ROWs. The entire area would be OHV limited, and grazing would be open on the entire area. Under Alternative D, the lands with wilderness characteristics parcel would be managed as VRM Class III on the entire area. Because the entire area under Alternative D would be open for mineral development, there would be increased potential for road development, surface disturbance, visual intrusions, and noise intrusions. As discussed in the Methods and Assumptions section above, these effects would reduce the area's wilderness qualities of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. Similar to the No Action Alternative, Alternative D offers little protection from wilderness character, and the parcel would not retain its wilderness qualities if developed.

4.2.10 Visual Resources

4.2.10.1 Indicators

The BLM's VRM class objectives (see Section 3.2.11 and below) and the CFO planning area acres within each of the VRM classes are the indicators used in analyzing surface disturbance, visual intrusions, or air quality (i.e., visibility) impacts on visual resources. These objectives provide a systematic and consistent basis for determining how much current management actions or a proposed action would affect scenic quality, as well as determining the level of disturbance an area could support while still meeting that area's VRM objectives.

As discussed in Section 3.2.11, a visual resource inventory (VRI) was conducted to assess current scenic conditions throughout the planning area, and acreages were determined for each inventory class (VRI Class I–IV). The BLM VRI classes assign value and serve as the principal consideration when making management decisions that affect the visual environment during land use planning. In general, VRI Class I is assigned to special areas where previous management decisions have been made to maintain a natural landscape. Examples of these areas are designated wilderness areas and segments along a designated WSR. VRI Class II, III, and IV are usually assigned based on a combination of scenic quality, visual sensitivity, and viewing distances. Visual sensitivity is the concern that the public has for maintaining an area's scenic quality; viewing distance is the distance that an area can be seen from commonly used public viewpoints such as highways and secondary travel routes, trails, byways, points of interest, and campgrounds. The resulting current visual inventory is the baseline for visual values in the planning area and it assisted the CFO in considering visual values during the RMP process. The results of the VRI for the planning area are shown below in Table 4-100.

The VRI classes do not provide management direction and are not used to limit or constrain surface-disturbing activities within the planning area. As mentioned above, these VRI acreages were used during the RMP process along with other resource management considerations (balancing the needs of other resources and planning area activities) to create a range of proposed VRM class acreages for each alternative. As such, the proposed VRM classes for each action alternative are the result of a synthesis or balance of other proposed resource and land management actions, including balancing the needs for minerals exploration and development, the need for providing recreational opportunities for a variety of activities, the need to establish special designations areas to preserve wildlife and vegetation habitat, and the need to permit land use authorizations for utility power lines with the visual inventory classifications of scenic quality, visual resource values, and viewer sensitivity within the Carlsbad planning area.

The BLM's VRM classes provide direct management through the designation of objectives that establish the desired outcomes and future landscape conditions when implementing the land use plan. Once the proposed VRM classes are designated when the revised RMP is approved, then the visual objectives that define each of the VRM classes can be used to limit, constrain, or permit resource activities to meet those objectives. The four VRM classes and their objectives used within the VRM system to describe the different degrees of project-related impacts allowed to the existing landscape are:

- **Class I.** The objective is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and should not attract attention.
- **Class II.** The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- **Class III.** This class objective is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- **Class IV.** The objective of Class IV is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of the basic elements of the landscape (BLM 1986).

Table 4-100. VRI Class Acreages (BLM-administered lands only)

VRI Class I	VRI Class II	VRI Class III	VRI Class IV	Total Acreage
7,001	66,414	185,878	2,524,131	2,783,424

4.2.10.1.1 Methods and Assumptions

Methods

The impacts analysis method compared the current VRI acreages with the existing and proposed VRM acreages for all of the alternatives and an analysis that compared the VRM class acreages designated for the BLM-administered portion of the planning area (the current 1988 RMP VRM Class I–IV) with the acres of proposed VRM classes determined during the revised RMP process for each alternative. The action alternatives VRM class acreages are the areas that are proposed for VRM class designation and management when the RMP process has been completed and the revised Carlsbad RMP has been approved.

Once the RMP is completed and the VRM classes are approved and designated, the VRM class objectives for an area are applicable to all of the land management actions within that area. All resource management and planning actions that could impact visual quality (for example, well drilling, utility power line construction, or hard rock mining) are required to consider and comply with the VRM class objectives of the area within which that activity takes place. This means that the level or degree of all potential impacts on visual resources that would be produced by the proposed RMP management actions would be required to conform to the approved VRM class objectives. It also means that while these activities would have to conform to the VRM objectives, there would still be potential long-term impacts to the landscape that could change the value ratings within the visual resource inventory factors (see the Impacts of Other Resource Actions on Visual Resources subsection at the end of this section).

Assumptions

The analysis of impacts to visual resources when comparing current VRM class acreages (No Action) to the proposed VRM class (Alternatives A–D) acres is based on the following:

- Increased acreages of proposed VRM Class I and II would be more protective of visual resources within the planning area because these VRM classes allow less visual contrast and visual disturbance. These VRM classes, therefore, would preserve existing scenic quality once these classes are designated when the revised RMP is approved.
- Increased acreages of proposed VRM Class III and IV would be less protective of visual resources within the planning area because they would allow more surface disturbances and changes to existing scenic quality when these classes are designated.
- Designated VRM class objectives, once established at the approval of the revised Carlsbad RMP, would supersede other resource activities. In other words, potential impacts caused by activities that are proposed within an area with a designated VRM class must conform to and not exceed the visual resource objectives permitted under that VRM class.

4.2.10.2 Direct and Indirect Impacts

4.2.10.2.1 Impacts of Visual Resources Actions

Impacts from Management Common to All

The impacts common to all of the alternatives would designate VRM classes and class objectives for all of the BLM-administered public lands within the planning area. The designations for the No Action and the action alternatives are shown in Table 4-101. As discussed above, VRM Class I and II objectives would permit very low to minor surface disturbances and changes to visual resources; VRM Class III and IV objectives would permit moderate to major surface disturbances and alterations of visual resources. Note that the use of low, minor, moderate, and major in this context are not subjective terms. These are terms contained within the BLM's VRM class objective descriptions and are used to define those objectives' limitations on project-related scenic quality and landscape contrast changes.

Table 4-101. Visual Resource Management Acreages under BLM Administration, by Alternative

VRM Class	No Action	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Class III	402,725	367,205	294,177	549,329	546,205
Class IV	2,330,462	2,142,600	2,131,501	2,166,266	2,189,116
Subtotal I and II	50,671 (1.8)	273,710 (9.8)	357,802 (12.8)	67,962 (2.4)	48,263 (1.7)
Subtotal III and IV	2,733,187 (98.2)	2,509,805 (90.2)	2,425,678 (87.2)	2,715,595 (97.6)	2,735,321 (98.3)
Total*	***2,783,858***	***2,783,514***	***2,783,481***	***2,783,558***	***2,783,585***

Note: The number in parentheses is the percentage of total acreage.
*Totals differences are due to slight differences in GIS mapping shapefiles.

Impacts from the No Action Alternative

Visual Resource Inventory Analysis

Using GIS, the VRI Class I through IV within the planning area were compared to the current designated VRM classes under the No Action Alternative and to the proposed VRM classes under the action alternatives. Table 4-102 below shows the VRM classes by the VRI classes. The numbers in the table cells represent the acres of VRM within each VRI class. For example, of the 7,002 acres inventoried and determined to be at the highest level of visual values and scenic quality under VRI Class I, 6,984 acres are within the VRM Class I areas for the highest level of scenic quality protection, and 8 acres of VRI Class I are within VRM Class II areas for high scenic protection. The numbers in parentheses under the action alternatives (A–D) represent the acreage changes (increased or decreased) when compared to the No Action Alternative; the numbers within brackets represent the percent of acreage change compared to the No Action Alternative.

Table 4-102. VRM Classes by VRI Class in the No Action Alternative

VRM Class	VRI Class I	VRI Class II	VRI Class III	VRI Class IV
VRM Class I	6,984	35	8	28
VRM Class II	8	12,297	9,108	22,186
VRM Class III	10	54,074	65,932	282,655
VRM Class IV	0	9	110,830	2,219,262
Totals	***7,002***	***66,414***	***185,878***	***2,524,131***

Under the No Action Alternative 6,992 acres of designated VRM Class I and II lie within areas inventoried as having very high scenic quality and visual values under VRI Class I (99.9% of the total VRI Class I area). Under VRI Class II (areas determined to have high scenic quality and visual values), 12,332 acres of designated VRM Class I and II lie within the VRI boundaries, which is 19% of the total VRI Class II area.

The following three tables for scenic quality, sensitivity rating, and distance zones show the VRM class acreages within the VRI scenic quality ratings areas, sensitivity ratings areas, and distance zone areas under the No Action Alternative. These acreages lie within the BLM-administered portions of the CFO.

Table 4-103. VRM Classes by VRI Scenic Quality Ratings in the No Action Alternative

VRM Class	Scenic Quality Ratings		
	A*	B	C
VRM Class I	2,864	4,162	0
VRM Class II	4,722	25,764	10,664
VRM Class III	26,203	174,479	199,341
VRM Class IV	9	247,340	2,072,661
Total	***33,798***	***451,745***	***2,282,666***

*[1]The “A” scenic quality rating encompasses lands with high scenic quality; “B” ratings include lands with moderate scenic quality; “C” ratings are lands with low scenic quality.

Table 4-104. VRM Classes by VRI Sensitivity Ratings in the No Action Alternative

VRM Class	VRI Sensitivity Rating		
	Low	Medium	High
VRM Class I	7,058	0	0
VRM Class II	19,199	24,336	29
VRM Class III	61,279	315,485	24,294
VRM Class IV	415	824,476	1,503,413
Total	***87,951***	***1,164,296***	***1,527,736***

Table 4-105. VRM Classes by VRI Distance Zones in the No Action Alternative

VRM Class	VRI Distance Zones		
	Foreground-Middleground	Background	Seldom Seen
VRM Class I	3,572	261	3,222
VRM Class II	19,208	4,648	19,744
VRM Class III	167,496	34,897	200,277
VRM Class IV	614,785	348,320	1,270,982
Total	***805,061***	***388,126***	***1,494,225***

Visual Resource Management Analysis

Under the current RMP (see Table 4-101), 7,058 acres (0.25% of BLM-administered lands within the planning area) would be managed for the highest level of visual resources protection under VRM Class I objectives, and 43,613 acres (1.57% of BLM-administered lands) would be managed at a high level of protection under VRM Class II. The remainder of the BLM-administered lands in the planning area (2,733,187 acres or 98.18%) would be managed under lower levels of visual resource protection through VRM Class III and IV objectives. The area managed under VRM Class I is the Lonesome Ridge ACEC; VRM Class II areas include the Pecos River corridor SRMA, cave management units, numerous ACECs, and dispersed acreages within the planning area. The impacts to visual resources would be beneficial in the long term for those areas that are managed for resource protection under VRM Class I and II, while there would be long-term, adverse impacts to scenic quality in those areas that would continue to be managed under VRM Class III and IV.

Impacts from Alternative A

Visual Resource Inventory Analysis

Table 4-106 shows the acres and percent change of proposed Alternative A VRM classes within the VRI classes. The numbers in parentheses show the changes of acreage, either increased or decreased, when compared to the No Action Alternative acreages; the numbers in brackets show the acreage percent increase or decrease compared to the No Action Alternative.

Table 4-106. VRM Classes by VRI Class for Alternative A

VRM Class	VRI Class I	VRI Class II	VRI Class III	VRI Class IV
VRM Class I	6,985 (+1) [0%]	126 (+91) [261%]	2,368 (+2,360) [30274%]	28,271 (+28,243) [0%]
VRM Class II	3 (-5) [-62%]	26,232 (+13,935) [113%]	40,481 (+31,373) [344%]	169,186 (+147,000) [663%]
VRM Class III	14 (+4) [46%]	40,055 (-14,019) [-26%]	50,182 (-15,750) [-24%]	276,919 (-5,736) [-2%]
VRM Class IV	(+) [0%]	(-9) [-100%]	92,822 (-18,008) [-16%]	2,049,466 (-169,796) [-8%]
Total	***7,002 (+1) [0%]***	***66,413 (-1) [0%]***	***185,853 (-25) [0%]***	***2,523,842 (-289) [0%]***

When compared with the No Action Alternative, management actions under Alternative A would not change the areas considered for designation as VRM Class I and II within VRI Class I, and increase the areas considered for VRM Class I and II designation by 14,026 acres within VRI Class II. These increases would be beneficial for visual resources in the long term because very high scenic quality would be maintained and there would be an increase in scenic quality preservation or maintenance within known high-quality, sensitive scenic landscapes.

The following three tables for scenic quality, sensitivity rating, and distance zones show the proposed VRM class acreages within the VRI scenic quality ratings areas, sensitivity ratings areas, and distance zone areas for Alternative A (Table 4-107 through Table 4-109). These acreages lie within the BLM-administered portions of the planning area. As mentioned for the above Table 4-98, the numbers in parentheses show the changes of acreage, either increased or decreased, when compared to the No Action Alternative acreages. The numbers in brackets show the acreage percent increase or decrease compared to the No Action Alternative. These symbols are also used for the tables that follow for Alternatives B, C, and D.

Table 4-107. VRM Classes by VRI Scenic Quality Ratings in Alternative A

VRM Class	Scenic Quality Ratings		
	A	B	C
VRM Class I	2,898 (+33) [1%]	14,209 (+81) [2%]	20,611 (+20,611) [0%]
VRM Class II	15,804 (+10,486) [296%]	123,040 (+95,041) [374%]	93,718 (+83,054) [779%]
VRM Class III	15,096 (+-10,516) [-43%]	111,886 (+-63,536) [-44%]	239,137 (+39,796) [20%]
VRM Class IV	0	202,575 (+-31,546) [-17%]	1,929,052 (+-143,609) [-7%]
Total	***33,798 (+) [0%]***	***451,710 (+-35) [0%]***	***2,282,518 (+-148) [0%]***

Table 4-108. VRM Classes by VRI Sensitivity Ratings in Alternative A

VRM Class	VRI Sensitivity Rating		
	Low	Medium	High
VRM Class I	7,171 (+113) [0%]	30,571 (+30,571) [0%]	0
VRM Class II	29,236 (+10,037) [52%]	203,508 (+179,172) [736%]	1,677 (+1,648) [5723%]
VRM Class III	51,538 (-9,741) [-16%]	227,983 (-87,502) [-28%]	87,545 (+63,251) [260%]
VRM Class IV	0	702,196 (-122,280) [-15%]	1,438,393 (-65,020) [-4%]
Total	***87,945 (-6) [0%]***	***1,164,258 (-38) [0%]***	***1,527,615 (-121) [0%]***

Table 4-109. VRM Classes by VRI Distance Zones in Alternative A

VRM Class	VRI Distance Zones		
	Foreground-Middleground	Background	Seldom Seen
VRM Class I	10,990 (+7,418) [208%]	1,000 (+739) [283%]	25,759 (+22,537) [699%]
VRM Class II	113,329 (+94,121) [490%]	23,635 (+18,987) [409%]	98,946 (+79,202) [401%]
VRM Class III	145,866 (-21,630) [-13%]	34,959 (+62) [0%]	186,345 (-13,932) [-7%]
VRM Class IV	543,956 (-70,829) [-12%]	329,889 (-18,431) [-5%]	1,172,375 (-98,607) [-8%]
Total	***814,141 (+9,080) [1%]***	***389,483 (+1,357) [0%]***	***1,483,425 (-10,800) [-1%]***

Visual Resource Management Analysis

Under Alternative A, 37,764 acres (1.36% of BLM-administered lands) would be designated under VRM Class I objectives to maintain very high-quality scenic landscapes (see Table 4-101 above). Preservation of scenic quality at high levels under VRM Class II objectives would be applied to 235,946 acres (8.48% of the BLM-administered lands in the planning area). Management of visual landscapes at lower levels of scenic quality that would permit moderate to major changes to the landscape under VRM Class III and IV designations would be applied to the remaining 2,509,805 acres of the planning area (90.17%).

Compared to the No Action Alternative, VRM class designations under Alternative A would increase 30,706 acres of VRM Class I protection and increase 192,333 acres managed under VRM Class II protection. This would be beneficial to visual resources because there would be more direct, long-term preservation-related impacts to the resource and visual values than under the No Action Alternative; a total of 273,710 acres would be protected under the high and highest VRM management objectives compared to 50,671 acres under the No Action Alternative. This is an increase in the acreage of BLM-administered lands in the planning area managed under VRM Class I and II by 8.0%, with a corresponding reduction in acres managed under VRM Class III and IV. Areas where there would be a long-term, beneficial increase in VRM Class I protection would be within the Devil’s Den, Lonesome Ridge, McKittrick Canyon, and Mudgett’s WSAs. Areas beneficially managed under VRM Class II protection would include numerous proposed ACECs and the Delaware and Black Rivers segments recommended for inclusion in the NWSRS. Under this alternative, management actions would require hooded or downward-facing lighting for all lighted production facilities that would be beneficial in the long term to scenic quality and visual resources to lower light pollution by reducing skyglow (skyglow is the light that radiates upward into the sky at night from artificial light sources). Reduced skyglow would beneficially improve night sky viewing.

Impacts from Alternative B

Visual Resource Inventory Analysis

Table 4-110 shows the acres of proposed Alternative B VRM classes within the VRI classes. The numbers in parentheses show the changes of acreage, either increased or decreased, when compared to the No Action Alternative acreages.

Table 4-110. VRM Classes by VRI Class for Alternative B

VRM Class	VRI Class I	VRI Class II	VRI Class III	VRI Class IV
VRM Class I	6,986 (+2) [0%]	4,474 (+4,439) [12722%]	2,351 (+2,343) [30056%]	28,278 (+28,250) [0%]
VRM Class II	5 (-3) [-37%]	47,297 (+35,000) [285%]	65,842 (+56,734) [623%]	202,505 (+180,319) [813%]
VRM Class III	11 (+1) [15%]	14,644 (-39,430) [-73%]	27,458 (-38,474) [-58%]	252,037 (-30,618) [-11%]
VRM Class IV	(+) [0%]	(-9) [-100%]	90,201 (-20,629) [-19%]	2,040,988 (-178,274) [-8%]
Total	***7,002 (+1) [0%]***	***66,415 (+1) [0%]***	***185,852 (-26) [0%]***	***2,523,808 (-323) [0%]***

When compared with the No Action Alternative, management actions under Alternative B would not change the areas considered for designation as VRM Class I and II within VRI Class I, and increase the areas considered for VRM Class I and II designation by 39,439 acres within VRI Class II. These increases would be beneficial for visual resources in the long term because very high scenic quality would be maintained and there would be an increase in scenic quality and visual values preservation or maintenance within known high-quality, sensitive scenic landscapes.

The following three tables for scenic quality, sensitivity rating, and distance zones show the proposed VRM class acreages within the VRI scenic quality ratings areas, sensitivity ratings areas, and distance zone areas for Alternative B (Table 4-111 through Table 4-113). Acreage changes and percentages of acreage change (parentheses and brackets), either increased or decreased, are the comparisons to the No Action Alternative.

Table 4-111. VRM Classes by VRI Scenic Quality Ratings in Alternative B

VRM Class	Scenic Quality Ratings		
	A	B	C
VRM Class I	2,898 (+34) [1%]	4,242 (+80) [2%]	(+) [0%]
VRM Class II	6,738 (+2,016) [43%]	34,233 (+8,469) [33%]	17,994 (+7,330) [69%]
VRM Class III	24,162 (+-2,041) [-8%]	207,136 (+32,657) [19%]	315,375 (+116,034) [58%]
VRM Class IV	1 (+-8) [-89%]	206,084 (+-41,256) [-17%]	1,949,206 (+-123,455) [-6%]
Total	***33,799 (+1) [0%]***	***451,695 (+-50) [0%]***	***2,282,575 (+-91) [0%]***

Table 4-112. VRM Classes by VRI Sensitivity Ratings in Alternative B

VRM Class	VRI Sensitivity Rating		
	Low	Medium	High
VRM Class I	11,512 (+4,454) [63%]	30,570 (+30,570) [0%]	0
VRM Class II	62,644 (+43,445) [226%]	226,672 (+202,336) [831%]	24,821 (+24,792) [86092%]
VRM Class III	13,793 (-47,486) [-77%]	210,258 (-105,227) [-33%]	70,025 (+45,731) [188%]
VRM Class IV	0	696,798 (-127,678) [-15%]	1,432,693 (-70,720) [-5%]
Total	***87,949 (-2) [0%]***	***1,164,298 (+2) [0%]***	***1,527,539 (-197) [0%]***

Table 4-113. VRM Classes by VRI Distance Zones in Alternative B

VRM Class	VRI Distance Zones		
	Foreground-Middleground	Background	Seldom Seen
VRM Class I	11,310 (+7,738) [217%]	1,312 (+1,051) [402%]	29,465 (+26,243) [814%]
VRM Class II	170,378 (+151,170) [787%]	26,973 (+22,325) [480%]	118,306 (+98,562) [499%]
VRM Class III	94,951 (-72,545) [-43%]	33,195 (-1,702) [-5%]	166,004 (-34,273) [-17%]
VRM Class IV	537,460 (-77,325) [-13%]	328,004 (-20,316) [-6%]	1,169,658 (-101,324) [-8%]
Total	***814,099 (+9,038) [1%]***	***389,484 (+1,358) [0%]***	***1,483,433 (-10,792) [-1%]***

Visual Resource Management Analysis

Under Alternative B, 42,102 acres (see Table 4-101) would be managed under VRM Class I objectives (1.51% of BLM-administered lands in the planning area) for very high-quality landscape preservation. Approximately 315,700 acres would be designated under VRM Class II objectives (11.34% of the BLM planning area) for preservation of high-quality landscapes. The remaining 87.2% of the planning area (2,425,678 acres) would be managed under VRM Class III and IV objectives that would permit moderate to major landscape changes.

Compared to current VRM class designations (under the No Action Alternative), management actions under this alternative would designate 35,044 more acres under VRM Class I and 272,087 more acres under VRM Class II. This would have more beneficial, direct, long-term impacts on visual resources and visual values because 11% more of the planning area would be managed to preserve scenic quality under VRM Class I and II objectives than under the No Action Alternative. Areas that would be beneficially impacted in the long term under VRM Class I objectives would be the same as discussed under Alternative A with additional visual resource protection given to the Lonesome Ridge and the Serpentine Bends ACECs. Beneficial visual quality protection under VRM Class II objectives would be given to the La Cueva SRMA, numerous proposed ACECs, a 1-mile-wide visual buffer on either side of Dark Canyon Road, and the Black and Delaware River corridors. Under this alternative, management actions would require that all permanent lighting in the Guadalupe Escarpment area be hooded or downward facing to reduce light pollution (skyglow). This would have long-term beneficial impacts on night sky viewing within the area and surrounding areas.

Impacts from Alternative C

Visual Resource Inventory Analysis

Table 4-114 shows the acres of proposed Alternative C VRM classes within the VRI classes. The numbers in parentheses show the changes of acreage, either increased or decreased, when compared to the No Action Alternative acreages.

Table 4-114. VRM Classes by VRI Class for Alternative C

VRM Class	VRI Class I	VRI Class II	VRI Class III	VRI Class IV
VRM Class I	6,985 (+1) [0%]	126 (+91) [261%]	30 (+22) [285%]	28 (+) [0%]
VRM Class II	3 (-5) [-62%]	15,893 (+3,596) [29%]	12,484 (+3,376) [37%]	32,409 (+10,223) [46%]
VRM Class III	14 (+4) [46%]	50,393 (-3,681) [-7%]	78,771 (+12,839) [19%]	420,064 (+137,409) [49%]
VRM Class IV	(+) [0%]	1 (-8) [-88%]	94,557 (-16,273) [-15%]	2,071,396 (-147,866) [-7%]
Total	***7,002 (+1) [0%]***	***66,413 (-1) [0%]***	***185,842 (-36) [0%]***	***2,523,897 (-234) [0%]***

When compared with the No Action Alternative, management actions under Alternative C would maintain the areas considered for designation as VRM Class I and II within VRI Class I (the same as Alternatives A and B), and increase the areas considered for VRM Class I and II designation by over 3,687 acres within VRI Class II. These increases would be beneficial for visual resources in the long term because, as discussed under Alternatives A and B, areas with very high scenic quality would be preserved and there would be an increase in scenic quality and visual values preservation or maintenance within known very high and high-quality landscapes.

The following three tables for scenic quality, sensitivity rating, and distance zones show the proposed VRM class acreages within the VRI scenic quality ratings areas, sensitivity ratings areas, and distance zone areas for Alternative C (Table 4-115 through Table 4-117). Acreage changes and percentages of acreage change (parentheses and brackets), either increased or decreased, are the comparisons to the No Action Alternative.

Table 4-115. VRM Classes by VRI Scenic Quality Ratings in Alternative C

VRM Class	Scenic Quality Ratings		
	A	B	C
VRM Class I	2,898 (+34) [1%]	4,242 (+80) [2%]	0
VRM Class II	6,738 (+2,016) [43%]	34,233 (+8,469) [33%]	17,994 (+7,330) [69%]
VRM Class III	24,162 (-2,041) [-8%]	207,136 (+32,657) [19%]	315,375 (+116,034) [58%]
VRM Class IV	0 (-9) [-100%]	206,084 (-41,256) [-17%]	1,949,206 (-123,455) [-6%]
Total	***33,798 (+) [0%]***	***451,695 (-50) [0%]***	***2,282,575 (-91) [0%]***

Table 4-116. VRM Classes by VRI Sensitivity Ratings in Alternative C

VRM Class	VRI Sensitivity Rating		
	Low	Medium	High
VRM Class I	7,171 (+113) [2%]	(+) [0%]	(+) [0%]
VRM Class II	21,291 (+2,092) [11%]	32,464 (+8,128) [33%]	6,984 (+6,955) [24152%]
VRM Class III	59,218 (-2,061) [-3%]	397,549 (+82,064) [26%]	90,933 (+66,639) [274%]
VRM Class IV	266 (-149) [-36%]	734,287 (-90,189) [-11%]	1,429,702 (-73,711) [-5%]
Total	***87,946 (-5) [0%]***	***1,164,300 (+4) [0%]***	***1,527,619 (-117) [0%]***

Table 4-117. VRM Classes by VRI Distance Zones in Alternative C

VRM Class	VRI Distance Zones		
	Foreground-Middleground	Background	Seldom Seen
VRM Class I	3,674 (+102) [3%]	266 (+5) [2%]	3,228 (+6) [0%]
VRM Class II	29,876 (+10,668) [56%]	6,171 (+1,523) [33%]	24,741 (+4,997) [25%]
VRM Class III	217,484 (+49,988) [30%]	54,473 (+19,576) [56%]	277,294 (+77,017) [38%]
VRM Class IV	563,100 (-51,685) [-8%]	328,573 (-19,747) [-6%]	1,178,213 (-92,769) [-7%]
Total	***814,134 (+9,073) [1%]***	***389,483 (+1,357) [0%]***	***1,483,476 (-10,749) [-1%]***

Visual Resource Management Analysis

Management actions under Alternative C would designate 7,171 acres as VRM Class I and 60,791 acres as VRM Class II. The combined acreage of these classes would total 67,962 acres (or 2.44% of the planning area) to preserve or protect visual resources and scenic quality. Management under VRM Class III and IV objectives would encompass 2,715,595 acres (or 97.55% of the BLM-administered planning area) to permit moderate to major changes to the visual landscape.

Compared to the current management decisions under the No Action Alternative, there would be an increase of 113 acres of VRM Class I protection with direct, beneficial, and long-term impacts to visual resources and visual values because more surface acreage would be protected to preserve pristine, high-quality scenic values. There would be 17,178 acres designated for protection under VRM Class II objectives than the No Action Alternative, which would have direct, long-term, beneficial impacts to scenic quality because more acres would be proposed for protection of high-quality landscapes. Areas managed for protection of scenic quality under VRM Class II objectives would be acreages within numerous proposed ACECs, a 1-mile-wide visual buffer on either side of Dark Canyon Road, and segments along the Black River. Under Alternative C, management actions would require that all permanent lighting within VRM Class II and III areas with sensitive receptors be hooded or downward facing to reduce skyglow and nighttime light pollution. Sensitive receptors would be people living in or near these areas that would be sensitive to visually intrusive nighttime light pollution or skyglow. Sensitive receptors would include campgrounds, residential areas, and nearby communities.

Impacts from Alternative D

Visual Resource Inventory Analysis

Table 4-118 shows the acres of proposed Alternative D VRM classes within the VRI classes. The numbers in parentheses show the changes of acreage, either increased or decreased, when compared to the No Action Alternative acreages.

Table 4-118. VRM Classes by VRI Class for Alternative D

VRM Class	VRI Class I	VRI Class II	VRI Class III	VRI Class IV
VRM Class I	6,985 (+1) [0%]	126 (+91) [261%]	30 (+22) [285%]	28 (+) [0%]
VRM Class II	1 (-7) [-87%]	8,384 (-3,913) [-32%]	9,066 (-42) [0%]	23,638 (+1,452) [7%]
VRM Class III	15 (+5) [56%]	57,899 (+3,825) [7%]	77,697 (+11,765) [18%]	410,506 (+127,851) [45%]
VRM Class IV	(+) [0%]	6 (-3) [-31%]	99,054 (-11,776) [-11%]	2,089,744 (-129,518) [-6%]
Totals	***7,001 (+) [0%]***	***66,415 (+1) [0%]***	***185,847 (-31) [0%]***	***2,523,916 (-215) [0%]***

When compared with the No Action Alternative, management actions under Alternative D would maintain the areas considered for designation as VRM Class I and II within VRI Class I, and decrease the areas considered for VRM Class I and II designation by 3,822 acres within VRI Class II. This would be adverse for visual resources in the long term because there would be a potential loss of scenic quality and visual values preservation or maintenance within known very high-quality, sensitive scenic landscapes.

The following three tables for scenic quality, sensitivity rating, and distance zones show the proposed VRM class acreages within the VRI scenic quality ratings areas, sensitivity ratings areas, and distance zone areas for Alternative D (Table 4-119 through Table 4-121). Acreage changes and percentages of acreage change (parentheses and brackets), either increased or decreased, are the comparisons to the No Action Alternative.

Table 4-119. VRM Classes by VRI Scenic Quality Ratings in Alternative D

VRM Class	Scenic Quality Ratings		
	A	B	C
VRM Class I	2,898 (+34) [1%]	4,242 (+80) [2%]	0
VRM Class II	6,738 (+2,016) [43%]	22,555 (-3,209) [-12%]	10,006 (-658) [-6%]
VRM Class III	24,158 (-2,045) [-8%]	211,674 (+37,195) [21%]	307,680 (+108,339) [54%]
VRM Class IV	5 (-4) [-44%]	213,232 (-34,108) [-14%]	1,964,905 (-107,756) [-5%]
Total	**33,799 (+1) [0%]**	**451,703 (-42) [0%]**	**2,282,591 (-75) [0%]**

Table 4-120. VRM Classes by VRI Sensitivity Ratings in Alternative D

VRM Class	VRI Sensitivity Rating		
	Low	Medium	High
VRM Class I	7,171 (+113) [2%]	0	0
VRM Class II	10,223 (-8,976) [-47%]	29,360 (+5,024) [21%]	1,469 (+1,440) [5001%]
VRM Class III	70,288 (+9,009) [15%]	384,207 (+68,722) [22%]	90,075 (+65,781) [271%]
VRM Class IV	268 (-147) [-35%]	750,750 (-73,726) [-9%]	1,436,082 (-67,331) [-4%]
Total	***87,950 (-1) [0%]***	***1,164,317 (+21) [0%]***	***1,527,626 (-110) [0%]***

Table 4-121. VRM Classes by VRI Distance Zones in Alternative D

VRM Class	VRI Distance Zones		
	Foreground-Middleground	Background	Seldom Seen
VRM Class I	3,674 (+102) [3%]	266 (+5) [2%]	3,228 (+6) [0%]
VRM Class II	18,043 (-1,165) [-6%]	3,884 (-764) [-16%]	19,161 (-583) [-3%]
VRM Class III	222,743 (+55,247) [33%]	53,939 (+19,042) [55%]	269,444 (+69,167) [35%]
VRM Class IV	569,683 (-45,102) [-7%]	331,398 (-16,922) [-5%]	1,191,655 (-79,327) [-6%]
Total	***814,143 (+9,082) [1%]***	***389,487 (+1,361) [0%]***	***1,483,488 (-10,737) [-1%]***

Visual Resource Management Analysis

Under this alternative (see Table 4-101), there would be the same acreage designation under VRM Class I as discussed for Alternative C (7,171 acres). Designation under VRM Class II would be 41,092 acres (1.47% of the planning area), for a total of 48,263 acres (1.68% of the planning area) under these VRM classes. The combined designated area for VRM classes III and IV would be 2,735,321 acres (or 98.32% of the BLM-administered planning area).

Compared to the current VRM management decisions under the No Action Alternative, there would be fewer acres managed for protection of high-quality landscapes under VRM Class I and II objectives. The impacts for visual resources managed VRM Class I objectives would be the same as discussed under Alternative C because they are the same; designated acreage under VRM Class II for this alternative compared to the No Action Alternative would be adversely decreased by 2,521 acres (0.09% of the planning area), with a corresponding increase in acreages managed under VRM Class III and IV. The areas managed under VRM Class II objectives would be the Lonesome Ridge and Serpentine Bends ACECs, a 0.25-mile-wide visual buffer on either side of the Dark Canyon Road. There would be long-term adverse impacts to visual resources from a decrease in scenic quality protection under both VRM Class II objectives, when compared to the No Action Alternative. Under this alternative, there would be no management action requirements for hooded or directed lighting.

Summary of Direct and Indirect Impacts

See Table 4-101 above for a concise summary comparison of proposed VRM class acreage designations under each of the alternatives.

Impacts from the No Action Alternative

Under this alternative, the current conditions for the resource in the 1988 Carlsbad RMP, 50,671 acres would be managed for the highest degrees of scenic quality preservation under VRM Class I and II objectives. The alternative would continue to manage 2,733,187 acres for moderate and major landscape changes under VRM Class III and IV.

Impacts from Alternative A

Alternative A would provide the second highest degree of resource protection under VRM Class I and II objectives (greater than Alternatives C and D) for long-term, beneficial preservation of scenic quality (273,710 acres).

Impacts from Alternative B

This alternative would have the greatest degree of long-term, beneficial impacts on visual resources because more acres would be protected under VRM Class I and II (357,802 acres) than the other action alternatives.

Impacts from Alternative C

Alternative C would have more long-term, beneficial impacts to visual resources than Alternative D, but less than Alternatives A and B, because 67,962 acres would be designated under VRM Class I and II objectives.

Impacts from Alternative D

When comparing the action alternatives, Alternative D would have the lowest degree of long-term beneficial impacts on visual resources because the least area would be proposed for visual resources preservation under VRM Class I and II (48,263 acres); it would be more adverse to long-term preservation of scenic quality and visual resources than the No Action Alternative because fewer acres would be preserved under VRM Class II objectives.

Impacts of Other Resource Actions on Visual Resources

As mentioned in the Methods and Assumptions subsection above, one of the major assumptions for analysis of visual resources is that proposed resource actions and activities, at both the programmatic and project levels, within an area with a designated VRM class must conform to and not exceed the visual resource objectives permitted under that VRM class. These constraints are described above in the Methods and Assumptions subsection. For example, if a scenic ACEC within the planning area is designated as having VRM Class II objectives, then all minerals leasing, minerals exploration and development projects, recreational infrastructure development, travel route designations and maintenance, utility ROWs construction, or any other surface disturbances must be constructed and/or the effects of construction mitigated so that they meet the long term VRM Class II objectives of the ACEC.

But it should be noted that these resource activities, whether they take place within VRM Class II, III, or IV areas, would still have some surface-disturbance-related impacts and produce changes to scenic quality and visual sensitivity because of the inevitable short- and long-term disturbances caused by human presence, equipment, and/or vehicles. Some form, line, color, and textures alterations would be produced.

4.2.10.2.2 Resources Eliminated from Further Impact Analysis

Cultural Resources – Cultural actions include the development of management plans to protect cultural resource complexes and sites, mitigate damage to cultural resources, and nominate eligible sites for the NRHP. Management actions would also solicit research for identification, monitoring, and data gathering of cultural resources. These actions would have no direct impact on visual values because there are no specific actions that affect an area’s visual sensitivity or scenic quality.

Paleontological Resources – These resource actions include stipulations on the collection of vertebrate and invertebrate fossils, which would not affect visual values because public fossil collecting would not cause obvious surface disturbances nor change an area’s visual contrasts, sensitivity, or scenic quality.

Water Resources – Water resources actions would evaluate flood hazards in the planning area and seek to reduce flood risks, watershed management plans would be developed, water rights would continue to be acquired as needed to continue public land management, and injection wells would not be permitted in freshwater aquifers. There would be no impact on visual values because these actions would not alter the landscape.

Air Quality – Under all of the alternatives, management actions would require that the CFO continue to meet U.S. Environmental Protection Agency (EPA)-based air quality standards. This would have no impact on visual values because the regulations are currently enforced and would continue to be enforced in the future.

Cave and Karst – Management actions under all of the alternatives would protect cave and karst resources and the area's immediately surrounding cave entrances. These actions would not affect visual values because the resource is underground.

Health and Safety – Management actions for this resource focus on buried and unburied pipelines, subsidence, increased traffic, and on protecting the public from toxic releases of hydrogen sulfide gas and explosive gases. These actions would not affect visual values because the actions are proposed to protect human health, and thus are not related to landscape scenic quality or visual sensitivity.

Land Tenure – Management actions would acquire easements, acquire and/or exchange lands, and withdraw or dispose of lands within the planning area. These actions would have no impact on visual values, visual sensitivity, or scenic quality at the RMP programmatic level of analysis.

Noxious Weeds – Actions common to all of the alternatives would follow BLM management prescriptions for treating noxious and invasive weed species with herbicides, and mechanical methods. These actions would have no impacts on visual resources in the long term because they would not change visual values, long term scenic quality, or the public's sensitivity to landscapes.

The effects of other resource management actions and activities on visual resources are described below.

4.2.10.2.3 Impacts of Minerals Actions on Visual Resources

Impacts Common to All Alternatives

The construction of minerals-related surface disturbances, infrastructure, roads, well heads, and transmission pipelines, where permitted within VRM Class II, III and IV areas, under the No Action and all of the action alternatives would adversely reduce the visual sensitivity of BLM-administered and other federally managed lands, state-owned, and privately owned landscapes and adversely reduce the scenic quality of those landscapes within the planning area. This would occur because, while activities must comply with the designated VRM objectives, lands adjacent to areas open to minerals activities (that may have higher VRM objectives) would also be affected. As discussed in the Trends subsection of Visual Resources in Section 3.2.11.3, industrial development (including minerals exploration and extraction) are major modifiers of the landscape within the planning area on BLM-administered and private lands. The trend indicates a continuing adverse reduction in scenic quality and a decline in visual sensitivity in the long term, creating an increasing (and adverse) scarcity of high scenic quality landscapes within the planning area.

4.2.10.2.4 Impacts of Wildland Fire Actions on Visual Resources

Under all of the action alternatives and the No Action Alternative, prescribed fires and controlled wildland fires would have short-term and long-term impacts on visual resources. In the short-term, fires would create strong line, color, and texture contrasts within the burned areas and on the surrounding landscape. The impacts would be adverse because scenic quality would be reduced from loss of vegetation and from scorched-surface disturbances. Adverse, indirect impacts would be produced and scenic quality would be degraded until vegetation regrowth and the visible signs of firefighting became less noticeable. The long-term impacts would be beneficial because vegetation regrowth would create scenically interesting and contrasting lines, colors, and textures of burned, unburned, and different vegetation types. Beneficial impacts would also be created by increasing public sensitivity to these areas from a heightened awareness of the potential loss from wildland fire.

4.2.10.2.5 Impacts of Land Use Authorizations Actions on Visual Resources

Under the No Action Alternative and all of the action alternatives, land use authorization actions would have long term adverse impacts on visual resources. As discussed above under minerals resources, while land use authorizations (e.g., establishing ROW utility corridors, authorizations for future projects) would comply with designated VRM class objectives, the impacts on visible, surrounding landscapes that possess higher scenic quality or higher VRM objectives from constructing within the ROWs, creating high power lines or liquid mineral transmission lines, or similar authorized projects would be adverse. The adverse impacts would be a reduction in scenic quality caused by visually intrusive infrastructure and surface disturbances that impinge on the viewscapes of the surrounding landscapes.

4.2.10.2.6 Impacts of Lands with Wilderness Characteristics Actions on Visual Resources

Under all of the action alternatives, lands designated as having wilderness characteristics management levels would have three levels of management applied to them (see Table 4-22 below). The impacts on visual resources under the protection management level would be beneficial because scenic quality would be preserved and public sensitivity to these areas would likely be increased because of the relative scarcity of undeveloped landscapes within the planning area. The impacts to scenic quality under the multiple use management levels would have adverse impacts on scenic quality because surface disturbances would be allowed that would potentially degrade scenic quality. Under the No Action Alternative, no land would be protected, which would have adverse impacts on visual resources because scenic quality would be lost or degraded and visual sensitivity for these areas would likely be diminished.

Table 4-122. Acres of Lands with Wilderness Characteristics by Alternative and Management Level

Management Level	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Protects wilderness characteristics	0	66,666	47,611	5,119	1,221
Emphasizes other multiple uses while applying some protective management	0	0	18,964	30,595	0
Emphasizes other multiple uses	0	0	0	30,862	65,446

4.2.10.2.7 Impacts of Special Designations (ACECs) Actions on Visual Resources

Under all of the alternatives, ACECs would be designated for preserving natural or cultural values. The impacts to visual resources would be beneficial in the long term because, as the visual resource trend is toward further loss of and scarcity of scenic quality and high visual values within the planning area (see Section 3.2.11.3), preserving these areas would likely enhance public sensitivity.

4.2.10.2.8 Impacts of Recreation Actions on Visual Resources

All of the alternatives would maintain or create SRMAs to manage recreation activities and user groups. The impacts to visual resources would be beneficial or adverse, depending upon the targeted users and activities. There would be beneficial impacts to scenic quality and visual sensitivity in those SRMAs that limit surface disturbances from OHV use, manage for scenic quality preservation, and limit infrastructure development. There would be adverse impacts in SRMAs that allow surface disturbance and scenic quality degradation.

4.2.10.2.9 Impacts of Backcountry Byways Actions on Visual Resources

Management actions under the No Action Alternative and Alternatives A, B, and C would maintain the landscapes along the 55-mile Guadalupe Backcountry Byway by designating the area for preservation of visual values (under VRM Class II objectives). This would be beneficial to visual resources because scenic quality would be maintained and visual sensitivity would likely be increased for sightseers traveling along this route. Alternative D would have potentially adverse impacts on visual resources because VRM Class III would be designated for landscapes along the route, which would permit moderate surface disturbances that would degrade the surrounding landscapes.

Management actions under the No Action Alternative would not designate the Dark Canyon Backcountry Byway and would manage the area under VRM Class III and Class IV objectives. The impacts would be adverse for visual resources by allowing moderate to major surface disturbances to degrade scenic quality. Under Alternatives A and B, the 9.5-mile Dark Canyon Backcountry Byway would be designated and managed under VRM Class II along a 2-mile buffer to beneficially preserve scenic quality for sightseers traveling along the route. Alternatives C actions would not designate a byway, but VRM Class II would be designated along a 0.5-mile buffer to beneficially protect foreground scenic quality. Alternative D management actions would not designate a byway within the canyon and would manage a one-mile buffer along the road under VRM Class III objectives to allow moderate, adverse surface disturbances to scenic quality.

4.2.10.2.10 Impacts of Livestock Grazing on Visual Resources

Under all of the alternatives, acreage would be managed as either open or closed to livestock grazing. Closed areas would have long-term, beneficial impacts on scenic quality and visual sensitivity because surface disturbances would be reduced, scenic quality would be preserved, and a higher degree of naturalness would be maintained. Areas open to livestock grazing would be potentially adverse for visual resources because of increased soil erosion from soil disturbances and vegetation loss.

4.2.10.2.11 Impacts of Renewable Energy Actions on Visual Resources

Management actions common to all alternatives would adopt the BMPs and programmatic policies in the Wind and Solar Energy EIS Records of Decision (BLM 2012a; National Renewable Energy Laboratory [NREL] 2012). These actions would, at the programmatic level of analysis, have no impact on visual resources. However, under Alternatives A through D, the encouragement of wind energy development in existing or planned areas of surface disturbance, such as transmission corridors, would be beneficial in the long term for visual resources because scenic quality would be maintained by the concentration of wind energy projects in areas where VRM class objectives allow major changes to the landscape.

4.2.10.2.12 Impacts of Riparian Actions on Visual Resources

The No Action Alternative and Alternatives A, B, and C would either prohibit or restrict OHV use in riparian areas, and other surface disturbances would be limited, including minerals development. These actions would be beneficial for visual resources by preserving riparian areas and enhancing scenic quality because surface disturbances would be managed for minimal impact. Alternative D would have less beneficial impacts on visual resources because OHV use in these areas is unspecified.

4.2.10.2.13 Impacts of Special Designations (WSRs and WSAs) on Visual Resources

The impacts of management actions that would designate river segments for WSR status would have beneficial impacts on visual resources because the scenic quality along both sides of designated segments would be maintained for their scenic or wild characteristics. Also, preservation of river segments would likely increase public sensitivity to these areas because of their rarity within the planning area.

Under all of the alternatives, the four WSAs within the planning area would continue until Congress releases these areas from wilderness review. Maintaining these special designation areas in an unimpaired condition would continue to be beneficial to visual resources in the long term because the pristine, natural condition of the WSAs would be maintained

4.2.10.2.14 Impacts of Travel and Travel Management Actions on Visual Resources

Under all of the travel management alternatives OHV travel throughout the planning area would either be limited or closed. Scenic quality under the No Action and the action alternatives would be beneficially maintained and improved by both restricting OHV use to trails and by closing areas to OHV use.

4.2.10.2.15 Impacts of Vegetation Actions on Visual Resources

Actions for all of the alternatives would include protecting trees within migratory and threatened and endangered bird habitat, rangeland restoration would continue in order to maintain and improved habitat for wildlife, and vegetation treatments would include chemical, mechanical, and fire. The impacts to visual resources from these actions would be both adverse and beneficial. The adverse short-term impacts of vegetation treatments are discussed in the Wildland Fire subsection above. The long-term impacts would be beneficial, caused by maintaining wildlife habitat and by treatment-improved wildlife habitat that would increase and maintain scenic quality. Viewer sensitivity would likely increase in these areas, as the visual trend indicates a continuing loss of scenic quality from encroachment of minerals and agricultural development.

4.2.10.2.16 Impacts of Fish and Wildlife Actions on Visual Resources

Under the No Action Alternative and Alternatives C and D, the Birds of Prey Grasslands would be open to renewable energy development projects and to minerals leasing. Surface disturbances from these activities would adversely degrade the area’s scenic quality and reduce visual sensitivity for the area. Under Alternatives A and B, the area would be designated as the 349,355-acre Birds of Prey Grasslands ACEC to preserve bird habitat. Minerals leasing would be restricted, and well pads would be reclaimed, which would benefit visual resources by reducing potential surface disturbances and maintaining and enhancing scenic quality.

4.2.11 Air Resources

This section describes the potential impacts to air resources from the implementation of the proposed CFO management alternatives. The evaluation of air resources included:

- near-field and far-field analyses of potential air quality impacts from proposed mineral development, other emission sources, and potential mitigation measures;
- evaluation of proposed mineral development on global climate change; and
- impacts of other resource management actions on air quality where applicable

These analyses are described in the following discussion. Existing conditions concerning air quality are described in Section 3.2.12. The impacts of water, karst, cultural, paleontology, land use, land tenure, riparian, recreation, visual resources and special designations would have negligible impacts on air quality and will not be discussed further in this section.

4.2.11.1 Analysis Methods

The Air Resources Technical Support Document (ARTSD) (URS 2013) describes the data and methodologies used to analyze potential near-field and far-field air quality impacts resulting from future oil and gas development and other sources in the planning area. The goals of the ARTSD are to predict air quality impacts using appropriate models, explain the modeling results, and identify any significant differences among potential oil and gas development alternatives. Additionally, greenhouse gas (GHG) emissions were estimated and compared to existing GHG inventories.

The ARTSD study area focuses on New Mexico’s Permian Basin and the planning area for other BLM-administered resources. For regional air quality impacts, the study area extends beyond the CFO planning area and New Mexico borders. The three nested domains used in the regional analyses are shown in Figure 4-1 (CFO 4 km, CFO 12 km, and continental U.S. [CONUS]). The study analyzes activities occurring or projected to occur on BLM-administered lands, but also includes emissions and impacts from sources not located on BLM-administered lands.

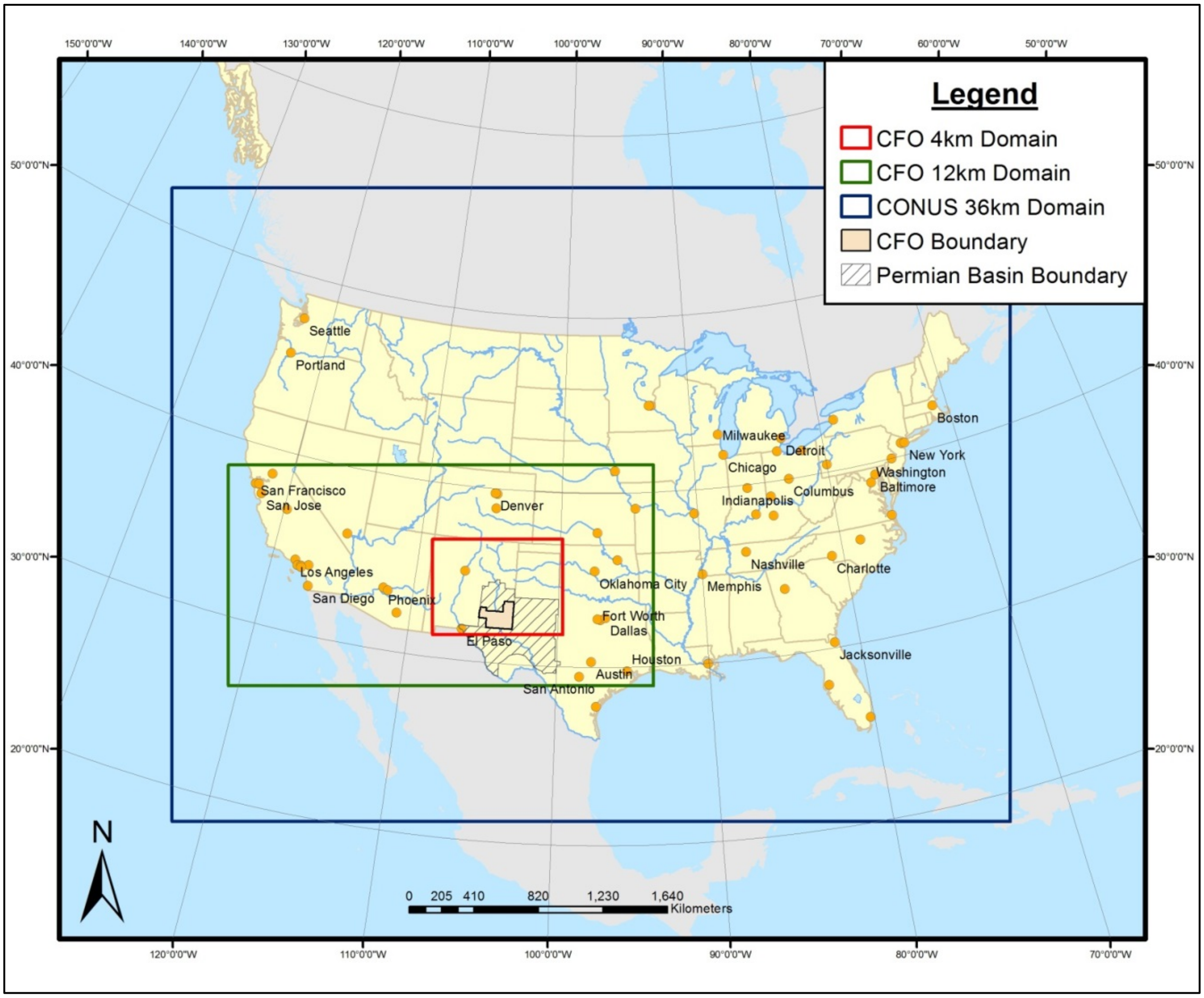

Figure 4-1. Regional Model Domains

The ARTSD focuses on emissions and potential air quality impacts due to oil and gas RFD within the CFO planning area. Up to 15,644 new oil and gas wells could be developed with approximately 3,538 to 6,044 of those wells being developed on federal mineral estate during the 20-year planning horizon. Development of several additional natural gas plants may also occur in the planning area. These values reflect the maximum level of development that can be expected during this time period. Emissions from one CFO RFD mining project are also included in this analysis for determining total CFO multiple resource RFD impacts.

4.2.11.1.1 Indicators

Section 3.3.12, Air Resources, identifies several indicators for evaluation of oil and gas development impacts on air resources: comparison of predicted concentrations to National Ambient Air Quality Standards (NAAQS), New Mexico Ambient Air Quality Standards (NMAAQS), and Prevention of Significant Deterioration (PSD) increments; predicted impacts on Air Quality Related Values (AQRVs); and comparison of predicted hazardous air pollutant (HAP) concentrations to health exposure levels. Action alternatives that are compliant with the NAAQS are assumed to be protective of human health and the environment. A predicted threshold exceedance of an AQRV means that an adverse impact could occur. A predicted exceedance of known health exposure levels means that an adverse impact could occur. The near-field and far-field modeling results were used for the analysis of management impacts.

4.2.11.1.2 Methods and Assumptions

Management actions associated with each of the resources are discussed below. With the exception of mineral actions, emission inventories have not been developed for each of the resources. Inventories were developed for regional and oil and gas sources, but these inventories were not related to specific resources. In addition, the far-field modeling results do not contain detailed results by emission source. Consequently, only a qualitative analysis was performed for each of the other resources.

The assumptions considered for analysis include the following:

- The hypothetical near-field source analyses are a conservative estimate of impacts from oil and gas development. Near-field ambient air models of criteria pollutants and HAPs were created with AERMOD to assess potential impacts from oil and gas related construction and production activities. To estimate potential near-field emissions, 49 facilities within a 2 × 2–mile area were grouped together for AERMOD modeling under two scenarios.
- For the far-field analysis, the CAMx photochemical grid model analyses are a conservative estimate of impacts to ambient ground-level concentrations resulting from air emissions in the planning area.
- The base year is 2008 and the emission inventory was developed to portray emissions at various temporal and spatial scales.
- The future year analyzed is 2028. The 2017 base case inventory was assumed to represent 2028 emissions for the No Action Alternative.
- Two modeling scenarios (alternatives) were performed as a part of this analysis. The first scenario includes the future year base case emissions, plus the BLM oil and gas emissions inventory on-the-books emissions control regulations. The second scenario includes all the sources and controls in the first scenario, plus accounts for additional BLM-approved emissions controls in the planning area for oil and gas sources. The first scenario is assumed to represent Alternatives C and D, and the second scenario is assumed to represent Alternatives A and B. Both scenarios contained emissions from 10,117 active BLM oil and gas wells and 20,379 non-BLM oil and gas wells. The maximum number of wells in the modeling analysis for the planning area is much greater than the number of wells projected for the planning area (3,538 to 6,044 wells on BLM-administered lands and 9,600 wells on non-BLM-administered lands).

4.2.11.2 Direct and Indirect Impacts

Both direct and indirect impacts to air resources occur primarily as the result of oil and gas development and other surface- and subsurface-disturbing activities in the planning area. Emissions increases resulting from construction and operation of the facilities are direct impacts. Indirect impacts include increased traffic throughout the planning area and combustion of the oil and gas. Potential impacts to air resources associated with oil and gas development are discussed in greater detail below in the Minerals section.

Many of the resource areas have proposed management and travel-related decisions that limit or reduce surface and vegetation disturbance, increase vegetation and habitats, limit or reduce OHV and other off-trail access, and improve existing roadway and trail surfaces. To the extent that these decisions reduce emissions, there may be an insignificant positive impact on air quality. With the exception of mineral actions, each of the resource management actions is analyzed in a qualitative fashion in separate sections below.

4.2.11.3 Impacts of Air Quality Actions

Chapter 2 identifies actions specifically designed to manage activities and development within the planning area to protect and improve air quality and, within the scope of the BLM's authority, minimize emissions that 1) cause or contribute to violations of air quality standards, 2) that negatively impact AQRVs, and 3) are GHGs. Management actions would reduce air resource impacts from oil and gas development on BLM-administered lands in the planning area. The following discussion presents a qualitative evaluation of air quality actions. A quantitative evaluation of air quality impacts is presented in the Impacts of Mineral Actions on Air Quality Section.

4.2.11.3.1 Impacts from Management Common to All

In total, 9,600 new oil and gas wells on non-BLM-administered lands are projected for all alternatives. The number of wells on BLM-administered lands varies by alternative. At a minimum for all alternatives, the oil and gas facilities would be required to comply with current regulatory requirements. Projected emissions common to the No Action Alternative and all development scenarios include particulate matter with an aerodynamic diameter less than a nominal 10 micrometers (PM_{10}), particulate matter with an aerodynamic diameter less than a nominal 2.5 micrometers ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs), hydrogen sulfide (H_2S), and GHGs.

While air emissions from either fracing or conventional drilling methods are generally similar, fracing has opened new opportunities for oil and gas production, and associated air emissions from construction, drilling, and operations due to the ability to extract oil and gas product in areas previously considered inaccessible or too costly. This increased opportunity for oil and gas development is reflected in the number of wells predicted. Additionally, truck traffic associated with fracing operations is higher than conventional drilling methods due to the need for water and fracing fluids. The amount of water per well varies greatly but an American Geophysical Union study provides a range for the New Mexico Permian Basin of 1,001–10,000 m^3/well (264,426–2,641,721 gallons/well) (AGU 2015). This water would be trucked or piped in. Emission sources associated with oil and gas development include fugitive dust and vehicle exhaust emissions from construction, drilling (hydraulic fracturing and conventional), and operations; vehicle travel and reclamation activities; fuel combustion emissions from drilling, completions, compressor and oil pump engines, flares, combustors, and heaters; and VOC and HAP emissions from glycol dehydrators, storage tanks, process piping fugitive emissions from facility components, pneumatic controllers, natural gas venting, and other ancillary sources. Other emission sources considered in the air quality analyses include stationary area sources, non-road mobile sources, on-road mobile sources, non-oil and gas point sources, and biogenic sources.

The following regulatory requirements apply to all alternatives:

Each existing and new oil and gas facility is required to submit a NOI or Construction Permit Application to the New Mexico Environment Department (NMED) if potential emissions of any regulated air contaminant exceed 10 tons per year.

New and modified centrifugal or reciprocating compressors at gas gathering and boosting stations, well sites, and gas processing plants would be required to meet the requirements of applicable EPA and NMED requirements and standards. These requirements would reduce VOC and HAP emissions by a significant amount for all alternatives, compared to compressors constructed or modified prior to August 23, 2011.

New and modified natural gas sweetening units at natural gas processing plants would be required to meet the requirements of applicable EPA and NMED regulations addressing emissions from sweetening units. These requirements would reduce SO_2 emissions from the sweetening units at the facilities by a significant amount for all alternatives, compared to sweetening units installed prior to August 23, 2011.

New drill rig and fracturing pump engines would be required to meet current New Mexico and EPA Tier 4 Nonroad Diesel Engine Emission Standards.

Operators must comply with all applicable EPA NSPS regulations, including those limiting emissions during well completions. Operators must also comply with all applicable BLM regulations pertaining to the venting and flaring of gas.

Hydrocarbon storage tanks are required to meet the requirements of New Mexico Administrative Code (NMAC) 20.2.38 Hydrocarbon Storage Facilities.

Fugitive emissions which is the collection of fugitive emissions components at well sites or compressor stations, would be required to meet the requirements of applicable EPA and NMED regulations. These requirements would address GHG and VOC emissions from the fugitive components.

Equipment leak emissions at onshore natural gas processing plants, would be required to meet the requirements of applicable EPA and NMED regulations. These requirements would address GHG and VOC emissions from leaking components.

Glycol dehydrators located at well sites, gathering and boosting stations, gas processing plants, and natural gas transmission stations would be required to meet applicable National Emission Standards for Hazardous Air Pollutants (NESHAP) for Oil & Natural Gas Production (40 CFR Part 63, Subpart HH).

Diesel engines and natural gas fired engines would be required to meet the applicable NESHAP for Stationary Reciprocating Internal Combustion Engines (40 CFR Part 63, Subpart ZZZZ), Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (40 CFR Part 60, Subpart IIII), or Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (40 CFR Part 60, Subpart JJJJ), as applicable based on engine type and date of manufacture.

4.2.11.3.2 Impacts from Management Common to All Action Alternatives

The following management actions are common to all action alternatives.

- During drilling, socks should be put on vent lines when transferring cement from bulk trucks to silos and when blowing down silos into bulk trucks. This management action would reduce particulate emissions during drilling activities.
- Existing drill rig, completion rig, work-over rig, and fracturing pump engines would be required to meet current New Mexico and within 1 year of the ROD, EPA Tier 4 Nonroad Diesel Engine Emission Standards. Because the Tier 4 standards would be applied to existing engines, this management action would further reduce NO_x, VOC, and particulate emissions below levels required by current regulations. Tier 4 regulations also require a reduction in fuel sulfur content to 15 parts per million; however, this reduced sulfur content is currently widely used and is therefore, expected to have minimal further impact to ambient sulfur reductions.
- The actions authorized on BLM-administered land and federal minerals would comply with the Clean Air Act and State Implementation Plan requirements,and would follow BMPs to ensure air quality is maintained below NAAQS/NMAAQS thresholds. The BLM would evaluate effects to air quality at the activity planning level and prepare detailed monitoring and mitigation prescriptions for proposals that could degrade air quality.
- VRUs would be required on new wells and production facilities on a case-by-case basis as determined by the BLM. A VRU is effective in controlling emissions when there is sufficient and consistent gas flow. If the flow is insufficient, the VRU would be less effective or not effective for controlling emissions. This action would require controls for facilities that otherwise would not need additional controls under current regulatory requirements. This action would reduce GHGs, VOCs, and HAPs by a significant amount for facilities with sufficient flow when compared to current regulatory requirements and the No Action Alternative.

4.2.11.3.3 Impacts from the No Action Alternative

Under the No Action Alternative, existing management under the current 1988 Carlsbad RMP as amended in 1997 and 2008 would be continued. Oil and gas activity would continue and increase with the addition of 5,874 new wells projected on BLM-administered lands. Other emission sources considered in the air quality analyses include stationary area sources, non-road mobile sources, on-road mobile sources, non-oil and gas point sources, and biogenic sources. Stipulations would be incorporated into project proposals to meet air quality standards.

4.2.11.3.4 Impacts from Alternative A

Under Alternative A, 4,465 new wells on BLM-administered lands are projected, 1,409 fewer than for the No Action Alternative. The following management actions require additional controls to decrease emissions.

Vapor recovery units (VRUs) would be required on all new wells and production facilities. A VRU is effective in controlling emissions when there is sufficient and consistent gas flow. If the flow is insufficient, the VRU would be less effective or not effective for controlling emissions. This action would require controls for facilities that otherwise would not need additional controls under current regulatory requirements. This action would reduce GHGs, VOCs, and HAPs by a significant amount for facilities with sufficient flow, when compared to current regulatory requirements and the No Action Alternative.

New and existing drill rig, completion rig, work-over rig, and fracturing pump engines would be required to meet EPA Tier 4 Nonroad Diesel Engine Emission Standards or equivalent emission standards, regardless of when they begin operation in the planning area or when the engine was constructed. For existing engines, this requirement would be effective 1 year of the ROD. This action would reduce exhaust emissions from the engines that would otherwise not be required to meet the more stringent EPA Tier 4 standards but would have no effect on those that are already subject to those standards. This action would therefore significantly reduce exhaust emissions as compared to the No Action Alternative.

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During construction activities (including well drilling, completion, and work-over), twice daily watering (or equivalent) of construction areas and associated resource roads would be required to prevent at least 50% of fugitive dust from vehicular traffic, equipment operations, or wind events. The Authorized Officer may direct the operator to change the level and type of treatment if dust abatement measures are observed to be insufficient to prevent fugitive dust. In addition, fugitive dust control plans would be required. These requirements would reduce particulate emissions during construction by a significant amount as compared to the No Action Alternative.

Emission controls such as vapor recovery, flare, or other combustion device would be required for oil tanks, condensate tanks, and produced water tanks, without regard to the quantity of uncontrolled VOC emissions from the equipment. VOC and HAP emissions from oil tanks, condensate tanks, and produced water tanks would be reduced by at least 95% from uncontrolled emission levels. Low emitting tanks are often difficult to control effectively due to low or inconsistent oil throughputs and a flare or other combustion device may be the only feasible control option. Combustion controls would reduce VOC and HAP emissions, but would add NO_x and carbon monoxide (CO) emissions. Therefore, this action would likely provide significant VOC and HAP emission reductions for tanks not otherwise controlled as compared to the No Action Alternative, but may increase NO_x and CO emissions, with the greatest benefit coming from emission reductions on older high emitting tanks.

In addition to EPA NESHAP (40 CFR Part 63, Subpart HH) applicable to glycol dehydrators, emission controls would be required for glycol dehydrators, without regard to the location of the equipment or the quantity of uncontrolled VOC emissions from the equipment. VOC and HAP emissions from glycol dehydrators would be reduced by at least 95% from uncontrolled emission levels for dehydrators that would otherwise not be subject to control requirements. The greatest emission reductions would likely be seen at oil and gas production facilities, which often have small dehydrators (less than 3 million standard cubic feet per day), and at facilities with dehydrators that are otherwise only regulated at facilities that are major sources of HAPs (ethylene glycol and diethylene glycol dehydrators). This management action is expected to have less of a benefit at compressor stations and natural gas processing plants because many dehydrators at these facilities already have regulatory control requirements, although 95% control is frequently not required. To achieve 95% control of VOC and HAPs, a flare or other combustion device is often required. Combustion controls would reduce VOC and HAPs emissions, but would add NO_x and CO emissions. When compared to current regulatory requirements and the No Action Alternative, this management action would decrease VOC and HAP emissions but may increase NO_x and CO emissions.

At least 70% of gas compression at compressor stations (gathering, boosting, transmission, and gas plants) and gas and oil well head pumps would be powered by electricity. Any new electricity transmission lines would be buried underground in existing ROWs. This requirement would reduce exhaust emissions from compressor and pump engines by 70% because the compressors and pumps would otherwise be driven by natural gas-fired engines.

4.2.11.3.5 Impacts from Alternative B

Under Alternative B, 3,538 new wells on BLM-administered lands are projected, 2,335 fewer than for the No Action Alternative.

The management actions under Alternative B are identical to those described above under Alternative A. A small incremental positive impact on air quality is expected for Alternative B due to 927 fewer wells as compared to Alternative A. Similar to Alternative A, a positive air quality impact is expected as compared to the No Action Alternative due to management actions that are above and beyond the federally mandated requirements.

4.2.11.3.6 Impacts from Alternative C

Under Alternative C, 5,832 new wells on BLM-administered lands are projected, 41 fewer than for the No Action Alternative.

Overall, certain equipment at the oil and gas facilities would be required to meet regulatory requirements in both the No Action Alternative and Alternative C. Because fewer wells are projected for Alternative C, there may be a significant air quality benefit between the two alternatives.

4.2.11.3.7 Impacts from Alternative D

Under Alternative D, 6,044 new wells on BLM-administered lands are projected, 170 more than for the No Action Alternative.

Overall, certain equipment at the oil and gas facilities would be required to meet regulatory requirements in both the No Action Alternative and Alternative D, resulting in no significant air quality benefit between the two alternatives for each facility. Because more wells are projected for Alternative D, there may be a small negative impact under Alternative D, compared to the No Action Alternative. Local atmospheric dispersion characteristics such as elevation differences would contribute, either negatively or positively, to the impacts from the additional wells as compared to air quality standards.

4.2.11.4 Impacts of Soils Actions on Air Quality

Management actions for soils (Appendix L) are generally projected to result in increased vegetation (density and height) and lower overall surface/soil disturbance and wind and water surface erosion.

Proposed management decisions generally include limiting surface occupancy on open dunes and unsuitable slopes, reclaiming disturbed sites in sensitive areas, increasing vegetation cover, and lowering overall surface/soil disturbance. Direct air quality impacts from soils actions would likely be small and most noticeable in a cumulative fashion when coupled with other management actions. Potential effects from these management decisions include improved vegetative cover in many areas.

Short-term benefits to air quality would most likely not be measurable in the overall planning area. Long-term benefits would include incremental site-specific reductions in windborne particulate from reduced erosion of exposed soils as vegetation improves over time.

4.2.11.5 Impacts of Fish and Wildlife Actions, Special Status Species, Vegetation and Noxious Weeds and Invasive Species on Air Quality

Management actions for fish and wildlife are generally projected to result in increased vegetation composition, cover, production, lower overall surface/soil disturbance, and wind and water surface erosion as habitat is improved. Direct air quality impacts from vegetative community actions would likely be small and most noticeable in a cumulative fashion when coupled with other management actions. Potential effects from these management decisions include improved vegetative cover in many areas.

Short-term benefits to air quality would most likely not be measurable in the overall planning area. Long-term benefits would include incremental site-specific reductions in windborne particulate from reduced erosion of exposed soils as vegetation improves over time.

4.2.11.6 Impacts of Wildland Fire and Fuels Management Actions on Air Quality

It is estimated that 19,500 acres of vegetation would be subject to prescribed burning each year. Short-term air quality effects projected from prescribed burns include a general increase in particulate matter and CO emissions specific to the burn area and locations downwind. The magnitude of increase is directly dependent on the size, extent, and controlled level of the burn. The type and amount of air pollutants released from burning wildland vegetation varies with type of fuel, moisture content, temperature of the fire, and the amount of smoldering occurring after the fire. Because prescribed burning occurs irregularly, it is generally possible to restrict burning on "bad air quality days" to avoid violating air quality standards.

Long-term direct air-quality effects projected from prescribed burns include a general increase in airborne particulate materials from the burn site as a result of ash dispersion and transport. This increase would occur only until revegetation is complete and growth matures.

Short- and long-term indirect effects on air quality from prescribed burns include an increase in airborne particulates from the burn sites as a result of wind-based erosion of devegetated areas. This effect is expected to be small, as vegetation management is an active part of fire management techniques. A greater long-term effect of prescribed burning is a reduction in particulate, CO, methane, and nitrous oxide emissions specific to wildfire in unmanaged areas.

Wildfire emissions were included in the air quality analysis using 2008 emission estimates. The detrimental effects from wildfire would likely be greater than those from prescribed fire and exert a larger negative effect on air quality.

4.2.11.7 Impacts of Lands with Wilderness Characteristics Actions on Air Quality

4.2.11.7.1 Impacts from Management Common to All

There are no air quality impacts common to all alternatives.

4.2.11.7.2 Impacts from Management Common to All Action Alternatives

There are no air quality impacts common to all action alternatives.

4.2.11.7.3 Impacts from the No Action Alternative

Under the No Action Alternative, there would be no units managed as lands with wilderness characteristics.

4.2.11.7.4 Impacts from Alternative A

Under Alternative A, 66,666 acres would be managed to protect wilderness characteristics. Eliminating these acres from construction of new roads and the associated vehicle traffic would reduce particulate and exhaust emissions in the planning area compared to the No Action Alternative.

Of the Action alternatives, Alternative A has the largest area to be managed as lands with wilderness characteristics, with more than 1.4 times the acreage of Alternative B, more than 10 times the acreage of Alternative C, and 52 times the acreage of Alternative D. Alternative A is therefore, the most favorable to air quality with respect to managed acreage to protect lands with wilderness characteristics. While there is likely not a direct correlation of managed acreage to beneficial air quality impacts, it is expected that the more acreage that is managed as lands with wilderness characteristics, the greater the local beneficial impact due to reduced surface disturbance.

4.2.11.7.5 Impacts from Alternative B

Under Alternative B, 47,611 acres would be to protect wilderness characteristics. Impacts relative to acres managed is discussed above in Impacts from Alternative A.

4.2.11.7.6 Impacts from Alternative C

Under Alternative C, 5,119 acres would be managed to protect wilderness characteristics. Impacts relative to acres managed is discussed above in Impacts from Alternative A.

4.2.11.7.7 Impacts from Alternative D

Under Alternative D, 1,221 acres would be managed to protect wilderness characteristics. Impacts relative to acres managed is discussed above in Impacts from Alternative A.

4.2.11.8 Impacts of Minerals Actions on Air Quality

The air quality impacts of mineral actions oil and gas development and one mining project on air quality are described below for the near- and far-field modeling analyses.

4.2.11.8.1 Impacts from Management Common to All

There are no BLM management actions common to all alternatives. Each existing and new oil and gas facility is required to submit a NOI or Construction Permit Application to the NMED if potential emissions of any regulated air contaminant exceed 10 tons per year.

4.2.11.8.2 Impacts from Management Common to All Action Alternatives

There are no management actions common to all alternatives.

4.2.11.8.3 Impacts from the Alternatives

The detailed evaluation of impacts from the No Action and action alternatives is presented below.

Near-Field Analysis

Modeling Methodology

The EPA's recommended guideline model, AERMOD (version 12060), was used to assess near-field impacts. Near-field modeling predicted long- and short-term averaged ambient concentrations for the following criteria pollutants: CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$. HAP concentrations and potential human health risk were estimated for benzene, ethylbenzene, formaldehyde, n-hexane, toluene, and xylenes. In addition, H_2S and total suspended particulate (TSP) concentrations were estimated to address the NMAAQS.

The following list highlights some of the assumptions and methodologies that were applied for the near-field modeling assessment:

- Near-field modeling was not performed for each action alternative. Modeling was performed based on reasonable emissions that could conceivably occur under a restrictive combination of emissions scenarios.
- Near-field modeling was completed for two "typical" near-field (approximately 4-square-mile area) clustered oil and gas layouts. These two analyses were performed because of the clustered oil and gas development that can currently be found in near-field sections (approximately 4-square-mile area) in the Permian Basin: one with minimal natural gas operations (i.e., mostly oil wells), and then a balanced oil and gas scenario (~50% oil and ~50% gas) that can be found within the basin.

The available air quality monitoring data collected in and near the planning area were used to compare changes in air quality contributed by the modeled emission sources. Detailed information on the air quality modeling techniques employed, parameters utilized, and meteorological conditions incorporated is presented in the ARTSD (URS 2013).

Near-Field Assessment of Air Quality Impacts

The maximum predicted concentrations are shown in Table 4-123 and Table 4-124. For all near-field modeled criteria pollutants and averaging times, predicted near field concentrations are below the NAAQS and NMAAQS. The model-predicted 24-hour TSP concentrations are close to the NMAAQS, but do not exceed the standard.

Near-field HAP modeling was based on the same source and receptor layouts as for criteria pollutants. Short-term (1-hour) average HAP concentrations were compared to acute Reference Exposure Levels (RELs). RELs are defined as concentrations at or below which no adverse short-term health effects are expected. No RELs are available for ethylbenzene and n-hexane; instead, the Immediately Dangerous to Life or Health values divided by 10 (IDLH/10) were used.

As shown in the Table 4-125, HAP maximum 1-hour concentrations (with inclusion of background concentrations) are well below the REL or IDLH/10 reference concentrations.

Long-term maximum potential exposure to HAPs is compared to Reference Concentrations for Chronic Inhalation (RfCs) in Table 4-126. An RfC is defined by the EPA as the daily inhalation concentration at which no long-term adverse health effects are expected. RfCs exist for both carcinogenic (cancer causing) and non-carcinogenic effects on human health.

Only benzene and formaldehyde are suspected to be carcinogenic. RfCs for these HAPs are expressed as unit risk factors (URFs) and are shown in Table 4-127. Accepted methods for risk assessment were used to evaluate the incremental cancer risk for these pollutants. A cancer risk range of 1 in a million to 100 in a million (10^{-6} to 10^{-4} risk) is generally acceptable. Cancer risks for each individual HAP and for combined exposure to both HAPs for both most likely exposure (MLE) and maximally exposed individual (MEI) are within or below this range.

Table 4-123. Gaseous Maximum Predicted Concentrations

Criteria Pollutant	Avg. Period	Oil Wells Scenario Concentration (μg/m^3)			Balanced Scenario Concentration (μg/m^3)			Ambient Standard (μg/m^3)	
		Modeled	Background	*Total*	Modeled	Background	*Total*	NAAQS	NMAAQS
CO	1-hour	1,356.1	2,400	***3,756***	1,356.1	2,400	***3,756***	40,000	14,971
CO	8-hour	959.8	1,667	***2,627***	960.0	1,667	***2,627***	10,000	9,667
NO_2	1-hour	110.4	56.6	***167***	110.5	56.6	***167***	189	N/A
NO_2	Annual	12.8	5.7	***19***	12.9	5.7	***19***	100	N/A
SO_2	1-hour	35.5	52.8	***88***	35.5	52.8	***88***	196	N/A
SO_2	3-hour	34.8	13.8	***49***	34.8	13.8	***49***	1,300	N/A
H_2S	0.5-hour	74.8	N/A	***75***	46.1	N/A	***46***	N/A	141

μg/m^3 – micrograms per cubic meter.

Table 4-124. Particulate Matter Maximum Predicted Concentrations

Criteria Pollutant	Avg. Period	Oil Wells Scenario Concentration (μg/m^3)			Balanced Scenario Concentration (μg/m^3)			Ambient Standard (μg/m^3)	
		Modeled	Background	*Total*	Modeled	Background	*Total*	NAAQS	NMAAQS
PM_{10}	24-hour	45.5	51.9	***97***	45.7	51.9	***98***	150	N/A
$PM_{2.5}$	24-hour	3.4	16.9	***20***	3.4	16.9	***20***	35	N/A
$PM_{2.5}$	Annual	0.05	6.2	***6.3***	0.1	6.2	***6***	12	N/A
TSP	24-hour	87.2	61.5	***149***	87.8	61.5	***149***	N/A	150
TSP	Annual	0.7	28.1	***29***	0.9	28.1	***29***	N/A	60

μg/m^3 – micrograms per cubic meter.

Table 4-125. 1-Hour Hazardous Air Pollutant Maximum Concentrations Comparison to Reference Exposure Levels

HAP	Oil Wells Scenario Concentration (μg/m^3)			Balanced Scenario Concentration (μg/m^3)			REL (μg/m^3)
	Modeled	Background	*Total*	Modeled	Background	*Total*	
Benzene	16.2	110.1	***126***	32.4	110.1	***143***	1,300
Ethylbenzene	1.0	149.2	***150***	0.7	149.2	***150***	350,000
Formaldehyde	16.6	15.2	***32***	16.6	15.2	***32***	94
n-Hexane	3,016.3	544.5	***3,561***	6,055.7	544.5	***6,600***	390,000
Toluene	280.6	320.9	***602***	556.6	320.9	***878***	37,000
Xylene	273.4	N/A	***273***	541.0	N/A	***541***	22,000

μg/m^3 – micrograms per cubic meter.

Table 4-126. Annual Average Predicted Hazardous Air Pollutant Concentrations Compared to Reference Concentrations for Chronic Inhalation

HAP	Oil Wells Scenario Concentration (µg/m^3)			Balanced Scenario Concentration (µg/m^3)			RfC (µg/m^3)
	Modeled	Background	*Total*	Modeled	Background	*Total*	
Benzene	0.6	6.2	***7***	1.1	6.2	***7***	30
Ethylbenzene	0.1	3.3	***3***	0.1	3.3	***3***	1,000
Formaldehyde	1.3	3.3	***4.6***	1.3	3.3	***4.6***	9.8
n-Hexane	91.2	25.7	***117***	182.7	25.7	***208***	700
Toluene	8.6	13.2	***22***	16.9	13.2	***30***	400
Xylene	8.4	N/A	***8***	16.4	N/A	***16***	100

µg/m^3 – micrograms per cubic meter.

Table 4-127. Cancer Risk from Long-Term Exposure

HAP	Analysis	Carcinogenic RfC URF 1/(µg/m^3)	Exposure Adjustment Factor	Oil Wells Scenario Cancer Risk (in a million)	Balanced Scenario Cancer Risk (in a million)
Benzene	MLE	7.80E-06	0.095	0.4	0.85
	MEI	7.80E-06	0.29	1.2	2.58
Formaldehyde	MLE	5.5E-09	0.095	0.0	0.00
	MEI	5.5E-09	0.29	0.0	0.00
Total Combined	***MLE***	***N/A***	***N/A***	***0.4***	***0.85***
	MEI	***N/A***	***N/A***	***1.2***	***2.58***

N/A = not applicable

Far-Field Analysis

Photochemical grid modeling programs were used to assess impacts to ambient ground-level pollutants resulting from air emissions associated with the planning area. Modeling was performed using a 2008 base case year and emissions growth projections with data reflecting 2017 emissions inventories. The pollutant assessment focuses on impacts throughout the state of New Mexico and nearby surrounding states, although pollutant concentrations were predicted for the contiguous United States.

Three models were used in the planning area assessment. The CAMx photochemical grid model predicted ambient pollutant concentrations based on meteorological data inputs prepared using the Weather Research and Forecasting Model and emissions data prepared using the SMOKE emissions processing system.

The planning area pollutant assessment modeling included three nested domains (4 km, 12 km, and CONUS). The 4-km domain was the focus of the ozone modeling assessment. This domain encompasses the planning area and the entire New Mexico portion of the Permian Basin.

Future Year Emission Inventories

Each of the two future year planning area alternative emission data sets required combining the following types of emissions:

- Year 2017 non-oil and gas reasonably foreseeable future action emissions sets (e.g., mobile, biogenic, etc.)
- Year 2017 non-oil and gas RFD emissions sets
- Year 2028 planning area RMP revision emissions (oil and gas RFD)

The 2017 emission inventories were assumed to represent 2028 emission levels for the No Action Alternative. The 2028 planning area RMP revision emissions were added to the 2017 emissions to obtain the total 2028 emissions. A summary of the emission totals for the future year modeling is presented in Table 4-128. Alternatives A and B were represented by one emission data set and reflect RFD with extra management emission control requirements. Alternatives C and D were represented by a second emission data set with existing emission control requirements. Both scenarios contained emissions from 10,117 active BLM oil and gas wells and 20,379 non-BLM oil and gas wells. The maximum number of wells in the modeling analyses is much greater than the number of new wells projected for the planning area (3,538–6,044 wells on BLM-administered lands, and 9,600 wells on non-BLM-administered lands).

Table 4-128. 2028 Planning Area Emissions for Future Year Modeling

Emissions Scenario	Emissions (tpy)					
	CO	NO_X	VOC	SO_2	PM_{10}	$PM_{2.5}$
No Action Alternative	5,809	7,625	26,475	89	1,603	306
Alternatives A and B	11,014	14,833	33,865	163	2,605	515
Alternatives C and D	11,881	16,510	62,271	163	3,380	630

tpy = short tons per year

Far-Field Assessment of Predicted Ozone and $PM_{2.5}$ Impacts

Ozone

The greatest 8-hour ozone concentration increase due to RMP revision emissions alone is 2.5 parts per billion (ppb). The maximum increase occurs within the planning area. The average daily maximum ozone increase attributable to RMP revision emissions is 0.02 ppb for Alternatives C and D. The maximum difference between Alternatives A and B and Alternatives C and D is 1 ppb, and the average difference is 0 ppb.

Based on calculated design values (DVs) from the base year (2008) predicted concentrations and the future year (2028) predicted concentrations for the 31 ozone monitors in the 4-km domain, the 0.075-part-per-million (ppm) ozone NAAQS is expected to be attained at 21 of the 31 monitors in the 4-km domain for both alternatives data sets including cumulative emissions. Two of the three monitors in the planning area (Carlsbad and Carlsbad Caverns National Park) show an expected exceedance. The highest DV for all monitors (79 ppb) occurs at the Navajo Dam monitor in the Four Corners region.

To summarize, ozone impacts attributable to the RMP revision and cumulative emissions are not expected to cause or contribute to violations of the ozone NAAQS. One-third of the projected DVs in the 4-km domain are above the 75-ppb ozone NAAQS. The projected DVs for the two modeled emission data sets show little to no change from the future year No Action Alternative. In addition, modeled ozone impacts attributable to RMP revision emissions do not extend to any non-attainment areas, when comparing future year modeling results with and without RMP revision emissions.

$PM_{2.5}$

The greatest 24-hour average $PM_{2.5}$ concentration increase due to RMP revision emissions is 3.8 micrograms per cubic meter ($\mu g/m^3$). The maximum increase occurs within the planning area. The annual average $PM_{2.5}$ increase of 1.1 $\mu g/m^3$ also occurs within the planning area. The average 24-hour average $PM_{2.5}$ increase attributable to RMP revision emissions is 0.01 $\mu g/m^3$ for Alternatives C and D.

Predicted $PM_{2.5}$ concentration differences between the two modeled emission data sets occur, but are small in magnitude. The modeling results indicate that at most the difference is 1.11 $\mu g/m^3$. The average difference is 0.005 $\mu g/m^3$ for the 24-hour average. With respect to the annual average, the maximum difference is 0.3 $\mu g/m^3$.

Calculated $PM_{2.5}$ DVs (both baseline and future DVs, or DVF) have the same format as the 24-hour or annual average NAAQS and can be compared directly to the NAAQS to assess compliance. The annual average $PM_{2.5}$ NAAQS is expected to be attained at seven of the 11 monitors in the 4-km domain for modeled emission data sets including cumulative emissions. The monitor closest to the planning area shows future DVs under the standard. The greatest DV for all monitors (17.15 $\mu g/m^3$) occurs at the Odessa-Hays Elementary School monitor in Odessa, Texas.

The 24-hour average $PM_{2.5}$ NAAQS is expected to be attained at nine of the 11 monitors in the 4-km domain for both modeled emission data sets including cumulative emissions. The monitor closest to the planning area shows future values under the standard. Predicted DVs for the Alternatives A and B and Alternatives C and D for all monitors have a DVF equal to that of the future year base case. The greatest DVF for all monitors (43.4 $\mu g/m^3$) occurs at the Odessa-Hays Elementary School monitor in Odessa, Texas.

To summarize, annual average and 24-hour average $PM_{2.5}$ impacts attributable to the RMP revision and cumulative emissions are not expected to cause or contribute to violations of the $PM_{2.5}$ NAAQS. The projected DVs for the two modeled emission data sets show no change from the No Action Alternative. In addition, modeled $PM_{2.5}$ impacts attributable to RMP revision emissions do not extend to any non-attainment areas when comparing future year modeling results with and without RMP revision emissions.

Far-Field Assessment of Air Quality Impacts

Far-field assessments of air quality impacts included assessments of NO_2, CO, PM_{10}, and SO_2, as well as assessments of AQRVs. Predicted criteria pollutant concentrations were compared with applicable NAAQS and with NMAAQS when the New Mexico standards are more stringent or have different averaging times than the NAAQS. Far-field modeling results were also compared to applicable PSD Class I or II increments. These comparisons to PSD increments were made to identify potential significance and do not represent a regulatory increment consumption analysis.

NO_2

Predicted 1-hour NO_2 concentrations at Class I and sensitive Class II areas are less than 50% of the NAAQS. Nearly all project impacts are in the planning area, with the maximum impact being approximately 13 $\mu g/m^3$. The future year No Action Alternative and both modeled emission data sets have nearly identical predicted 1-hour concentrations for grid cells in all Class I and sensitive Class II areas. The lack of variation between the alternatives and the future year base case indicates that project source impacts are relatively insignificant compared to other sources in the cumulative analysis.

The EPA has not set a NAAQS for the 24-hour average; however, New Mexico has set a standard. According to NMED guidance (NMED 2011), demonstration of compliance with the 1-hour standard is a demonstration of compliance with the 24-hour New Mexico standard. Because the project impacts are below the 1-hour standard, 24-hour compliance has been demonstrated.

Project annual NO_2 impacts at Class I and sensitive Class II areas are below the NAAQS. The maximum concentration in the 4-km domain occurs in only one grid cell in the Four Corners region of New Mexico. The project impacts are almost completely within the planning area with a maximum project impact of approximately 11 $\mu g/m^3$.

PM_{10}

All of the second highest 24-hour concentration values (including background) for the Class I and sensitive Class II areas are well below the NAAQS of 150 $\mu g/m^3$. In addition, the 24-hour concentration values from project sources are below 0.3 $\mu g/m^3$ for the Class 1 and sensitive Class II areas. The project impacts are almost completely within the planning area with a maximum project impact of approximately 4 $\mu g/m^3$. The maximum concentration occurs just to the south of Albuquerque. The future year No Action Alternative and both modeled emission data sets have nearly identical predicted 24-hour concentrations for grid cells in all Class I and sensitive Class II areas. This lack of variation indicates that project source impacts are relatively insignificant compared to other sources in the cumulative analysis.

SO_2

For all averaging times the future year No Action Alternative and both modeled emission data sets have nearly identical predicted 24-hour concentrations for grid cells in all Class I and sensitive Class II areas. The lack of variation between the No Action Alternative and the modeled emission data sets indicates that project source impacts are relatively insignificant compared to other sources in the cumulative analysis.

Maximum 1-hour SO_2 values are well below the standard for all Class I and sensitive Class II areas. Cumulative 1-hour SO_2 total concentrations greater than the NAAQS are predicted for each alternative at two areas near Amarillo, Texas, and at another area in the lower panhandle of Texas. The maximum predicted concentration is 16 times the 1-hour SO_2 standard. Project only impacts are less than 0.1 $\mu g/m^3$ for both modeled emission data sets.

Maximum 3-hour SO_2 project impacts are below the PSD increment for all Class I and sensitive Class II areas in New Mexico and Texas. The NMED does not provide background values for the 3-hour average; therefore, the impacts are not compared to the NAAQS.

Maximum 24-hour SO_2 project impacts are below the PSD increment for all Class I and sensitive Class II areas in New Mexico. The NMED does not provide background values for the 24-hour average; therefore, the impacts are not compared to the NMAAQS.

Maximum annual SO_2 project impacts are below the PSD increment for all Class I and sensitive Class II areas in New Mexico. The NMED does not provide background values for the annual average; therefore, the impacts are not compared to the NMAAQS.

CO

All 1- and 8-hour project impacts are well under the NAAQS and NMAAQS for CO.

Visibility

Visibility is affected by plume impairment (heterogeneous) or regional haze (homogeneous). Because potential air pollutant emission sources include many small sources spread over a large area, discrete visible plumes are not likely to impact distant sensitive areas. At this preliminary resource planning stage, the RFD emission sources in this analysis consist of sources that do not have a defined location. Regional haze is caused by fine particles and gases scattering and absorbing light.

For this modeling analysis, potential changes to regional haze were calculated in terms of the level of perceptible change in visibility when compared to background conditions. A 1.0-deciview (dv) change is considered potentially significant in mandatory federal PSD Class I areas A 1.0-dv change is defined as approximately a 10% change in the extinction coefficient (corresponding to a 2% to 5% change in contrast for a black target against a clear sky at the most optically sensitive distance from an observer), which is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory federal Class I areas.

The visibility screening analysis for this modeling analysis followed the recommendations in the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report - Revised Guidelines (FLAG 2010). The absolute total number of days of significant visibility changes (greater than 0.5 delta-dv and greater than 1.0 delta-dv) calculated for base year 2008, base case 2017, and future RFD alternatives is 366 days (every day of a leap year). Therefore, to show relative impacts among the alternatives with respect to the base case emissions scenarios, the calculated delta-dv (change in visibility) was divided by 15 for each day before counting and reporting the number of days above the thresholds. This essentially equates to evaluating impacts for thresholds of 7.5 delta-dv and 15 delta-dv.

Table 4-129 provides a summary of the project-only contribution to visibility air quality impacts for each Class I area and sensitive Class II area based on a 1.0 delta-dv threshold (after dividing each day visibility change [delta-dv] by 15). The project-only day count values are determined by subtracting out the number of days of “significant” visibility changes associated with the future base case modeling scenario (contains all cumulative emissions except project emissions) from the number of days of “significant” visibility changes associated with each modeled emission data set.

Project visibility impact contributions associated with the projected future alternatives are minimal. As shown, there are a few instances where “significant” impacts are predicted to occur at Class I or sensitive Class II areas. The highest number of days associated with project emissions occurs at Muleshoe National Wildlife Refuge, which is just downwind (predominant direction) of projected project oil and gas development. Non-project cumulative emissions (No Action Alternative) visibility impacts are driving the overall visibility impacts. A refinement of the non-project cumulative emissions estimates would reduce the number of days of total visibility impacts that would be likely closer to matching actual base and future visibility impacts/baseline conditions.

Table 4-129. Visibility Impacts at Class I and Sensitive Class II Areas Associated with Project Emissions

Class I or Sensitive Class II Areas	Number of Days in Modeled Year (normalized)	
	Alternatives A & B (1.0 dv)	Alternatives C & D (1.0 dv)
Bandelier WA	0	0
Bosque del Apache	0	0
Carlsbad Caverns NP	0	0
Gila Wilderness	1	1
Guadalupe Mountains NP	0	0
Pecos WA	0	0
Salt Creek WA	0	1
San Pedro Parks WA	0	0
Wheeler Peak WA	0	0
White Mountain WA	0	0
Aztec Ruins NM	0	0
Bitter Lake NWR	0	0
Buffalo Lake NWR	0	0
Capulin Volcano NM	1	1
Chaco Culture NHP	0	0
El Malpais NM	1	1
Fort Davis NHS	0	0

Class I or Sensitive Class II Areas	Number of Days in Modeled Year (normalized)	
	Alternatives A & B (1.0 dv)	Alternatives C & D (1.0 dv)
Fort Union NM	0	0
Grulla NWR	1	1
Lake Meredith NRA	0	0
Las Vegas NWR	0	0
Muleshoe NWR	2	2
Petroglyph NM	0	0
Salinas Pueblo Missions NM	1	1
San Andres NWR	0	0
Sangre De Cristo CA	0	0
Sevilleta NWR	0	0
White Sands NM	1	1

NWR = National Wildlife Refuge; WA = Wilderness Area; NHS = National Historic Site; NP = National Park; NRA = National Recreation Area; NM = National Monument; CA = Conservation Area; NHP = National Historic Park.

Deposition

The maximum annual nitrogen and sulfur deposition rates were estimated for 1 year of CAMx model outputs using project and cumulative emissions. For disclosure purposes only, project impacts were compared to the National Park Service (NPS) screening deposition analysis thresholds (DATs), which are defined as 0.005 kilogram per hectare per year (kg/ha/yr) in the western United States for both nitrogen and sulfur. Project impacts were determined by subtracting the annual deposition for the future year base case from the alternative annual deposition value. A DAT is the additional amount of nitrogen or sulfur deposition within a Class I area, below which estimated impacts from a proposed new or modified source are considered to be insignificant. The DAT is a screening threshold that was developed primarily to assess impacts from a single stationary source. Modeling results showing deposition greater than a DAT do not indicate the need for mitigation.

Full cumulative modeling was performed as part of this analysis. Project and cumulative impacts were compared to the level of concern, which is defined by the NPS and the USFS as 3 kg/ha/yr for nitrogen and 5 kg/ha/yr for sulfur. Deposition rates that are below the level of concern are believed to cause no adverse impacts.

At all areas and for both modeled emission data sets, the nitrogen DAT is exceeded at all Class I and sensitive Class II areas. The maximum nitrogen deposition was predicted for Alternatives C and D. The predicted deposition from all project sources was a factor of 58 times the nitrogen DAT. For a large aggregate project that includes thousands of sources (such as oil and gas development in the planning area), deposition greater than the DAT is typical. The predicted impacts are not considered to be significant for the aggregate project sources.

The maximum total project deposition (including background deposition) was predicted for Alternatives C and D. Total project nitrogen deposition is less than the level of concern at all Class I and sensitive Class II areas.

At all areas and for both modeled emission data sets, the sulfur DAT is greater than the project impacts at all Class I and sensitive Class II areas. Project sulfur deposition is less than the level of concern at all Class I and sensitive Class II areas.

An analysis of potential changes to lake acid neutralizing capacity (ANC) was performed. Annual deposition fluxes of sulfur and nitrogen predicted by CAMx at sensitive lake receptors were used in conjunction with baseline ANC values to estimate the change in ANC. The USFS considers lake chemistry changes to be potentially significant if the screening methodology predicts decreases in ANC of more than the limit of acceptable change (LAC). A lake's LAC depends on its baseline ANC value. The LAC is 10% change in ANC for lakes with baseline ANC values greater than or equal to 25 microequivalents per liter (μeq/L and no more than 1 μeq/L cumulative loss in ANC is acceptable for lakes with ANC baseline values less than 25 μeq/L (USFS 2012). For this analysis, all lakes have a baseline ANC value greater than 25 μeq/L. Consequently, a decrease of 10% in ANC at any of the lakes is considered to be a significant impact. For all lakes, the project impacts are less than 1% ANC change.

Mitigation Measures

The alternatives matrix in Chapter 2 describes mitigation measures for oil and gas development on BLM-administered lands.

In addition, a variety of multi-level regulatory processes exist to ensure that pollutant levels do not increase above identified thresholds and/or air quality criteria. Pre-construction permitting processes are required to consider cumulative impacts of proposed and surrounding future sources to ensure that proposed sources within the project area would not contribute to exceedances of the NAAQS.

4.2.11.9 Impacts of Special Designations on Air Quality

Air quality impacts from Special Designations are generally projected to result in localized incrementally positive effects on both short- and long-term air quality to the extent that surface disturbance from construction activities, new roads, and traffic would be reduced or eliminated within ACECs, RNAs, SMAs, WSRs, WSAs, and VRM. This air quality improvement would be related to the number of acres designated and the management decisions for each designation that would limit activity on the designated lands. Conversely, some of these designations may have the potential to increase traffic and surface disturbance in other areas depending on traffic patterns and route diversion around the designated areas. Due to the reduction in surface disturbance and re-entrained road dust from traffic, the greatest improvement would likely be a reduction of particulates in and near the designated areas.

Table 4-130. Summary of Acres Managed as ACECs and Percent Open to Leasable Mineral Development by Alternative - BLM Surface Lands Only

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acreage managed as ACECs	13,435	495,042	561,433	98,562	28,894
Total leasable – open	6,173	95,450	165,173	70,441	9,766
Percent of ACECs open	46%	19%	29%	71%	34%
Leasable – closed	7,262	399,592	396,260	28,120	19,127

Table 4-130 summarizes the acres managed as ACECs. The No Action Alternative has the least area managed as ACECs with about 46 percent of the total area open to leasable mineral development, while Alternative B has the greatest area managed as ACECs and open to leasable mineral development. Alternative A has the second most area managed as ACECs and open to development. Alternatives C and D fall between the No Action Alternative and Alternative A in terms of total managed area as well as area open to development. In terms of general magnitudes of impacts, Alternatives A and B would have similar impacts and would impact air quality the least because of the sizeable area managed and the magnitude of leasable area closed to minerals development. Similarly, Alternatives C and D would be expected to have a similar impact to air quality with Alternative C having less of an impact than Alternative D due to larger area managed and closed to minerals development. Both would be expected to have a much greater impact than Alternatives A and B. Within these groupings it is speculative to state which would have greater impacts to air quality because the area that would actually be developed under each alternative is unknown.

Impacts to air quality from managing areas as WSAs would have localized positive effects as noted above. Since the WSAs would be designated under all alternatives and would be closed to mineral development impacts would be the same under all alternatives. Managing an area as a WSR would also have localized positive effects because those areas would be managed as closed to development. Alternative A would have the greatest localized benefits as approximately 12 miles would be designated as WSRs. Alternatives B, C, and D would designate 3.67 miles. No river segments would be designated under the No Action Alternative; therefore, all of the action alternatives would provide for more positive effects to air quality than the No Action Alternative.

There would be no substantial positive or negative effects from alternatives decisions related to WSAs and WSRs due to the limited acreage that would be closed to disturbance under each category, 7,086 acres and 3.67 to 8.22 miles, respectively.

Impacts to air quality from VRM actions would have localized positive effects as noted above. Because VRM Class I and II severely constrain leasable mineral operations, these areas would impact air quality the least. All alternatives have comparable total acres with VRM decisions (Class I–IV), but Alternative B has the greatest acreage (357,803 acres) designated VRM Class I and II, followed by Alternative A (273,709 acres), Alternative C (67,963 acres), No Action (50,671 acres), and Alternative D (48,263 acres). Therefore, Alternative B would have the least air quality impact while the Alternative D would have the greatest air quality impact due to its limited acreage managed as VRM Class I and II.

4.2.11.10 Summary of Air Quality Impacts

The results of this analysis indicate that air quality impacts, while noticeable, are generally acceptable as compared to the indicators. Most predicted criteria pollutant concentrations are below the NAAQS throughout the extensive modeling domains included in this analysis. In a few cases and in limited locations, criteria pollutant concentrations are predicted to be greater than the NAAQS when assessing cumulative impacts, as shown in Table 4-131. Because of the many assumptions included in the analysis and the conservative nature of the modeling, these predictions may or may not indicate future exceedances of the NAAQS. Predictions of pollutant concentrations approaching or exceeding the NAAQS indicate the potential need for additional ambient monitoring data, refined modeling, and consideration of additional mitigation measures. As noted previously, both modeling scenarios contained emissions from 10,117 active BLM oil and gas wells and 20,379 non-BLM oil and gas wells. The maximum number of wells in the modeling analyses is much greater than the number of wells projected for the planning area (3,538 - 6,044 wells on BLM surface and subsurface administered lands and 9,600 wells on non-BLM-administered lands). Consequently, the modeling results should be considered conservatively high. As the air quality permitting agency, the NMED Air Quality Bureau (AQB) would closely track future air quality changes and require facility-specific modeling for high-emitting sources before issuing air quality permits.

Table 4-131. Summary of Far-Field Potential National Ambient Air Quality Standard Impacts

Pollutant	Averaging Time	No Action Alternative Impacts Above NAAQS/NMAAQS?	Potential Project Impacts Above NAAQS/NMAAQS?	Potential Cumulative Impacts Above NAAQS/NMAAQS?	Comments on Potential Cumulative Impacts
CO	1 hour	No	No	No	–
	8 hour	No	No	No	–
NO_2	1 hour	No	No	No	–
	Annual	No	No	No	–
Ozone	8 hour	Yes [a]	No [a]	Yes [a]	Ten of the 31 monitors in the 4-km domain have DVFs above the NAAQS for the No Action and all action alternatives (maximum 79 ppb in the Four Corners Area vs. 75 ppb standard).
PM_{10}	24 hour	No	No	No	–
$PM_{2.5}$	24 hour	Yes [a]	No [a]	Yes [a]	Two of the 11 monitors in the 4-km domain have DVFs above the NAAQS for the No Action and all action alternatives (maximum 43 µg/m^3 in Odessa, TX, vs. 35 µg/m^3 standard).
	Annual	Yes [a]	No [a]	Yes [a]	Four of the 11 monitors in the 4-km domain have DVFs above the NAAQS for the No Action and all action alternatives (maximum 17 µg/m^3 in Odessa, TX, vs. 12 µg/m^3 standard).
SO_2	1 hour	Yes	No	Yes	Potential impacts above the NAAQS may occur for all alternatives at some Class II receptors. Differences among alternatives are slight (maximum 16 times the 196 µg/m^3 standard in Amarillo, TX, for all alternatives).
	3 hour	No	No	No	–
	24 hour	No	No	No	–
	Annual	No	No	No	–

[a] Based on DVFs

Far-field potential AQRV impacts are summarized in Table 4-132 and described below. The nitrogen deposition results shown in the table represent Alternatives C and D. Predicted impacts for Alternatives A and B are lower. Results above the DAT are not considered significant, because of the large number of sources included in the modeling analysis. The sulfur deposition results shown in the table represent Alternatives A and B. Predicted impacts for Alternatives C and D are lower. The lake ANC results shown in the table represent Alternatives A and B. Predicted impacts for Alternatives C and D are lower.

Project visibility impact contributions associated with the projected future alternatives are minimal and are not considered to be significant. There are a few instances where “significant” impacts are predicted to occur at Class I or sensitive Class II areas. Non-project cumulative emissions (No Action Alternative) visibility impacts are driving the overall visibility impacts. A refinement of the non-project cumulative emissions estimates would reduce the number of days of total visibility impacts that would be likely closer to matching actual base and future visibility impacts/baseline conditions.

At all areas and for both modeled emission data sets, the nitrogen DAT is exceeded at all Class I and sensitive Class II areas. The DAT is a screening threshold that was developed primarily to assess impacts from a single stationary source. Modeling results showing deposition greater than a DAT do not indicate the need for mitigation. For a large aggregate project that includes thousands of sources (such as oil and gas development in the planning area), deposition greater than the DAT is typical. The predicted impacts are not considered to be significant for the aggregate project sources.

For the No Action Alternative and the cumulative analyses for the action alternatives, the ANC is above the LAC for all lakes. Project-only impacts are below the LAC.

Table 4-132. Summary of Far-Field Potential Air Quality Related Value Impacts

AQRV	No Action Alternative Impacts	Potential Project Impacts	Potential Cumulative Impacts
Visibility at Class I areas	366 days (leap year).	1 day above 1.0 dv at Gila Wilderness for Alternatives A, B, C, and D. 1 day above 1.0 dv at Salt Creek Wilderness for Alternatives C and D.	366 days.
Visibility at sensitive Class II areas	366 days.	1 or 2 days above 1.0 dv at 7 locations for Alternative A and B and 8 locations for Alternatives C and D.	366 days.
Nitrogen deposition	Above the DAT at all receptors by a factor of approximately 10,900). Above the LOC at all receptors by a factor of 18).	Above the DAT at most Class I and sensitive Class II areas (maximum impact 58 times the DAT for Alternatives C and D), but below the LOC at all receptors.	Above the DAT at all receptors by a factor of approximately 10,900). Above the LOC at all receptors by a factor of 18).
Sulfur deposition	Above the DAT at all receptors (maximum impact approximately 9,900 times the DAT). Above the LOC at most receptors (maximum impact approximately 16.5 times the LOC).	Below the DAT and LOC at all receptors.	Above the DAT at all receptors (maximum impact approximately 9,900 times the DAT). Above the LOC at most receptors (maximum impact approximately 16.5 times the LOC).
Lake ANC	Above the LAC for all lakes (maximum impact approximately 174 times the LAC).	Below the LAC for all lakes.	Above the LAC for all lakes (maximum impact approximately 174 times the LAC).

ANC = acid neutralizing capacity; LOC = level of concern; LAC = limit of acceptable change.

4.2.11.10.1 Emissions and Alternative Comparisons

Air quality impacts differed among the alternatives, with Alternatives C and D generally having the greatest air quality impacts when emissions from project sources were modeled. The Alternatives C and D modeled emission data set includes management actions required by state and federal "on the books" regulations. This modeled emission data set has greater emissions of pollutants than Alternatives A and B that include additional emissions controls applied to project oil and gas RFD sources.

4.2.11.10.2 Near-Field Results

With regard to criteria pollutants subject to NAAQS or NMAAQS, six pollutants were modeled. Near-field modeling predicted concentrations are below both NAAQS and NMAAQS for each non-ozone (and non-lead) criteria (state and national) pollutant and averaging time. HAP emissions were also modeled, though there is no ambient standard for these pollutants. Risks associated with six modeled HAPs were predicted to be less than RELs and RfCs. Cancer risk was estimated to be below one in one million for the MLE individual scenario.

4.2.11.10.3 Far-Field Criteria Pollutant Results

Far-field criteria pollutant modeling results are briefly summarized, as follows:

- Project impacts are predicted to be below the NAAQS for each modeled emission data set and at each modeled receptor for the following pollutants and averaging times:
  - Ozone (8-hour)
  - NO_2 (1-hour and annual)
  - PM_{10} (24-hour and annual)
  - $PM_{2.5}$ (24-hour and annual)
  - SO_2 (1-hour, 3-hour, 24-hour, and annual)
  - CO (1-hour and 8-hour)
- The No Action Alternative and cumulative impacts are predicted to be below the NAAQS for each modeled emission data set and at each modeled receptor for the following pollutants and averaging times:
  - PM_{10} (24-hour)
  - NO_2 (1-hour and annual)
  - SO_2 (3-hour, 24-hour, and annual)
  - CO (1-hour and 8-hour)
- Cumulative 8-hour ozone total concentrations greater than the NAAQS are predicted for each modeled emission data set at approximately one-third of the monitors in the 4-km domain. The majority of the monitors lie in the El Paso, Texas, area. The projected DVs for the two modeled emission data sets show little to no change from the No Action Alternative.
- Cumulative 1-hour SO_2 total concentrations greater than the NAAQS are predicted for each modeled emission data set at two areas near Amarillo and at another area in the lower panhandle of Texas. Project only impacts are less than 0.1 $\mu g/m^3$ for both modeled emission data sets.
- Cumulative 24-hour and annual $PM_{2.5}$ total concentrations greater than the NAAQS are predicted for each modeled emission data set at a few monitors not in the planning area. In each case, the results for the modeled emission data sets are the same as those for the No Action Alternative.

4.2.11.10.4 AQRV Results

AQRV assessments led to the following conclusions:

- **Visibility** – Visibility impacts were assessed in terms of the number of days in which visibility changes may equal or exceed a 0.5-dv (single source) or 1.0-dv (multiple sources) change from estimated natural visibility conditions.
  - The absolute total number of days of significant visibility changes (greater than 0.5 delta-dv and greater than 1.0 delta-dv) for base year 2008, No Action Alternative 2017, and future RFD alternatives is 366 days (every day of the year). Therefore, to show relative impacts among the alternatives with respect to the base case emissions scenarios, the calculated

delta-dv (change in visibility) was divided by 15 for each day before counting and reporting the number of days above the thresholds. Baseline conditions were subtracted from alternatives impacts to determine project contributions, and there are only several instances where “significant” project-related impacts are predicted to occur at Class I or sensitive Class II areas. The highest number of days (2) associated with project emissions occurs at Muleshoe National Wildlife Refuge, which is just downwind (predominant direction) of projected project oil and gas development.

- **Deposition** – Project sulfur and nitrogen deposition are below the level of concern at all modeled Class I and sensitive Class II areas. Nitrogen impacts for the No Action Alternative and cumulative impacts are above the level of concern at all receptors. Sulfur deposition impacts for the No Action Alternative and cumulative impacts are above the level of concern at most receptors.
- **Lake Chemistry** – At the five modeled sensitive lakes, ANC changes due to project emissions are predicted to be less than 1%. The greatest ANC changes are predicted to occur at Upper Truchas Lake. ANC changes attributable to the No Action Alternative and cumulative impacts for the action alternatives are above the LAC for all lakes.

4.2.11.10.5 Climate Change Analysis

Research on how emissions of GHGs influence global climate change and associated effects has focused on the overall impact of emissions from regional or global aggregate sources. This approach is required primarily because GHG emissions from single sources are small relative to aggregate emissions and GHGs, once emitted from a given source, become well mixed in the global atmosphere and have a long atmospheric lifetime (EPA 2008). The climate change research community has not yet developed tools specifically intended for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. The current tools for simulating climate change generally focus on global- and regional-scale modeling. Global- and regional-scale models lack the capability to represent many important small-scale processes. As a result, confidence in regional- and sub-regional-scale projections is lower than at the global scale. Therefore, limited scientific capability exists to assess, detect, or measure the relationship between emissions of GHGs from a specific single source and any localized impacts.

Climate change analyses are composed of several factors, including GHGs, land use management practices, and the albedo effect (i.e., how much of the sun’s energy is reflected off the surface of the earth). While it is possible in many cases to quantify potential quantities of GHG emissions or the amount of carbon sequestered from particular activities, the tools necessary to quantify the incremental climatic impacts of those specific activities are presently unavailable. While there are difficulties in attributing specific climate change impacts to any given project or activity and quantifying those impacts, projected GHG emissions can serve as a proxy for a proposed action’s climate change impacts.

Table 4-133 provides maximum annual planning area RMP revision (i.e., project) GHG emissions for each alternative and each of the three estimated GHGs, as well as carbon dioxide equivalent (CO_2e) emissions in metric tons per year (mtpy) for year 2028. GHG emissions calculated for this analysis include GHGs that would be emitted from oil and gas equipment (combustion sources and equipment leaks), gas venting, and motor vehicle emissions.

In Table 4-133, planning area RMP revision GHG emissions are compared to statewide annual 2007 New Mexico emissions. Annual estimated 2007 New Mexico GHG emissions were 76.2 million metric tons of CO_2e. There is little difference in CO_2e emissions among the alternatives, with Alternatives A and B producing slightly higher CO_2e emissions. Maximum GHG emissions are estimated to be approximately 17% of 2007 New Mexico GHG emissions. The maximum estimated GHG emissions are approximately 0.2% of total U.S. 2008 CO_2e emissions of 6,821E+06 mtpy.

Table 4-133. 2028 GHG Emissions as Percentage of New Mexico Annual Inventory

Alternative	Emissions (mtpy)			CO_2e Emissions (10^6 mtpy)	Percentage of New Mexico Inventory
	CO_2	CH_4	N_2O		
Alternatives A and B	11,547,017	46,191	208	13	17%
Alternatives C and D	11,512,402	13,235	208	12	16%

Note: The ARTSD does not include GHG emissions for the No Action Alternative.
CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide.

GHG emissions are also produced from livestock grazing which is expected to create 58,480 mtpy CO_2e produced from enteric fermentation and manure management within the planning area under the No Action Alternative based on CFO current allotment categorization. This represents less than 0.1% of the New Mexico inventory. Because there is not typically any planting or cultivation associated with livestock grazing in the area, other potential GHG associated with these activities are not included in the livestock grazing emissions estimate. Because Alternatives A and B have less acreage open to livestock grazing, impacts are expected to be less than the No Action Alternative as shown in Table 4-134. Alternatives C and D have similar acreage open to livestock grazing as the No Action Alternative, with Alternative D being slightly higher, as such, impacts are expected to be similar, with Alternative D expected to be slightly higher.

Table 4-134. GHG Emissions from Enteric Fermentation and Manure Management (CO2e emissions mtpy)

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
58,480	44,803	54,321	58,400	58,526

Oil and gas operations are subject to a multitude of state and federal regulations that would help mitigate the effects of the activities. State permitting requirements as well as most federal NSPS and NESHAP are primarily established to reduce regulated criteria pollutants and hazardous air pollutants. However, many of these regulations would have the added benefit of reducing GHG emissions by capturing and recycling waste streams where possible, limiting the allowable uncontrolled vented emissions, combusting waste streams, and reducing fugitive emissions.

Climate change is affecting the southwest United States with temperature increases of almost 2°F in the last century and further increases of 3.5°F to 9.5°F anticipated by the end of this century. Drought conditions are already common in the Southwest and drought periods are expected to become more frequent, intense, and longer. Drought will affect important water sources, including the Colorado River Basin. Combined with expected population growth, climate change will exacerbate existing stresses (EPA 2016a). Preparing for and adapting to these changes will be a challenge moving forward. Climate change researchers and policy makers have not yet spelled out how to adapt to climate change with ground-level action; however, natural resource mismanagement contributes to the vulnerability of human systems to these hazards, and enhanced management can provide a tool for vulnerability reduction. (EPA 2016a). GHG emitting sources within the planning area would affect the resources ability to adapt to climate change by utilizing land that would otherwise be left in a natural state and utilizing diminishing resources such as water. Management of the GHG emitting sources within the planning area would facilitate vulnerability reduction.

Cumulative and Planning Area Specific End-Use GHG CO2e Emissions

Upstream (wellhead) and midstream (booster station or processing plant) GHG emissions for projected oil and gas development / production are readily estimated using common GHG emissions factors (40 CFR Part 98, American Petroleum Institute [API], non-roads emissions model, etc.) along with equipment and emissions source information directly related to the new oil and gas development. Production project. Downstream / end-use GHG emissions are usually not calculated for a particular subset of the cumulative / total oil and gas production (i.e., for a field office / planning area oil and gas Reasonable Foreseeable Development [RFD] scenario) but these downstream emissions are directly related to end-use energy consumption. Downstream emissions refer to the refining of petroleum crude oil and the processing and purifying of raw natural gas. It also includes the marketing and distribution of products derived from crude oil and natural gas. End use refers to the consumption of those end products in various sectors such as residential, commercial, industrial, and transportation. The challenge for estimating these downstream emissions comes with understanding how the oil and gas will ultimately be distributed and used for energy. Because this information is not typically available during the planning stage, an alternate method of end use emissions estimation based on production data was developed (BLM 2017).

To estimate the ultimate end-use/energy consumption emissions for a particular field office planning area the baseline and projected annual oil and gas production values must be estimated and then multiplied by appropriate emission factors to calculate CO2e emissions.

Historical annual oil and gas production volumes were obtained from the Office of Natural Resources Revenue for Federal mineral estate in the planning area (ONRR 2016) and were used as the basis for projecting the total production of oil and gas in the CFO. It is believed that 2 percent growth per year for hydrocarbon production represents a reasonable National average growth that takes into consideration periods of high and low drilling activity. There are factors, such as the number of drilling rigs and maximum permit processing rates that can limit the amount of growth in production. The 2 percent national growth rate is also supported by the U.S. Energy Information Administration which projected a 1-2 percent growth rate for hydrocarbon production in the U.S. (http://www.eia.gov/outlooks/aeo/). The ONRR data for the planning area from 2010 to 2015, however, reflects a 10% growth rate. Utilizing a 2% to 10% range thus depicts the potential hydrocarbon production for the CFO, based on the national projection and the historical growth in the planning area.

For comparison, natural gas and crude oil production data by state and for the U.S. were obtained from the U.S. Energy Information Administration (EIA 2016). Projections for oil and gas production are based on a 2 percent annual growth for New Mexico and the rest of the United States. Historical and projected production are shown in table 4-134.

The primary GHGs associated with the oil and gas industry are carbon dioxide (CO2) and methane (CH4) and, to a lesser extent, nitrous oxide (N2O). Because methane has a global warming potential that is 25 times greater than the warming potential of CO2, and nitrous oxide has a global warming potential that is 298 times greater than the warming potential of CO2, the EPA uses measures of CO2 equivalent (CO2e) which takes the difference in warming potential into account for reporting greenhouse gas emissions.

Emissions are expressed in metric tons of CO2 equivalent in this analysis. CO2e emissions are based on emission factors generated for CO2 (BLM 2017), CH4 and N2O (CFR 2013). Table 4-135 shows the indirect production of oil and gas and Table 4.-136 shows the associated CO2e emissions assuming that the products are ultimately combusted.

The data show that for a 2% growth rate the CFO federal wells account for about 35 percent of the end use emissions resulting from the state of New Mexico oil and gas production. Likewise, the CFO federal wells account for about 1.4 percent of the end use emissions resulting from U.S. oil and gas production. It would be speculative to assume where these emissions would occur as products could be distributed regionally, across the U.S. or be transported internationally. These estimates are based on expected oil and gas growth but indicate that end use emissions generated from products extracted from the CFO federal wells are significant compared to New Mexico oil and gas contributions as a whole.

If production continues to rise at a 10% growth rate for CFO oil and gas production over the next 20 years the total production would be 17.7 Billion MCF of gas and 4.62 Billion BBLS of oil. This would result in the end use emissions increasing to 971 Million Metric Tons CO2e for gas and 1.99 Billion Metric Tons CO2e for oil, for a total of 2.96 Billion Metric Tons CO2e. The CFO production would account for 3.6 % of the end use emissions of all U.S. production.

Table 4-135. Estimated Indirect Production from Oil and Gas by Geographic Area

Geographic Area→		CFO Federal Wells [6]		All New Mexico		United States	
	Year	Gas SE NM (MCF)	Oil for SE NM (BBLS)	Total Gas for All NM (MCF) [4]	Total Oil for All NM (BBLS) [5]	Total Gas for US (MCF) [4]	Total Oil for US (BBLS) [5]
	2006	2.28E+08	2.25E+07	1.62E+09	5.95E+07	2.35E+10	1.86E+09
	2007	2.19E+08	2.34E+07	1.56E+09	5.92E+07	2.47E+10	1.85E+09
	2008	2.04E+08	2.38E+07	1.49E+09	6.02E+07	2.56E+10	1.83E+09
	2009	1.92E+08	2.63E+07	1.43E+09	6.12E+07	2.61E+10	1.95E+09
	2010	1.87E+08	2.92E+07	1.34E+09	6.55E+07	2.68E+10	2.00E+09
	2011	1.83E+08	3.33E+07	1.29E+09	7.15E+07	2.85E+10	2.06E+09
	2012	1.98E+08	4.20E+07	1.28E+09	8.55E+07	2.95E+10	2.37E+09
	2013	2.18E+08	4.98E+07	1.25E+09	1.02E+08	2.95E+10	2.73E+09
	2014	2.46E+08	6.20E+07	1.27E+09	1.24E+08	3.14E+10	3.20E+09
	2015*	2.82E+08	7.33E+07	1.30E+09	1.47E+08	3.29E+10	3.44E+09
1	2016	2.87E+08	7.48E+07	1.32E+09	1.50E+08	3.36E+10	3.51E+09
10	2025	3.43E+08	8.94E+07	1.58E+09	1.79E+08	4.01E+10	4.19E+09
20	2035	4.19E+08	1.09E+08	1.93E+09	2.18E+08	4.89E+10	5.11E+09
Total (20 year)		***6.98E+09***	***1.82E+09***	***3.21E+10***	***3.64E+09***	***8.15E+11***	***8.52E+10***

*Used for 20-year projections

Table 4-136. Projected Estimated Indirect CO2e Emissions from End Use of Oil and Gas by Geographic Area

Geographic Area→		CFO Federal wells		All New Mexico		United States	
	Year	Gas (Metric Tons CO2e)	Oil (Metric Tons CO2e)	Gas (Metric Tons CO2e)	Oil (Metric Tons CO2e)	Gas (Metric Tons CO2e)	Oil (Metric Tons CO2e)
	2006	1.25E+07	9.69E+06	8.87E+07	2.56E+07	1.29E+09	7.98E+08
	2007	1.20E+07	1.00E+07	8.52E+07	2.54E+07	1.35E+09	7.97E+08
	2008	1.12E+07	1.02E+07	8.15E+07	2.59E+07	1.40E+09	7.87E+08
	2009	1.05E+07	1.13E+07	7.81E+07	2.63E+07	1.43E+09	8.40E+08
	2010	1.02E+07	1.25E+07	7.35E+07	2.82E+07	1.47E+09	8.59E+08
	2011	1.00E+07	1.43E+07	7.05E+07	3.07E+07	1.56E+09	8.86E+08
	2012	1.08E+07	1.81E+07	6.99E+07	3.68E+07	1.62E+09	1.02E+09
	2013	1.19E+07	2.14E+07	6.83E+07	4.38E+07	1.62E+09	1.17E+09
	2014	1.34E+07	2.67E+07	6.94E+07	5.32E+07	1.72E+09	1.38E+09
	2015*	1.54E+07	3.15E+07	7.10E+07	6.31E+07	1.80E+09	1.48E+09
1	2016	1.57E+07	3.22E+07	7.24E+07	6.44E+07	1.84E+09	1.51E+09
10	2025	1.88E+07	3.84E+07	8.66E+07	7.69E+07	2.20E+09	1.80E+09
20	2035	2.29E+07	4.69E+07	1.06E+08	9.38E+07	2.68E+09	2.20E+09
Total (20 year)		***3.82E+08***	***7.82E+08***	***1.76E+09***	***1.56E+09***	***4.47E+10***	***3.66E+10***
Total (20-year gas + oil)		*–*	***1.16E+09***	*–*	***3.32E+09***	*–*	***8.13E+10***
CFO Federal Wells/ Each Group Total		*–*	*–*	*–*	***35.0%***	*–*	***1.4%***

Unavoidable Adverse Impacts

Unavoidable adverse impacts to air resources as a result of oil and gas development and other emission sources in the planning area under the No Action Alternative and any of the four action alternatives would consist of increases in concentrations of criteria pollutants and HAPs. As a consequence of increased concentrations of criteria pollutants, some degradation in AQRVs would occur. The number of days with visibility impacts greater than or equal to 1.0 dv was one or two at eight of the Class 1 and sensitive Class II areas. Calculated nitrogen impacts exceeded the DAT but were below the level of concern (LOC) at the Class I and sensitive Class II areas. Calculated nitrogen impacts were below the DAT and LOC at the Class I and sensitive Class II areas. Lake ANC changes were below the LAC at the five lakes in the study area. Although concentrations would increase under the alternatives modeled, values show compliance with all the NAAQS for project sources.

Short-Term Use Versus Long-term Productivity

Development of the oil and gas resources may result in short- and long-term degradation of air quality. The short-term use of the tract for mining operations would result in impacts to air resources in the analysis area for the duration of the oil and gas operations. Upon cessation of operations these impacts would be eliminated and would not impact the long-term productivity of the air resource.

Irreversible and Irretrievable Commitments of Resource

The irreversible commitment of a resource means that, once committed, the resource is permanently lost to other uses. This type of commitment generally applies to nonrenewable resources (e.g., minerals, geologic features, or cultural resources) or to resources that are only renewable over a very long period of time (e.g., soil productivity or perhaps old-growth forest.). Irretrievable commitments of resources, on the other hand, are not regained following cessation of the activity and reclamation. There would be no irreversible commitments of air resources as a result of oil and gas operations. All air resource impacts described would be retrievable, because air quality would cease to be impacted by oil and gas operations following cessation of activities.

4.2.11.11 Impacts of Renewable Energy Actions on Air Quality

Air quality impacts from renewable energy management actions are generally projected to result in negligible to incrementally positive effects on both short- and long-term air quality to the extent that fossil fuel combustion emissions are reduced. Short term air quality impacts from construction emissions would depend on the level of development and land disturbance that occurs under each alternative.

Renewable energy actions’ effect on climate change, while difficult to quantify, is generally expected to have a positive impact by helping to reduce GHG emissions from fossil fuels. However, land disturbance associated with renewable energy projects may have a negative impact on the resources’ ability to adapt to climate change by reducing natural buffer systems.

Under the No Action Alternative, 964,322 acres would be open for geothermal development, 271,316 acres would be open for solar development, and 1,134,948 acres would be open for wind development on BLM-administered lands. The geothermal and solar development under the No Action Alternative is significantly less than any of the action alternatives as 59% to 82% of the land would be open to geothermal and solar in the action alternatives with Alternative D providing the most acreage open to geothermal and solar development. The area open to wind development ranges from 36% to 52% of the area open in the action alternatives. While a direct correlation cannot be made between acres available for renewables to reductions in fossil fuel combustion, the No Action Alternative provides the least opportunity to develop renewable energy, and, therefore, may have the least air quality benefit. Because the Action Alternatives have comparable area open to renewables development, the air quality impact is expected to be similar in magnitude among each of the Action Alternatives, although Alternative D would provide the most opportunity to develop renewable energy.

4.2.11.12 Impacts of Livestock Grazing Actions on Air Quality

Livestock grazing actions are generally projected to result in localized air quality impacts and would depend on the level of grazing (bare soils subject to wind erosion) and the number of animals grazed (methane emissions). To the extent that this land is unavailable for other uses such as minerals development and industry, more land reserved for grazing may result in an incremental positive effect on air quality, however, this would be dependent on the number of animals grazed per acre and potential alternate land uses.

Common management actions such as control of land utilization levels, erosion control, and livestock grazing standards would generally have a positive impact on air quality. Minimal impact to air quality is expected from locating livestock outside of archaeological districts.

The No Action Alternative opens the largest area to grazing, whereas, the Action Alternatives would allow slightly less grazing on BLM-administered lands. Because alternate land uses and animals grazed per acre are ill defined, the impacts to air quality would be speculative; however, there are no appreciable differences in the areas open to grazing among the alternatives so there impacts are expected to be similar.

Refer to Section 4.2.11.10.5 for a discussion of livestock emissions and adaptation to climate change.

4.2.11.13 Impacts of Travel and Transportation Management Actions on Air Quality

4.2.11.13.1 Impacts from Management Common to All

Phantom Banks Heronries, motorized wheeled cross-country travel limitations, and emergency OHV limitations would have a positive impact on air quality because these measures effectively reduce traffic in designated areas. Because these areas would likely be dirt roads, the greatest improvement would be in particulate emissions.

4.2.11.13.2 Impacts from Management Common to All Action Alternatives

Management actions common to all action alternatives are not expected to significantly impact air quality.

4.2.11.13.3 Impacts from the No Action Alternative

Under the No Action Alternative, 2,035,307 acres would be OHV limited and 55,966 acres would be closed to vehicle travel. Air quality impacts would be dependent on the number and types of vehicles and the types of travel surfaces used by the vehicles. All of the action alternatives are similar in magnitude to the No Action Alternative with a progressive decrease in area closed to vehicle travel from Alternative A down to Alternative D, which represents 74% of the No Action Alternative. While a direct correlation cannot be made to air quality impact, Alternative D would likely have the greatest impact on air quality because it has the least area closed to vehicle travel and the No Action Alternative would likely have the least impact on air quality because it provides the greatest area closed to travel.

4.2.11.13.4 Impacts from Alternative A

Under the Alternative A, 2,039,299 acres would be OHV limited and 52,028 acres would be closed to vehicle travel. Alternative A is the second most restrictive for areas closed to travel. Effects to air quality are dependent on actual road development and vehicle miles traveled but would be expected to be improved as compared to the No Action Alternative.

4.2.11.13.5 Impacts from Alternative B

Under the Alternative B, 2,049,391 acres would be OHV limited and 41,936 acres would be closed to vehicle travel. Effects to air quality are expected to be similar to No Action and Alternative A although there is decrease in areas closed to travel which may be more detrimental to air quality.

4.2.11.13.6 Impacts from Alternative C

Under the Alternative C, 2,052,582 acres would be OHV limited and 38,738 acres would be closed to vehicle travel. Effects to air quality are expected to slightly greater than No Action and Alternatives A and B due to a decrease in areas closed to travel, which may be detrimental to air quality.

4.2.11.13.7 Impacts from Alternative D

Under the Alternative D, 2,052,584 acres would be OHV limited and 38,737 acres would be closed to vehicle travel. Alternative D is the least restrictive in areas closed to travel and therefore would likely be the most detrimental to air quality.

4.2.11.14 Summary of Direct and Indirect Impacts

Both modeling scenarios for evaluation of mineral actions on air quality contained emissions from 10,117 active BLM oil and gas wells and 20,379 non-BLM oil and gas wells. The maximum number of wells in the modeling analyses is much greater than the number of wells projected for the planning area (3,538–6,044 wells on BLM0-administered lands and 9,600 wells on non-BLM-administered-lands). The numbers of wells used in the analyses are almost two times the number of wells projected for the planning area. Consequently, the modeling results are considered conservatively high.

It is difficult to quantify air quality impacts from management actions for the other resource areas. Although there are some specific data for some of the resource areas, the available data do not allow emissions to be calculated for the different alternatives. Many of the resource areas have proposed management and travel-related decisions that limit or reduce surface and vegetation disturbance, increase vegetation and habitats, limit or reduce OHV and other off-trail access, and improve existing roadway and trail surfaces. However, no specific data have been developed to quantify the level of impact from the management actions. In addition, not all of the potential emission sources were included in the modeling analyses.

Because of the level of conservatism contained in the air quality modeling (number of wells), the potential air quality benefits of reducing the number of wells in the analysis to the numbers projected for the planning, are greater than the potential air quality benefits of management actions for the other resource areas.

Table 4-131 summarizes the impacts to air quality from management actions for each resource in the planning area. Table 4-132 summarizes the direct impacts to air quality from mineral actions.

In Table 4-133, project visibility impact contributions associated with the projected future alternatives are minimal. There are a few instances where “significant” impacts are predicted to occur at Class I or sensitive Class II areas. Non-project cumulative emissions (No Action Alternative) visibility impacts are driving the overall visibility impacts. A refinement of the non-project cumulative emissions estimates would reduce the number of days of total visibility impacts that would be likely closer to matching actual base and future visibility impacts/baseline conditions.

For both modeled emission data sets, the nitrogen DAT is exceeded at all Class I and sensitive Class II areas. The DAT is a screening threshold that was developed primarily to assess impacts from a single stationary source. For a large aggregate project that includes thousands of sources (such as oil and gas development in the planning area), deposition greater than the DAT is typical. Modeling results showing deposition greater than a DAT do not indicate the need for mitigation. The predicted impacts are not considered to be significant for the aggregate project sources.

4.3 RESOURCE USES

4.3.1 Minerals

This section presents the environmental consequences of resource management decisions proposed under each of the five alternatives described in Chapter 2 - Alternatives upon leasable, locatable, and salable mineral resource development. Existing conditions concerning minerals including the RFD are described in Section 3.3.1. In accordance with BLM policy and its recognition of the national Energy Policy and Conservation Act of 2000, as discussed in Chapters 2 and 3, mineral resource development would be allowed throughout the CFO planning area subject to standard lease terms unless precluded by other program prescriptions, as specified in this RMP/EIS.

As explained in detail in Chapter 3, the Permian Basin began producing oil and gas in 1924 and has produced continuously since (Engler et al. 2012:1). Mineral activity is high in the planning area as demonstrated by the fact that the majority of the federal mineral estate managed by the CFO is currently leased. This trend is not expected to change in the 20-year planning horizon, as millions of barrels of oil and billions of cubic feet of gas still remain in the existing fields, and new oil and gas plays are explored each day.

Given this history and projections for future mineral development in the planning area, it is important to note that the CFO has been managing this heavy mineral development and other resources in the planning area following FLPMA's multiple-use mandate. This balancing act is facilitated by the application of management actions, including constraints placed on mineral development at the project implementation level to protect and conserve other public resources, such as recreation, special status species, and cultural resources. The existing RMP was written in 1988 and contains COAs, stipulations, and BMPs necessary to meet the multiple-use mandate. Since that time, two RMP amendments (1997 and 2008) have modified and added to the list of COAs, stipulations, and BMPs used by the CFO. All the while, mineral development in the planning area has continued, as represented by the trends described in Chapter 3 and the RFD scenario. This understanding is the foundation of the impacts analysis presented in this section.

Under the alternatives described in this RMP/EIS, the CFO would continue to require mineral developers to conduct operations in a manner that would minimize adverse impacts to other resources, land uses, and land users in accordance with laws, regulations, orders, and other constraints. These constraints could lead to increase costs and time required to fully development leasable minerals and could influence an operator's investment decision to conduct exploration. In many cases, these would be considered typical costs of doing business on public lands and would not result in a change in the long-standing trend of heavy mineral development in the planning area.

Impacts to mineral resource development were developed based on 1) professional experience from BLM mineral resource specialists, 2) the existing mineral development trends established for the planning area, and 3) knowledge of the existing trends for mineral development in light of the existing constraints placed on mineral development necessary to maintain BLM's multiple-use mission.

4.3.1.1 Leasable Minerals

4.3.1.1.1 Analysis Methods

Indicators

Land management planning decisions may have a direct impact on and result in an increase or reduction of lands available for leasing, the number of productive wells, and the number of producing operations depending on the alternative.

The amount of constraint on mineral leasing in a particular area can vary widely, depending on the need to mitigate impacts to other resources or uses in that area. An area may be closed to mineral leasing entirely if other resources or uses cannot be adequately protected from leasable mineral development with even the most restrictive lease stipulations. This would render any leasable mineral deposit in that area inaccessible for the life of the plan subject to valid existing rights. In contrast, an area with few resource or use conflicts may be open to mineral leasing subject to existing laws, regulations, and formal orders and the terms and conditions of the standard lease form. Between these two endpoints lay various degrees of other constraints where such restrictions may be required to mitigate impacts to other resource values. These restrictions may include seasonal and CSU restrictions (moderate constraints) or NSO (major constraints). Management for other resources within the planning area can also affect leasable mineral exploration and development. In general, management direction can either prohibit mineral exploration and development altogether or restrict leasable mineral exploration and development, which adds cost and delay, increases the complexity of the permitting process, and impacts the logistical operation of these exploration and development activities.

The impact indicators used in this analysis to measure the impacts of management decisions on oil and natural gas and geothermal resources development are:

- Acres of BLM-administered lands available for leasing fluid minerals, including oil and natural gas and geothermal resources;
  - Open under standard terms and conditions,
  - Open with moderate constraints (either CSU or timing limitation stipulations),
  - Open with major constraints (either NSO or overlapping CSU/timing limitation), or
  - Closed to leasing.
- Number of productive oil and natural gas (gas) wells to be impacted based on the RFD scenario for the planning area (Engler and Cather 2014); and
- Number of geothermal resource operations impacted.

Note that productive oil and gas wells are used instead of the total number of wells drilled because productive wells are the only ones that tap the resource. An increase or reduction in productive wells leads to an increase or decrease in royalties and depletion of the resource. Dry holes only have an impact on the drilling economy, so they are not used as an indicator for impacts on oil and gas development.

The impact indicators used to measure the impacts of management decisions on solid leasable mineral development are:

- Acres of BLM-administered lands available for leasing for potassium;
- Number of potassium mines predicted to be opened;
- Acres of BLM-administered lands available for leasing of sodium;
- Number of sodium mines predicted to be opened; and
- Acres of BLM-administered lands available for leasing of sulfur.

Methods and Assumptions

This section describes the methods and assumptions used for the analyses, discusses the availability of data, and identifies management decisions described in detail in Chapter 2 that would have very minor, if any, impacts to mineral resources.

As described in Chapter 3, extensive deposits of fluid leasable (oil, natural gas, and geothermal) and solid leasable (potassium, sodium, and sulfur) minerals occur in the planning area. These deposits have value to society if they can be economically produced. Management actions that temporarily prohibit or restrict development of these deposits may have a long-term beneficial effect on the resource in the ground because that resource would be available for development at a later date. However, current laws encourage and facilitate the development by private industry of public land mineral resources in a manner that satisfies societal needs and provides for economical and environmentally sound exploration, extraction, and reclamation practices.

Methods

The baseline used to determine potential impacts is the existing conditions as described in Chapter 3. Analysis assumptions were developed below to help guide the determination of impacts. The analyses described in this chapter represent the best estimates of impacts because exact locations of development or management often are not known. The magnitudes of effects are quantified to the extent practical based on available data. Effects are sometimes described using ranges of potential impacts. Qualitative descriptions of the nature of the impacts are also provided.

Management actions to protect other resource values could directly and indirectly impact new mineral leases, exploration, and development. A direct impact is one that specifically prohibits or allows leasing, exploration, or development. An example of a direct impact is the decision to identify areas as administratively unavailable or closed to new leasing. Management actions that do not explicitly allow or prohibit mineral exploration and development activity, but could influence a company's decision whether to proceed with a given project, are considered indirect impacts to leasing, exploration, or development. Effects can vary from beneficial to adverse. Effects include anything that would enhance or restrict leasing, exploration, and development. Adverse effects restrict leasable mineral development, and beneficial effects enhance leasable mineral development.

Fluid Leasables

The number of oil and gas wells affected is used to quantify the impacts from a number of decisions. The number of projected wells during the planning period was estimated from the projections in the RFD scenario (Engler and Cather 2014). The RFD scenario projected that 780 new completions per year would occur during the next 20 years in the planning area, with 62% (480) on non-federal land and 38% (300) on federal land. Thus, 9,600 wells are projected for non-federal land and 6,400 wells are projected to be drilled on federal land in the next 20 years. Of the predicted wells on non-federal land, 2,104 wells are projected to be drilled on split estate lands, where the federal government owns the mineral estate and the surface estate is owned by another entity. The concept of split estate lands is discussed in more detail in Section 3.3.1.1.1. Oil and gas wells on federal land would be drilled in the low, moderate, and high potential oil and gas areas as shown on Map 3-22.

Each land use plan decision is analyzed for its impact on fluid leasable mineral development, as measured by lands available for leasing for both oil and gas and geothermal resources, the numbers of oil and gas wells affected, and numbers of oil and gas producing operations affected. The total predicted number of wells on BLM-administered surface lands (6,400) and BLM-administered subsurface estate (2,104) was used as the baseline to calculate the impacts to fluid leasable minerals, by alternative. The analysis assumes that the percentage of land affected by a specific decision is directly proportional to the amount of resource affected by that decision. For example, if a decision would affect 10% of the BLM-administered surface lands available to leasable mineral development, then it would affect 10% of the mineral resources on that land and 10% of the wells that would be used to develop that resource (i.e., 10% of 6,400 wells or 640 wells over 20 years). Additionally, if a decision would affect 10% of the BLM-administered subsurface estate available to leasable mineral development, then it would affect 10% of the wells that would be used to develop that resource (i.e., 10% of 2,104 wells or 210 wells over 20 years). Reductions in the number of well locations (and potential surface disturbance) from the baseline RFD scenario for each alternative are a result of proposed management actions presented in Chapter 2, which can affect oil and gas or geothermal development activities by not allowing leasing, restricting surface occupancy, or controlling surface use.

Solid Leasables

Only the solid leasable minerals potassium and sodium occur in the planning area in deposits of sufficient quantity and quality to be considered commercial. Modest expansion is expected to occur for both potassium and sodium over the next 20 years. No commercial deposits of sulfur are known to occur in the planning area, nor are any expected to be found in the reasonably foreseeable future. However, sporadic exploration for sulfur would likely occur over the next 20 years.

Exploration, leasing, and development activity for solid leasables was estimated for the entire planning period. Projected exploration and development activity is based on staff experience and historical data outlined in Chapter 3 for potassium, sodium, and sulfur.

Assumptions

Fluid Leasables

The analysis began with the baseline total unconstrained oil and gas development potential taken from the RFD scenario for oil and gas (Engler et al. 2012) and applied the constraints from the other resource programs that may affect oil and gas development. All wells drilled are assumed to be productive wells, as the incidence of dry holes in the planning area is very low. Therefore, it is assumed that every hole that is drilled results in a completion.

Leasing of fluid minerals is typically in areas of low, moderate, or high potential for fluid leasable minerals and not in areas with no potential. However, lands are available for leasing throughout the planning area.

There would be low interest in developing geothermal resources during the planning period. Based on the CFO's experience from other areas and government programs that encourage development of renewable resources, 10 geothermal leases would be issued during the 20-year planning period in the area with known geothermal potential (Map 3-23) in northwest and central Eddy County. However, based on historical data, none of the leases would be actively explored through drilling or developed during the planning period.

Percentage estimates of lands open with standard lease terms and conditions, open with moderate constraints, open with major constraints, and closed to leasing are compared to BLM-administered surface lands and BLM-administered subsurface estate available for leasable mineral development for each alternative.

Solid Leasables

Potash occurs in the planning area in the Salado Formation east of the Pecos River. Areas with measured, indicated, or inferred reserves are considered high potential for development. Areas currently under lease or prospecting permits outside the reserve areas are considered to have moderate potential for development. The rest of the area east of the Pecos River is considered to have low potential for potash development. Based on a modest increase in demand for potash during the planning period, the projection for the planning period is that 20 prospecting permits or exploration licenses would be filed and processed, and 10 new leases would be issued. Two new traditional underground potash operations and three new solution potash operations are expected during the planning period in high or moderate potential areas.

Sodium occurs in the planning area in the subsurface Salado Formation from central Eddy County eastward to the Texas border (Map 3-24). The entire area is considered to have high potential for sodium. However, because the demand for sodium is static, only 10 prospecting permits or exploration licenses are expected to be processed during the planning period and five new leases are expected to be issued. No new underground sodium mines are expected during the planning period. Sodium mining from potash tailings are expected to continue over the next 20 years. These sodium operations would be located within existing leased areas for potash operations; therefore, the analysis contained within this section does not account for additional impacts from sodium mining from tailings as the impacts from potash already account for the surface disturbance from the tailings ponds.

Sulfur deposits occur at or near the base of the Castille Formation. For this reason, exploration for sulfur would likely be concentrated where the Castille is exposed at or near the surface (Map 3-26). Based on historic sulfur development activities in the planning area, all other areas are considered to have no potential for development of sulfur. Exploration for sulfur is expected to be sporadic during the planning period. Five prospecting permits or exploration licenses would be expected to be issued for sulfur exploration during the planning period, but no leases would be expected to be issued, nor would any deposits be expected to be developed.

Management Actions with No Impacts or Minor Impacts on Leasable Minerals

This section addresses management actions that would have either minor or no impacts on leasable minerals. A brief explanation of the rationale in determining minor or no impact is presented, and the management actions are not carried forward for detailed analysis in the leasable minerals subsection.

Backcountry Byways

Designations of backcountry byways and national recreation trails would have a minor adverse impact on leasable mineral development because proposed backcountry byways under all alternatives are in an area of low mineral development potential.

Cultural Resources

Conflicts between leasable mineral development and cultural resources would be resolved in accordance with regulations, policy, and the Permian Basin Programmatic Agreement between the New Mexico SHPO and the BLM, including consultation with tribes concerning mineral development. Continuation of the Permian Basin Programmatic Agreement would occur under all alternatives. Some policies may cause minor delays in mineral development to allow for surveys and/or agency consultation. However, based on historic mineral development within the planning area, the delays would not result in the reduction of land available for leasing, the number of leasable mineral operations, or the number of drilled wells.

Lands with Wilderness Characteristics

Closing lands with wilderness characteristics to mineral leasing or allowing leasing only with NSO stipulations would prohibit or limit leasable mineral development on these lands. Oil and gas or geothermal wells would have to be directionally drilled to develop the resources in these areas. Underground mines would have to be developed outside the lands with wilderness characteristics or the solid leasable resources would have to be developed in situ through directional drilling. Use of these technologies would increase the cost of development of leasable resources, which could translate to a loss of production and royalties. Table 4-137 summarizes the lands with wilderness characteristics identified for management to maintain wilderness characteristics under all alternatives.

Most of the areas identified as lands with wilderness characteristics under all alternatives would be outside the area with known low, moderate, or high potential for oil and gas, so fluid leasable minerals would not be impacted. There would be no impact on geothermal resources, because there is no potential for geothermal resources in areas proposed to be managed for their wilderness characteristics. Areas with wilderness characteristics are also outside the area with known low, moderate, or high potential for potassium, so potassium development would not be impacted. The existing sodium mines would also not be impacted, and no new underground sodium or sulfur mines are projected for the planning period.

Table 4-137. Lands with Wilderness Characteristics to Be Managed to Protect Wilderness Characteristics, by Alternative (acres)

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
0	66,666	47,611	5,119	1,221

Livestock Grazing

The standards for rangeland health apply to reclamation of all leasable mineral operations in the planning area; however, these standards would not significantly increase the constraints placed leasable mineral operations nor affect leasing or the number of wells. Thus, livestock grazing has no impact on leasable mineral development.

Locatable Minerals

Locatable mineral mining operations would conflict with the location of leasable mineral operations; however, the low potential for development for locatable mineral deposits and the projection of only one locatable mineral operation during the planning period make the likelihood of conflict very remote. Therefore, locatable mineral actions would not affect the availability of land for leasing or leasable mineral operations.

Paleontological Resources

None of the paleontological resources decisions would impact the amount of land available for leasing or the number of leasable mineral operations.

Public Health and Safety

Leasable mineral operations already are required to follow all safety regulations and policies, including Occupational Safety and Health Administration (OSHA) and Mine Safety and Health Administration (MSHA) rules. Requirements to upgrade visual and audible alarm systems for wells with concentrations of H_2S greater than 100 ppm would protect public health and safety without being cost-prohibitive.

Renewable Energy

The wind energy development potential area is in the vicinity of the Guadalupe Mountains where there is little or no potential for leasable mineral resources. Thus, conflicts between the potential wind energy development and fluid and solid leasable mineral development is not expected.

Solar energy development could occur across Eddy and Lea Counties, so conflicts with leasable mineral operations could occur. However, the acreage needed for solar development would be minimal relative to the BLM-administered lands available for leasable mineral development. No geothermal operations are projected in the areas identified for solar development, so there would be no impact on geothermal resource development. It is likely that no more than one potassium operation would be impacted, so the chances of conflict would be minimal. No new underground sodium or sulfur operations are projected during the planning period.

Salable Minerals

Typically, salable operations are part of the infrastructure that helps support oil and gas operations or solid leasable mine operations. Thus, the salable mineral decisions would have a beneficial effect for leasable mineral development. They would have a similar effect for geothermal development; however, the number of wells affected would be few.

Travel Management

Implementation of a comprehensive travel management plan would have a beneficial effect on leasable mineral development because it would identify roads that would be available for access up front so these routes can be projected during the cost estimation phase of operation planning. The travel management plan would have no impact on the availability of land for leasable mineral development or the numbers of wells or production facilities.

Limiting cross-country travel by motorized vehicles except travel related to a lease or permit would have a beneficial effect for leasable mineral development because it would limit the amount of public traffic in the vicinity of oil and gas facilities and mining operations, which would be a safety concern for leasable mineral operations. This requirement would not impact the availability of land for leasing or the number of productive wells. The Gold Book standards have been adopted by the oil and gas industry already, so the requirement for Gold Book standards for roads would have no impact on leasable mineral development.

Travel management decisions would affect leasable mineral development because access roads for exploration and development can be closed or their use restricted or limited temporarily. This would cause the costs of operations to increase or, in rare cases, prohibit the operations. These actions would directly impact access to mineral deposits or limit the type of vehicular traffic to access the deposits, which constrains and increases the costs of leasable mineral operations. However, typically access routes that coincide with existing roadways or access roads are authorized under the lease or permit. Thus, travel management decisions often have only a minor impact on leasable mineral operations. Furthermore, the areas closed to travel under each alternative are small in comparison to the size of the planning area (Table 4-138).

Table 4-138. Travel Management Decisions, by Alternative (acres of BLM-administered surface lands)

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	-	–	–	–	–
OHV limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737
Total	***2,091,273***	***2,091,326***	***2,091,327***	***2,091,320***	***2,091,321***

Vegetation Management, Including Noxious Weeds

There are no vegetation management decisions considered in Chapter 2 that would impact the availability of leasable mineral leases or the numbers of wells or operations. Thus, vegetation management decisions would have no impact on leasable mineral development.

Water Resources

There are no water resource management decisions considered in Chapter 2 that would impact the lands available for mineral leases or the number of wells or operations. Thus, water resource management decisions would have no impact on leasable mineral development.

Wildland Fire Management

There are no management decisions considered in Chapter 2 for wildland fire management. Thus, wildland fire management actions would not impact the land available for leasing or the number of operations.

Cave and Karst Resources

There are no cave and karst resources management decisions considered in Chapter 2; therefore, there would be no impact to leasable minerals.

Riparian Resources

There are no riparian resources management decisions considered in Chapter 2 that would impact leasable minerals.

Soil Resources

There are no soil resources management decisions considered in Chapter 2; therefore, there would be no impact to leasable minerals.

Special Status Species

There are no special status species management decisions considered in Chapter 2; therefore, there would be no impact to leasable minerals.

Wildlife and Fish

There are no wildlife and fish management decisions considered in Chapter 2; therefore, there would be no impact to leasable minerals.

4.3.1.1.2 Direct and Indirect Impacts

Impacts of Leasable Minerals Actions on Leasable Minerals

Impacts from Management Common to All Alternatives

Under all alternatives, the BLM would continue to require mineral lessees to conduct operations in a manner that would minimize adverse impacts to other resources, land uses, and land users in accordance with regulations, orders, notices to lessees, lease stipulations. Mineral allocation decisions vary from those that prohibit operations to those that allow operations with little restriction other than those imposed by existing local, state, and federal laws and regulations. Decisions that close land to leasing have a direct adverse impact on leasable mineral development whereas decisions that place restrictions on development have an adverse impact due to increased operation constraints. Table 4-139 summarizes the leasable mineral allocations on BLM-administered lands, by each alternative.

Table 4-139. Leasable Minerals Allocations, by Alternative (acres of BLM-administered surface land)

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open with standard terms and conditions	1,598,870	1,142,802	1,089,481	1,750,774	1,997,681
Open with moderate constraints (CSU)	956,410	799,649	449,759	786,381	631,634
Open with major constraints (NSO)	54,602	80,394	162,013	158,401	70,142
Closed	174,391	761,404	1,082,972	88,502	84,687
Total	***2,784,273***	***2,784,248***	***2,784,224***	***2,784,058***	***2,784,145***

Under all alternatives, the CFO would facilitate the development of public land leasable mineral resources, where compatible with resource objectives, to meet societal needs. This would have a beneficial effect on mineral leasing, exploration, and development.

Interactions between Solid Leasable Minerals and Fluid Leasable Minerals

Lands available for leasing of fluid leasable minerals coincide with lands available for leasing of solid leasable minerals under all alternatives, and the areas with known potential for development of oil and gas and geothermal resources overlap the lands known to have potential for development of potassium, sodium, and sulfur. As a result, conflicts between fluid and solid leasable mineral development would be likely in the planning area over the next 20 years.

Under all alternatives, fluid leasable minerals would continue to be leased in the potash area according to *Secretary's Order 3324 for Oil, Gas, and Potash Leasing and Development within the Designated Potash Area of Eddy and Lea Counties, NM*, as amended (Secretarial Order 3324, U.S. Department of the Interior [USDI] 2012). Management decisions associated with co-development of potash, oil, and gas deposits in the Secretary's potash area would impact fluid mineral development in two ways. First, oil and gas wells must be drilled a safe distance from the operating potash mines so that mine workings are protected. This would be a major restriction (mostly NSO) on the development of oil and gas wells, which would substantively increase constraints on drilling locations. Second, the formation containing the potash must be protected for eventual development through design of oil and gas downhole equipment. Also, in some cases, no resolution for the conflict between oil and gas and potash would be available, so the oil and gas resource would go untapped until some later date after mining ceases. This would be a direct adverse impact on immediate fluid leasable exploration and development.

The 497,000-acre potash area encompasses approximately 24% of BLM-administered surface lands available to leasable mineral development in the planning area. As many as 1,536 wells over the next 20 years could be impacted by the potash order through increased constraints or prohibitions on drilling.

In the Secretary's potash area, fluid leasable mineral development would be managed as described in Secretarial Order 3324 and fluid lease stipulations within the designated potash area would beneficially impact potash development. No such protection would exist for sodium or sulfur deposits nor would any fluid leasable management decisions apply to sodium and sulfur.

Outside the Secretary's potash area, preference for development of solid or fluid mineral leases would be given to the senior lessee on a first come–first served basis. Also, solid leasable mineral deposits would be protected through imposition of moderate downhole constraints on oil and gas well drilling. No fluid leasable mineral decisions would impact the land available for leasing of solid leasable minerals or the numbers of existing and projected solid leasable operations.

Impacts from the No Action Alternative

Under the No Action Alternative, 57% of BLM-administered surface lands (2,784,273 acres) would be open with standard stipulations. Approximately 956,410 acres (34%) of BLM-surface administered lands would be open with moderate constraints, which would impact the development of as many as 2,198 wells (based on percentage of the RFD projected number of 6,400 wells) over the life of the plan. The moderate constraints would also affect as many as one prospecting permit or exploration license for potassium and one prospecting permit or exploration license for sodium during the life of the plan. Approximately 54,602 acres (2%) of BLM-administered lands would be open with major constraints. This allocation may impact as many as 126 wells by increasing the cost of operations. This may affect as many as one prospecting permit or exploration license for potassium and one prospecting permit or exploration license for sodium during the life of the plan. Finally, 174,391 acres (6%) of BLM-administered lands would be closed to leasable mineral exploration and development. As many as 400 wells would be impacted by the closure to leasable mineral development on BLM-administered surface lands. In total, the projected total number of wells under the No Action Alternative is 5,874 wells on BLM-administered lands when considering areas closed to leasable mineral development and NSO areas. Because of the small acreage, this action would most likely have no impact on potassium, sodium, and sulfur exploration and development.

Impacts from Alternative A

Under Alternative A, 41% of BLM-administered land (1,142,802 acres) would be open with standard terms and conditions. Approximately 799,649 acres (29%) of BLM-administered lands would be open with moderate constraints (CSU), which could impact as many as 1,856 wells over the life of the plan. Because of the small acreage, this action would most likely have a negligible impact on potassium, sodium, and sulfur exploration and no impact on potassium and sodium mining. Approximately 80,394 acres (3%) of BLM-administered lands would be open with major constraints (NSO), which would impact 184 wells over the next 20 years. Approximately 761,404 acres (27%) of BLM-administered lands would be closed. As many as 1,750 wells on BLM-administered surface lands would be impacted by the closure to leasable mineral development. In total, the projected total number of wells under the Alternative A is 4,465 wells on BLM-administered surface lands when considering areas closed to leasable mineral development and NSO areas. The decision to close 761,404 acres would have a direct adverse impact on no more than five prospecting permits or exploration licenses for potassium, on three prospecting permits or exploration licenses for sodium, and one prospecting permit or exploration license for sulfur during the life of the plan because these lands would not be available for exploration.

Impacts from Alternative B

Under Alternative B, 39% of BLM-administered lands (1,089,481 acres) would be open with standard stipulations. Approximately 449,759 acres (16%) of BLM-administered lands would be open with moderate constraints (CSU), which would impact the development of as many as 1,024 wells. The CSU allocation would most likely not impact any prospecting permits or exploration licenses. Approximately 162,013 acres (6%) of BLM-administered surface lands would be open with major constraints (NSO). This allocation may impact approximately 372 wells. This action would impact as many as one potassium prospecting permit or exploration license and one sodium prospecting permit or exploration license. Approximately 1,082,972 acres (39%) of BLM-administered surface lands would be closed. As many as 2,489 wells would be impacted by the closure to leasable mineral development on BLM-administered lands. In total, the projected total number of wells under Alternative B is 3,538 wells on BLM-administered lands and when considering areas closed to leasable mineral development and NSO areas. If closed areas are in low, moderate, or high potential areas, this would impact no more than five potassium prospecting permits and licenses, one potassium lease, three sodium prospecting permits or exploration licenses, one sodium lease, or one prospecting permit or exploration license for sulfur.

Impacts from Alternative C

Under Alternative C, 63% of BLM-administered surface lands (1,750,774 acres) would be open with standard stipulations. Approximately 786,381 acres (28%) of BLM-administered surface lands would be open with moderate constraints (CSU), which would impact as many as 1,808 wells over the life of the plan. Moderate constraints would also affect as many as two potassium leases, one sodium lease, or one prospecting permit or exploration licensed for sulfur during the life of the plan. Approximately 158,401 acres (6%) of BLM-administered lands would be open with major constraints (NSO). This allocation may impact as many as 364 wells. Major constraints would also impact as many as two potassium prospecting permits or exploration licenses, one potassium lease, or one sodium prospecting permit or exploration license. Finally, 88,502 acres (3%) of BLM-administered lands would be closed to leasable mineral development. As many as 203 wells would be impacted by the closure to leasable mineral development on BLM-administered lands. In total, the projected number of wells under Alternative C is 5,832 wells on BLM-administered lands when considering areas closed to leasable mineral development and NSO areas. Areas closed to leasable mineral development would most likely not impact any solid leasable prospecting permits, exploration licenses, or leases.

Impacts from Alternative D

Under Alternative D, 72% of BLM-administered surface lands (1,997,681 acres) would be open with standard stipulations. Approximately 631,634 acres (23%) of BLM-administered lands would be open with moderate constraints (CSU). Moderate constraints would impact as many as 1,452 wells over the life of the plan. Moderate constraints would impact as many as two potassium leases, one sodium lease, or one prospecting permit or exploration licensed for sulfur during the life of the plan. Approximately 70,142 acres (3%) of BLM-administered lands would be open with major constraints (NSO). Major constraints would impact as many as 161 wells over the life of the plan. The small acreage of lands open with major constraints would not impact any solid leasable mineral exploration permits or leases. Finally, 84,687 acres (3%) of BLM-administered lands would be closed to leasable mineral exploration and development. This may impact as many as 195 wells on BLM-administered surface lands. In total, the projected number of wells under Alternative D is 6,044 wells on BLM-administered lands when considering areas closed to leasable mineral development and NSO areas. The impact to solid leasable minerals would be negligible because of the small acreage.

Impacts of Air Resources Actions on Leasable Minerals

Impacts from Management Common to All Alternatives

Under all alternatives, oil and gas production facilities must comply with existing federal and state regulatory requirements for the protection of ambient air quality, including but not limited to EPA Nonroad Diesel Engine Emission Standards, New Mexico Administrative Code 20.2.38 Hydrocarbon Storage Facilities, and NESHAP (40 CFR 63, Subpart HH). The requirements would result in an adverse impact on leasable minerals because it would increase management constraints placed on operations.

Impacts from Management Common to All Action Alternatives

Within 1 year of the ROD, all new and existing drilling rig, completion rig, work-over rig, and fracturing pump engines would have to meet EPA Tier 4 Nonroad Diesel Engine Emission Standards or meet equivalent emission standards. This requirement probably would not result in a reduction of wells or facilities.

Pneumatic controllers and new and modified centrifugal or reciprocating compressors meeting EPA NSPS requirements would have to be installed at gas gathering and boosting stations, well sites, and gas processing plants. These requirements would increase the constraints placed on both existing and new operations but probably would not result in facility closure.

The requirement for new and modified natural gas sweetening units at gas processing plants to meet EPA NSPS requirements would increase the constraints placed on plant operations. However, this requirement probably would have little impact on the numbers of wells and no impact on the availability of land for leasing.

Impacts from the No Action Alternative

Under the No Action Alternative, stipulations would be imposed on all proposed projects to meet air quality standards. This is the same as the requirements under the Impacts from Management Common to All section, discussed above.

Impacts from Alternative A

Green completions involving recovery and clean-up of natural gas would be required for all natural gas and oil wells in accordance with EPA NSPS rules unless the need for an exemption can be documented. This requirement would increase the constraints placed on operations, but it is not expected to result in the abandonment of plans to drill.

During construction activities (including well drilling, completion, and work-over), twice daily watering (or equivalent) of construction areas and associated resource roads would be required to prevent at least 50% of fugitive dust from vehicular traffic, equipment operations, or wind events. This requirement would not result in a reduction of wells or facilities.

Emission controls would be required for oil tanks, condensate tanks, produced water tanks, and glycol dehydrators without regard to the location of the equipment or to the quantity of uncontrolled VOC emissions from the equipment in accordance with the EPA NESHAP. VOC emissions reduced by at least 95% from uncontrolled emission levels. This requirement would increase constraints placed on operations for existing productive wells (13,392). However, this requirement probably would not result in facility closure.

The requirement that at least 70% of gas compression at compressor stations (gathering, boosting, transmission, and gas plants), well heads, and oil well head pumps would be powered by electricity would be a direct adverse impact to leasable mineral development, which can impact the number of wells. Wells must produce a certain volume of product to pay for operations costs. If the costs are high, wells may be abandoned sooner because it becomes uneconomical to produce minerals.

Impacts from Alternative B

Green completions involving recovery and clean-up of natural gas would be required for all natural gas and oil wells in accordance with EPA NSPS rules unless the need for an exemption can be documented. This requirement would increase constraints placed on operations, but knowledge of the requirement up front allows operators to build requirement into their plans. Thus, it typically would not result in the abandonment of plans to drill.

Alternative B would have the same actions and impacts as Alternative A in regard to the fugitive dust, VOC emission controls, and electricity requirements.

Impacts from Alternative C

Operators must comply with all applicable EPA NSPS regulations, including those limiting emissions during well completions. Operators must also comply with all applicable BLM regulations pertaining to the venting and flaring of gas.

Glycol dehydrators located at well sites, gathering and boosting stations, gas processing plants, and natural gas transmission stations would be required to meet applicable EPA NESHAP. These requirements would increase the constraints placed on operations but would not result in facility closure.

Impacts from Alternative D

Alternative D would have the same actions and impacts as Alternative C in regard to the EPA NSPS Air Rules for the Oil and Gas Industry (2012), VOC emission controls, and electricity requirements.

Impacts of Land Tenure Actions on Leasable Minerals

Disposal of lands reduces the amount of land available for leasing. Thus, disposal of lands would have a direct adverse impact on leasable mineral development. If mineral rights are retained by the federal government, disposal would have no impact on the availability of land for leasing and, thus, no impact on leasable mineral development.

Retention zones include those lands specifically identified by the tribes as having special importance related to treaty and/or traditional uses/values; endangered, threatened, proposed, and candidate special status species habitat; NRHP-eligible and -listed properties; wildlife tracts for candidate or special status species;

and lands acquired under Land and Water Conservation Fund (LWCF). Although retained lands may be managed with restrictive prescriptions, typically retention of these types of lands would not reduce the amount of land available for leasing or impact the numbers of operations. Thus, retention of land would have no impact on leasable mineral development

Table 4-140 summarizes the lands identified for disposal and retention, by alternative.

Table 4-140. Land Tenure Actions (acres) by Alternative

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Disposal	218,318	18,703	26,125	31,536	51,579
Retention	1,872,747	2,070,580	2,063,155	2,057,744	2,037,362

Impacts from the No Action Alternative

Approximately 218,318 acres would be eligible for disposal through sale, exchange, or some other title transfer. This would have a direct adverse effect on leasable mineral development because disposal would remove these lands from leasing and development, which would result in a loss of production and royalties. The acreage represents 10% of the total BLM-administered surface lands. Although leasing and development already is restricted in some of the lands identified for disposal (e.g., Waste Isolation Pilot Plant site), this would affect leasing and as many as 610 oil and gas wells during the next 20 years since most of the identified tracts are in low, moderate, or high oil and gas potential areas. Lands identified for disposal also encompass about 50% of the area known to have low potential for geothermal resources. This action would adversely impact about five geothermal leases. Land disposal would impact leasing and as many as two potassium exploration permits, one potassium lease, or one sodium lease. Sulfur would not be impacted because none of the lands identified for disposal occur in the area known to have potential for sulfur (see Map 3-32 [Land Tenure Disposal Lands] and Map 3-26 [Sulfur Potential].

Impacts from Alternative A

Under this alternative, 18,703 acres in the planning area would be eligible for disposal through sale or exchange or other title transfer. This action would potentially remove these lands from leasing and development. This would be 1% of the total BLM-administered surface lands, so about 64 oil and gas wells would be impacted during the next 20 years. No geothermal, potassium, sodium, or sulfur leases or operations would be impacted.

Impacts from Alternative B

Under Alternative B, 26,125 acres would be eligible for disposal and potentially removed from mineral leasing. This would be 1.3% of the total BLM-administered surface lands. As many as 83 wells would be affected during the next 20 years, leading to a loss of production and royalties. No geothermal, potassium, sodium, or sulfur leases or operations would be impacted.

Impacts from Alternative C

Under Alternative C, 31,536 acres would be disposed and removed from mineral leasing. This would be 1.5% of the total BLM-administered surface lands in the planning area. Approximately 96 wells would be affected during the next 20 years. Alternative C would have the same actions and impacts as Alternative A for retention of lands.

Impacts from Alternative D

Under Alternative D, 51,579 acres would be disposed and removed from mineral leasing. This would be 2.5% of the total BLM-administered surface lands in the planning area. Approximately 160 wells would be affected during the next 20 years. Alternative D would have the same actions and impacts as Alternative A for retention of lands.

Impacts of Land Authorization Actions on Leasable Minerals

Land authorization actions include issuance of ROWs for pipelines, power lines, roads, and sites, along with stipulations that govern the operations. Leasable mineral facilities and infrastructure must be located within ROWs if they are located beyond the lease boundaries, so land authorization decisions that allow for more orderly and easy access to leases and allow for efficient production would have a moderate beneficial effect on mineral development.

The primary land authorization action that impacts mineral development is the decision to designate ROW avoidance and exclusion zones to protect sensitive resources, such as visual resources, cave and karst areas, and special status species. Exclusion or avoidance zones do not preclude mineral development from occurring within the zone. However, the terms and conditions placed on mineral development ROW grants could increase the constraints placed on operations if leasable mineral development facilities, such as compressor plants, cannot be located close to wells. However, multiple use conflicts typically would be resolved through movement of the ROW or relocation of new wells.

Exclusions and avoidance decisions would have an indirect adverse impact on mineral development depending on how much acreage and how many wells are impacted. Table 4-141 summarizes the ROW avoidance and exclusion zones, by alternative.

Table 4-141. ROW Avoidance and Exclusion Zones Located on BLM-administered Lands in the Planning Area (acres)

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Avoid	30,965	629,149	413,654	313,619	270,360
Exclude	7,056	662,038	918,701	165,378	69,540
Open	2,051,927	798,544	757,380	1,610,692	1,749,782

Utility corridors would be designated as shown on Map 2-47. These corridors cross lands with low, medium, and high potential for fluid mineral development and would impact a large number of wells even though fluid mineral operations would not be prohibited in the corridors. It is not anticipated that solid leasable mineral operations would be impacted by utility corridors.

Impacts from the No Action Alternative

Under the No Action Alternative, 30,965 acres would be managed as ROW avoidance areas and no areas would be managed as ROW exclusions areas within the planning area, which is approximately 1% of BLM-administered surface lands in the planning area. Leasable mineral development would not be prohibited in these areas; however, geophysical exploration lines would have to avoid the corridors, and leasable mineral development would be restricted. These areas would indirectly impact as many as 128 wells during the next 20 years. Avoidance areas could impact one geothermal lease, but the impacts would be negligible. Two potassium exploration permits, one potassium lease, or one sodium exploration permit would be impacted. The ROW corridors would not likely impact sulfur exploration.

Impacts from Alternative A

Under Alternative A, 629,149 acres would be designated as a ROW avoidance zone and 662,038 acres as a ROW exclusion zone. Combined, this would be 64% of the total BLM-administered surface land, so the corridors would impact as many as 2,304 wells over the next 20 years.

Impacts from Alternative B

Under Alternative B, 413,654 acres would be designated as a ROW avoidance zone and 918,701 acres as a ROW exclusion zone. Combined, this would be 64% of the total BLM-administered surface land, so the ROW management areas would impact as many as 2,560 wells over the next 20 years. The likelihood of conflicts with solid leasable mineral development operations is remote.

Impacts from Alternative C

Under Alternative C, 505,975 acres would be designated as a ROW avoidance zone and 228,642 acres as a ROW exclusion zone. Combined, this would be 35% of the total BLM-administered surface land, so the ROW management areas would impact as many as 2,240 wells over the next 20 years. No impacts to solid leasable minerals are expected.

Impacts from Alternative D

Under Alternative D, 270,360 acres would be designated as a ROW avoidance zone and 69,540 acres as a ROW exclusion zone. Combined, this would be 16% of the total BLM-administered surface land, so the corridors would impact as many as 1,920 wells over the next 20 years. No impacts to solid leasable minerals are expected.

Impacts of Recreation Actions on Leasable Minerals

Table 4-142 summarizes leasable mineral acreage allocations for SRMAs and ERMAs in the planning area, by alternative.

Table 4-142. Leasable Mineral Allocations for Proposed SRMA and ERMAs, by Alternative (acres)

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open with standard terms and conditions	1,477	1,533	7	1,528	1,533
Open with moderate constraints (CSU)	48,450	36,878	36,878	36,882	36,882
Open with major constraints (NSO)	6,008	9,483	10,085	9,983	11,218
Closed	13,534	2,096	3,018	1,275	40
Total	***69,469***	***49,991***	***49,988***	***49,669***	***49,673***

Impacts from Management Common to All

Development of RAMPs for SRMAs would have a beneficial effect for leasable mineral development because the management plans would identify mitigation during the mineral development planning stage, so the RAMP could be used during the design for mineral operations.

Impacts from the No Action Alternative

The Hackberry Lake OHV Area is in an area that has moderate and high potential for oil and gas and no potential for geothermal resources. Oil and gas locations could conflict with the OHV use area; however, the acreage represents only 2% of the total BLM-administered land available to mineral leasing, so no more than 128 wells would be affected during the next 20 years.

As shown in Table 4-142, under this alternative, 202 acres would be open with standard stipulations, 48,450 acres would be open with moderate constraints, and 6,008 acres with be open with major constraints. Only 13,534 acres would be closed to mineral leasing.

Decisions to close areas to leasing would be a direct adverse impact on leasable mineral development; however, 13,534 acres would be less than 1% of the total BLM-administered lands. Decisions to impose major or moderate constraints would increase the drilling costs, which can impact the decision to invest in exploration or operations. These decisions would impact 54,458 acres, which would be less than 2.0 % of the total BLM-administered lands. Most of the subject areas lie outside the geothermal potential zone, so there would be no impact on geothermal resources development. Even if all of the subject SRMAs and ERMAs are in areas known to have potential for potassium, sodium, or sulfur, most likely only one potassium lease and no sodium or sulfur leases or permits would be impacted.

Impacts from Alternative A

The Hackberry Lake OHV Area (36,889 acres) and the Alkali Lake Area (318 acres) are the preferred locations for recreational OHV use, and the Hackberry Lake OHV Area is the preferred site for commercial and organized competitive OHV events. Approximately 318 acres of the Alkali Lake Area would be managed to ensure that other land and resource uses would not interfere with organized recreational OHV use through NSO stipulations on leasable mineral development (major constraints), whereas Hackberry Lake would be managed with CSU (moderate constraints). However, the total acreage represents less than 1% of the total BLM-administered surface land, so no more than 128 wells, one potassium lease, and one sodium lease would be affected during the next 20 years.

As shown in Table 4-142, under this alternative, 1,533 acres would be open with standard stipulations, a total of 46,362 acres would be open but with moderate or major constraints, and 13,534 acres would be closed to leasing. Decisions to close lands would have a direct adverse impact on leasable mineral development. However, lands closed to leasing would represent a negligible amount of BLM-administered surface lands available to mineral leasing. Lands open with moderate and major constraints represent only 2% of the total BLM-administered lands available to mineral leasing.

Impacts from Alternative B

Alternative B would have the same actions and impacts as Alternative A in regard to the Hackberry Lake and Alkali Lake OHV areas.

As shown in Table 4-142, under this alternative, 7 acres would be open with standard stipulations, a total of 46,362 acres would be open but with moderate or major constraints, and 2,096 acres would be closed to leasing. Decisions to close lands would have a direct adverse impact on leasable mineral development. However, lands closed to leasing represents less than 1% of the total BLM-administered lands available to mineral leasing. Lands open with moderate and major constraints represent only 2% of the total BLM-administered lands.

Impacts from Alternative C

Under Alternative C, 1,341 acres of the Alkali Lake Area would be managed with NSO stipulations on leasable mineral development (major constraints), whereas Hackberry Lake would be managed with CSU (minor constraints). The total acreage represents only 2% of the total BLM-administered land, so no more than 128 wells, one potassium lease, and one sodium lease would be affected during the next 20 years.

As shown in Table 4-142, under this alternative, 1,528 acres would be open with standard stipulations, a total of 46,865 acres would be open but with moderate or major constraints, and 1,275 acres would be closed to leasing. Decisions to close lands would have a direct adverse impact on leasable mineral development. However, lands closed to leasing would represent less than 1% of the total BLM-administered lands available for mineral leasing. Lands open with moderate and major constraints would represent less than 2% of the total BLM-administered lands. At the most, one potassium or one sodium lease would be impacted.

Impacts from Alternative D

Under Alternative D, 1,342 acres of the Alkali Lake Area would be managed as open with standard terms and conditions, whereas Hackberry Lake would be managed with CSU. The acreage for the Hackberry Lake SRMA represents only 2% of the total BLM-administered land, so no more than 128 wells, one potassium lease, and one sodium lease would be affected during the next 20 years.

As shown in Table 4-142, under this alternative, 1,533 acres would be open with standard stipulations, a total of 48,100 acres would be open but with moderate or major constraints, and 40 acres would be closed to leasing. Decisions to close lands would have a direct adverse impact on leasable mineral development. However, lands closed to leasing would represent less than 1% of the total BLM-administered lands available to mineral leasing. Lands open with moderate and major constraints would represent less than 2% of the total BLM-administered lands. An estimated one potassium or one sodium lease would be impacted.

Impacts of Special Designations Actions on Leasable Minerals

Special designations considered within the RMP include ACECs, WSRs, and WSAs. Previously used special designations include RNAs, SMAs, historic sites, and Cultural Resource Management Areas (CRMAs). The designations of RNAs, SMAs, historic sites, and CRMAs would not be used in the new RMP. The areas would be designated as an ACEC or managed without a special designation. ACECs would replace most of the RNAs, SMAs, historic sites, and CRMAs under all action alternatives. WSRs would be recommended as suitable for inclusion in the NWSRS depending on the alternative decisions. WSAs in the planning area are already defined and await Congressional action, so the WSAs would be managed under the non-impairment standard. No wilderness areas exist in the planning area.

It is important to note, if Congress decides not to designate a river segment as part of the NWSRS, the protection management outlined in this section as WSRs would no longer apply. These segments would be managed according to decisions in other sections of the RMP. The impacts of these decisions on leasable mineral development are addressed in the riparian, water, special status species, and wildlife and fish sections.

Under all alternatives, WSAs would be managed as NSO or closed to leasing and existing leases would not be reissued after they expire. Lease closure would be a direct adverse effect on leasable mineral development. However, all the WSAs are in areas with no known potential or low potential for leasable minerals. Further, the total combined acreage under each alternative of the WSAs would be 7,086, which would represent only 0.3% of the total BLM-administered lands available to mineral leasing. Presumably, the WSAs would impact at most 0.3% of the low potential oil and gas resource (19 projected wells) or one well during the next 20 years.

If WSAs are not designated as wilderness areas by Congress and were released from WSA status, the lands would be managed closed to leasable development under Alternatives A through C and as open with major constraints under Alternative D. The effects of this decision would be negligible because of the small acreage (7,086 acres) included in the WSA lands.

Table 4-143 summarizes the leasable mineral allocations within proposed ACECs within the planning area.

Table 4-143. Proposed ACECs and Associated Leasable Mineral Allocations, by Alternative (acres)

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open with standard terms and conditions	1,438	71,191	61,907	33,947	–
Open with moderate constraints (CSU)	–	1,389	4,732	19,932	–
Open with major constraints (NSO)	4,816	22,870	98,534	16,644	9,766
Closed	7,262	399,592	396,260	28,120	19,127
Total*	***13,516***	***495,042***	***561,433***	***98,643***	***28,894***

*Total may not sum correctly due to rounding.

Maps 2.58–2.62 (WSAs and WSRs) and Maps 2.53–2.57 (ACECs) show the locations of special designations under all alternatives, Map 3-23 shows the land with geothermal potential, and Map 3-22 shows the area with known oil and gas potential. Map 3-28 shows the land with potassium potential, Map 3-24 shows the area with known sodium potential (subsurface salt), and Map 3-26 shows the land with potential for development of sulfur.

Impacts from the No Action Alternative

All the SMAs overlap the known leasable mineral potential areas to some degree except the Lonesome Ridge, Six Shooter, and Serpentine Bends areas. Management decisions for these areas have no impact to leasable mineral development. Only the Seven Rivers Hills, Cave Resources, Pecos Bluntnose Shiner Habitat, and Birds of Prey areas overlap the area known to have potential for geothermal resources. Management decisions in all other special designated areas would have no impact on geothermal development.

As shown in Table 4-143, under the No Action Alternative, 1,438 acres special designations would be open to leasable mineral development with standard lease terms and conditions. No acreage would be open with moderate constraints. Approximately 4,816 acres would be open to leasing but with major constraints like NSO. This would have the effect of increasing constraints on mineral operations, which could impact the investment decision whether to drill or mine.

Under this alternative, only 7,262 acres would be closed to mineral leasing. Overall, at the most, leasing would be precluded on only 0.3% of the total BLM-administered lands available to mineral leasing. So, at the most, these decisions would impact 6 oil and gas wells and one exploration permit or license for potassium, sodium, or sulfur during the 20 years and probably not impact any geothermal leases.

Impacts from Alternative A

Under this alternative, 399,592 acres within ACECs would be closed to leasing for leasable minerals, which is approximately 14% of the BLM-administered lands available to mineral leasing. This is a direct adverse effect on leasable mineral development. However, the Birds of Prey Grasslands ACEC closure would make up 340,511 acres or about 87% of the total closure area, and only about one-third of the Birds of Prey Grasslands ACEC (approximately 114,000 acres) overlaps areas with known potential for oil and gas or geothermal resources. Thus, about 227,000 acres of the closure would not have any potential for oil and gas or geothermal development. Additionally, the Birds of Prey Grasslands ACEC is outside the area known to have potential for solid leasable minerals. Therefore, approximately 163,000 acres or about 5.9% of the total BLM-administered lands available for mineral leasing would be removed from leasing in areas with oil and gas or geothermal potential under this alternative. Because most of the land in this alternative overlapped by a special designation is low, moderate, or high potential for oil and gas and low potential for geothermal resources, as many as 512 oil and gas wells would not be drilled and one geothermal lease would not be issued during the next 20 years. At most, one solid leasable permit or lease would be impacted by the closure.

An additional 22,870 acres of land would be open with major (NSO) constraints. This would represent only 0.2% of the total BLM-administered land, which would translate to an impact on 64 wells during the next 20 years. Constraints would be increased for these wells, which can affect the decision whether to drill. No solid leasable permits or leases are expected to be impacted by the major constraints.

Under this alternative, both the Black and Delaware Rivers would be recommended as suitable for inclusion in the NWSRS (Map 2-59). The combined acreage of both river segments would be less than 1% of the total BLM-administered lands.

Impacts from Alternative B

Under this alternative, 399,592 acres would be closed to leasing, which would be a direct adverse effect on leasable mineral development. As discussed under Alternative A, 340,511 acres of these closed lands would be the Birds of Prey Grasslands ACEC, two-thirds of which would be outside the area known to have potential for oil and gas. Only about 114,000 acres of the closed Birds of Prey Grasslands ACEC would overlap the known potential areas. Thus, only about 140,000 acres would be closed to oil and gas or geothermal development where there is potential for fluid leasable minerals. This would represent 4% of the total BLM-administered lands. Thus, the closure would impact as many as 448 wells over the next 20 years. No solid leasable permits or leases would be impacted by the lands closed to mineral development because 93% of the closed lands are located outside the area known to have potential for solid minerals.

Under this alternative, 98,534 acres would be open for leasing but have major constraints. This would increase the constraints placed on mineral development, which can have an impact on the investment decision whether to drill. This represents 3.5% of the total BLM-administered lands available for mineral leasing, so as many as 320 oil and gas wells and one solid leasable exploration permit that would be impacted during the next 20 years.

Under this alternative, the Black River would be recommended as suitable for inclusion in the NWSRS, but the Delaware River would not (Map 2-60). The acreage of the Black River segment would be less than 1% of the total BLM-administered lands.

Impacts to geothermal resources under this alternative are the same as Alternative A.

Impacts from Alternative C

Under this alternative, only 28,120 acres would be closed to leasing of leasable minerals. This would represent 0.6% of the total BLM-administered lands. Approximately 16,644 acres of the ACECs would be managed with major constraints, which can affect the decision whether to drill or mine on approximately 0.6% of the total BLM-administered land acreage. Because much of this acreage lies in areas with only low potential for oil and gas, this translates to only about three oil and gas wells and one solid leasable exploration permit that would be impacted during the next 20 years.

Under this alternative, 19,932 acres would be managed under moderate constraints for leasable minerals Moderate constraints would increase the costs of drilling and operations, which in the rare case would lead to a decision not to drill or early abandonment of production facilities. Approximately, 64 oil and gas wells would be impacted by moderate constraints during the next 20 years.

Under this alternative, the Black River would be recommended as suitable for inclusion in the NWSRS, but the Delaware River would not (Map 2-61). The acreage of the Black River segment would be less than 1% of the total BLM-administered lands.

Impacts to geothermal resources under this alternative are the same as Alternative A.

Impacts from Alternative D

Under Alternative D, 19,127 acres of land would be closed to leasable minerals. This would represent 1.0% of the total BLM-administered lands available for leasing, although most of the closed acreage would be outside the areas known to have potential for leasable mineral resources. Approximately 9,766 acres under this alternative would be managed with major constraints, which represents less than 1% of the total BLM-administered lands. Because most of the acreage would be in low oil and gas potential areas, only about two oil and gas wells would be impacted during the next 20 years. No solid leasable exploration permits or license would be impacted. Under this alternative, 201 acres would be managed with moderate constraints.

Under this alternative, the Black River would be recommended as suitable for inclusion in the NWSRS, but the Delaware River would not (Map 2-62). The acreage of the Black River segment would be less than 1% of the total BLM-administered lands. No solid leasable exploration permits or license would be impacted.

Impacts to geothermal resources under this alternative are the same as Alternative A.

Impacts of Visual Resources Actions on Leasable Minerals

VRM Class I and II severely constrain leasable mineral operations. VRM Class I is almost prohibitive to leasable mineral development because mitigation typically would increase the costs of operation to the point where it would no longer be economically viable. VRM Class II mitigation would increase constraints placed on mineral development and be cost-prohibitive in some locations. These impacts could influence the investment decision whether to drill or continue operations. VRM Class III constrains operations, but less than Class I and II areas. VRM Class IV is the least restrictive, and constraints placed on mineral development typically are minimal.

Under all alternatives, careful planning can help proponents design operations around VRM requirements. Whatever the case, VRM requirements would impact leasable mineral operations by requiring mitigation measures to reduce the visual impacts to the landscape form mineral development.

Table 4-144 summarizes the VRM decisions on BLM-administered surface lands, by alternative. The impacts to leasable mineral development are discussed under each alternative below.

Table 4-144. VRM Classes on BLM-administered Surface Lands by Alternative (acres)

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Class III	402,725	367,205	294,177	549,329	546,205
Class IV	2,330,462	2,142,600	2,131,501	2,166,266	2,189,116
Total	***2,783,858***	***2,783,514***	***2,783,481***	***2,783,558***	***2,783,585***

Impacts from Management Common to All Action Alternatives

The requirement that all non-temporary facilities and structures be screened, painted, and designed to blend with the surrounding landscape except where safety indicates otherwise. This decision would have little impact on new wells because mitigation is typically incorporated in the design early in the mineral development process.

Impacts from the No Action Alternative

Under this alternative, 7,058 acres of BLM-administered surface lands would be managed as VRM Class I, and much of this land is located outside areas known to have potential for leasable minerals. Thus, this decision has no impact on leasable mineral development.

Approximately 43,613 acres of BLM-administered lands would be managed as VRM Class II, which accounts only 2% of BLM-administered lands. Thus, the decision would at most impact 149 wells.

Under this alternative, 402,725 acres of BLM-administered surface lands would be managed as VRM Class III. This would be 14% of BLM-administered lands in the planning area. Mitigation such painting and facility design would increase the costs of leasable operations but probably would not preclude development. Approximately, 2,330,462 acres (84%) of BLM-administered lands would be managed as VRM Class IV with little or no constraint on leasable mineral development.

Low profile tanks and structures would be a requirement in VRM Class I and II areas, and in some cases in VRM Class III. This would increase the constraints placed on operations at oil and gas or geothermal facilities. However, this decision would have no impact on leasable mineral development for land assigned to VRM Class I because these lands are closed to leasing anyway and outside the oil and gas and geothermal potential areas. The decision would only impact 2% of the resources in VRM Class II areas. Most likely, this requirement would only affect a few wells and exploratory drill holes in VRM Class III areas.

Impacts from Alternative A

For the planning area, a total of 37,764 acres of BLM-administered lands would be managed as Class I, which would amount to 1.4% of the total BLM-administered surface lands in the planning area. Most of the VRM Class I acreage is located in WSAs where leasable mineral development would not occur.

For the planning area, 235,946 acres of BLM-administered surface lands would be managed as VRM Class II, which would be 8% of BLM-administered surface lands in the planning area. This would constrain operations and cause some operations to be relocated. This decision could affect as many as 671 new federal wells, 84 split estate wells, one exploration permit or license, and one solid mineral lease during the next 20 years, although some of the areas with VRM Class II requirements would be closed to leasable mineral leasing under this alternative.

Approximately 367,205 acres of BLM-administered lands would be managed as VRM Class III. This would represent 13% of the BLM surface lands, respectively, in the planning area. In these areas, mitigation would include facility design and painting to ensure that mineral operations fit in to their surroundings. Some of the VRM Class III areas already restrict leasable mineral development, but most of the areas are open to leasing.

Under Alternative A, 2,142,600 acres (77%) of BLM-administered lands would be managed as VRM Class IV.

Low profile tanks would be would not be allowed in VRM Class I, and low profile tanks and structures would be required in VRM Class II and III areas on a case by case basis. In VRM Class I areas, this would prohibit leasable mineral development or require tank burial. However, under this alternative, VRM Class I areas are outside the areas known to have potential for leasable minerals. Thus, the decision would have no impact on leasable mineral development in VRM Class I areas. In VRM Class II and III areas, this decision could impact a large number of wells and operations if low profile tanks were required in every case.

Impacts from Alternative B

Under this alternative, 42,102 acres of BLM-administered lands would be managed as VRM Class I, which would represent less than 2% of BLM-administered lands in the planning area. The subject areas would be closed to leasing or lie outside areas known to have potential for leasable minerals.

Approximately, 315,700 acres of BLM-administered lands would be managed as VRM Class II, which would represent 11% of BLM-administered lands in the planning area, respectively. This would constrain operations and cause some operations to be relocated.

Under this alternative, 294,177 acres of BLM-administered lands would be managed as VRM Class III. This would be 11% of BLM-administered surface lands in the planning area, respectively. In these areas, mitigation would include facility design and painting to ensure that mineral operations fit in to their surroundings. Under this alternative, 2,131,501 acres (77%) of BLM-administered lands would be managed as Class IV. Any mitigation required in these areas would be minimal.

Alternative B would have the same actions and impacts as Alternative A for low profile tanks.

Impacts from Alternative C

For the planning area, a total of 7,171 acres of BLM-administered lands would be managed as VRM Class I, which would amount to 0.3% of BLM-administered lands in the planning area. VRM Class I requirements would severely constrain or preclude leasable mineral development. However, most of the acreage is in WSAs where leasable mineral development would not occur anyway.

Approximately, 60,791 acres of BLM-administered lands would be managed as Class II. Most of the VRM Class II area would be outside the areas known to have potential for leasable minerals.

Under this alternative, 549,329 acres, or 20% of BLM-administered lands in the planning area, would be managed as Class III. Mitigation like painting and facility design would be required to ensure the facility fits in with the surrounding landscape. Under this alternative, 2,116,266 acres (78%) of BLM-administered lands would be managed as VRM Class IV. VRM Class IV mitigation would have only a minimal impact on operations.

Alternative C would have the same action and impact as Alternative A for low profile tanks.

Impacts from Alternative D

For the planning area, a total of 7,171 acres of BLM-administered surface lands would be managed as VRM Class I, which is the same as Alternative C. Approximately 41,092 acres (.3%) of BLM-administered lands would be managed as VRM Class II.

Under Alternative D, 546,205 acres (20%) of BLM-administered lands would be managed as VRM Class III. In these areas, mitigation would include facility design and painting to ensure that mineral operations fit in to their surroundings. Under this alternative, 2,189,116 acres (79%) of BLM-administered lands would be managed as VRM Class IV. Any mitigation associated with VRM Class IV would be minimal.

Alternative D would have the same action and impact as Alternative A for low profile tanks.

4.3.1.2 Locatable Minerals

4.3.1.2.1 Analysis Methods

This section describes potential impacts on the locatable minerals resource and activities from management actions for other resources and other management programs. The Locatable Minerals section of Chapter 3 describes existing locatable minerals resource conditions (see Section 3.3.1.4.2).

Indicators

The impact indicators used in this analysis that can be used to measure the impacts of management decisions on locatable mineral development in the reasonable foreseeable future are:

- acres of BLM-administered lands available for location and entry under the General Mining Laws;
- number of mining claims; and
- number of locatable mineral mines predicted to be opened in the planning period.

Land use management planning decisions may have a direct impact on and result in an increase or reduction of lands available for mining claim location or the number of productive mines.

Methods and Assumptions

This section describes the methods and assumptions used in the impacts analysis for the locatable minerals resource. Actions that limit the acres available to locatable minerals development are considered adverse because fewer acres available for mineral development restrict exploration and potential development of mineral resources within the planning area. Actions that increase the acres available to locatable minerals development are considered beneficial because fewer restricts facilitate the development of mineral resources within the planning area.

In general, the greater the number of acres affected, the greater the impact on the resource. Other actions may affect the accessibility of the locatable minerals resource, and these would likely lead to increased project costs by delaying operations or production. However, these actions would not affect the locatable minerals resource itself, and are not discussed in detail. Even in the extreme example that a number of such limitations resulted in such high project costs that the project became uneconomic, those acres of locatable minerals resource would still be available.

The amount of constraint on locatable mineral development in each alternative was quantified through analysis of the locatable mineral allocations and management actions for other resources. Some management direction in the sections analyzed in detail that would affect locatable mineral development cannot be quantified. In these cases, impacts are characterized as increasing or decreasing the amount of constraint on locatable mineral development.

Assumptions were developed based on interdisciplinary team knowledge of locatable mineral development and the planning area. These assumptions should not be construed to confine or redefine management contained within alternatives. Also, the assumptions were used to allow a comparison of impacts to locatable mineral development resulting from land use plan decisions in each of the alternatives.

Based on historical data and only one producing mine, the development potential for locatable mineral deposits is low across the entire planning area. This analysis assumes locatable mineral development is expected to occur at levels similar to the past. One mining claim and one locatable mineral mine is projected for the planning period.

The potential for development activity for mineral specimen gypsum and gemstones is moderate in southwestern Eddy County and low throughout the rest of the planning area for all other locatable minerals (e.g., gypsum, metallurgical-grade limestone, and many metals and non-metals) during the planning period.

Any areas recommended for withdrawal in the RMP would be withdrawn by Congressional, Secretarial, or Executive Order. As a result, acres recommended for withdrawal and those already withdrawn would be assumed to be unavailable for locatable mineral development for the purposes of this analysis. Locatable minerals on these lands are considered to be inaccessible.

Aside from the locatable mineral allocations, most management in the RMP that would affect locatable mineral development provides direction for reclamation or mitigation activities rather than direction for where location of mining claims may occur. This management, rather than preclude locatable mineral development in an area, would likely increase the costs associated with the development.

Locatable minerals management applies to mineral entry on federal mineral estate, including split-estate lands. Split estate lands are those where the federal government owns either the mineral estate or surface estate and another entity owns the other.

Management for areas within VRM Class I and II would result in more constraint on locatable mineral development than areas within VRM Class III and IV. It is assumed that more mitigation measures would be placed on mineral development in VRM Class I and II areas than in Class III and IV areas to ensure mineral development is appropriately designed for the surrounding landscape.

The occurrence of a locatable mineral does not imply that the mineral can be economically developed. Mineral occurrence potential includes both exploitable and potentially exploitable occurrences.

The locatable minerals resource discussed and analyzed in this document consists of only those acres of mineral ownership administered by the BLM. Not included are lands administered by the NPS, USFS, U.S. Bureau of Reclamation, and U.S. Department of Energy.

Notice-level operations do not require approval from the BLM (i.e., no federal action is required) but do require BLM acknowledgement and an acceptable reclamation bond. Such operations also are still bound by statutory requirements, including the Endangered Species Act, the NHPA, and the requirement under the Federal Land Policy and Management Act (FLPMA) to prevent unnecessary and undue degradation of public lands.

Development of locatable minerals resources may or may not involve the BLM. Federally administered locatable minerals resource in lands with BLM surface ownership is developed through BLM-approved actions (see Chapter 3). Development of federally owned locatable minerals resources in lands with private or state-owned surface are approved and handled by those entities. However, if an operator cannot obtain the private surface owner's written consent on Stock Raising Homestead Act or certain other lands, the BLM would administer the surface estate according to regulations in 43 CFR 3809 for surface-disturbing activities (in accordance with 43 CFR 3809.31). The administration of mineral estate in other lands, including those that have been sold, transferred, or acquired by the federal government, may operate differently (see 43 CFR 3800). Operations not involving the BLM are subject to all appropriate statutory requirements.

Any alternative that restricts locatable minerals activities (mining claim location, exploration, and development) would have some adverse impact on the potential use of the locatable minerals resource.

Restrictions on the locatable minerals resource (acres open to activities) and/or activities (mining claim location, exploration, and development) apply for the duration of the planning period. However, there could be changes through RMP amendments or changes in regulations.

Only a few management actions under the alternatives could affect the locatable minerals resource (acres open to locatable minerals activities). These would involve either withdrawing or segregating areas from mineral entry (operation under the mining laws). These actions (withdrawal or segregation) would close those areas to all locatable minerals activities (mining claim location, exploration, and development), subject to valid existing rights.

Except in areas withdrawn or segregated from mineral entry, mining claimants (as defined in 43 CFR 3830.3 and 3830.5) have an inherent right to locate claims, explore, and mine. The BLM cannot revoke this right.

Management Actions with No Impacts or Minor Impacts on Locatable Minerals

This section briefly addresses management actions would have either minor or no impacts on locatable minerals. A brief explanation of the rationale in determining minor or no impact is presented, and the management actions are not carried forward for detailed analysis in the locatable minerals subsection.

Air Resources

Requirements under all alternatives for diesel engine emission standards (EPA Tier 4 Nonroad Diesel Engine Emission Standards or equivalent for specific oil and gas production operations) to control fossil fuel emissions, and daily watering of construction areas to control fugitive dust would increase the operations constraints placed locatable mineral operations but not substantially. No operations would be curtailed because of the increased constraints.

Backcountry Byways

When backcountry byways and national recreation trails are designated in the future, they may encroach on existing or planned locatable mineral operations. Existing operations would not be impacted; however, mitigation requirements would most likely be imposed on the operations that postdate the backcountry byway designations. The conditions would most likely not preclude locatable mineral development under any of the alternatives.

Cultural Resources

Conflicts between locatable mineral development and cultural resources would be resolved in accordance with regulations, policy, and the Permian Basin Programmatic Agreement between the SHPO and the BLM, including consultation with tribes concerning mineral development. Some policies may cause minor delays in locatable mineral development, but the delays would not reduce the land available for location or the number of locatable mineral operations.

Continuation of the Permian Basin Programmatic Agreement for the protection of cultural resources would have a beneficial effect on locatable mineral development because it would continue to provide data and information that can be used to mitigate cultural resource–locatable mineral conflicts. However, efforts under the agreement would not increase the land available for location or increase the numbers of operations.

Land Authorizations

Utility corridors and communication sites can be in direct conflict with locatable mineral operations. However, only one locatable mineral operation is projected for the planning period, so the likelihood of conflict is unlikely. Minor ROWs typically have no impact on locatable mineral operations. Major ROWs for wind and solar power generation can be segregated from location and entry under the mining laws if conflicts are anticipated.

Leasable Mineral Resources

The locations of oil and gas wells and geothermal facilities can conflict with the locations of locatable mineral operations. However, only one locatable operation is projected during the planning period, so the likelihood of conflict is very remote. The impact of conflicts would be negligible. Also, none of the leasable decisions would have any impact on the availability of land for location and entry or the number of locatable mineral operations.

No lands would be specifically set aside under any alternative for development of solid leasable minerals, so the only impact on availability of lands for locatable mineral development would be conflicts with existing and projected solid leasable mines. Existing and projected solid leasable mines would be in eastern Eddy and western Lea Counties where the potential for locatable minerals is low. No additional sodium and sulfur mines are projected to be developed during the planning period.

Livestock Grazing

The standards for rangeland health apply to reclamation of all locatable minerals operations in the planning area; however, these standards would not significantly increase the constraints placed on locatable mineral operations or impact lands available for location and entry.

Paleontological Resources

There are no paleontological resources decisions considered in Chapter 2; therefore, there would be no impact to the amount of land available for location and entry under the mining laws or the number of locatable mineral operations.

Public Health and Safety

Locatable mineral operations already are required to follow all safety regulations and policies, including OSHA and MSHA rules. Management actions to enforce rules have no impact on locatable mineral development. Also, development of health and safety databases and monitoring has no impact on locatable mineral development. Thus, health and safety decisions under all alternatives have no impact on locatable mineral development.

Renewable Energy

Solar and wind projects would encompass significant acreage in the planning area. The wind resource maps (Map 3-28) show that most of the wind potential is in the Guadalupe Mountains. Solar resource maps illustrate that solar projects could be located throughout the planning area, although solar projects would most likely be situated near existing transmission corridors. Locations of both wind and solar projects could overlap with locatable mineral deposits; however, solar and wind energy project lands can be segregated from location and entry under the mining laws. Additionally, only one locatable operation is projected in the planning area for the planning period. Thus, the chances of location conflicts between wind and solar energy projects and locatable mineral operations would be minimal.

Riparian Resources

There are no riparian management decisions considered in Chapter 2 that would impact locatable minerals.

Salable Mineral Resources

The only impacts of salable mineral development on locatable mineral development would be a conflict from the location of existing and projected mines. Only one locatable mine exists in the planning area, and only one is projected for the planning period. Thus, the likelihood of a location conflict is remote. Additionally, ample supplies of salable mineral resources occur throughout the planning area removed from the one producing locatable mineral mine, so a conflict with location again is unlikely. Thus, salable mineral actions would have no impact on locatable mineral development.

Soil Resources

There are no soil resources management decisions considered in Chapter 2; therefore, there would be no impact to locatable minerals.

Travel Management

Travel management decisions can limit cross-country travel and restrict travel to established routes. These decisions have an adverse impact on locatable mineral exploration and development because these restrictions would increase the constraints placed on exploration operations. Requirements to design and restore roads to Gold Book standards would have little impact on locatable operations because access and haul roads would have to be built to high standards to withstand use by mineral extraction equipment. None of the decision under all alternatives would impact the availability of land for location and entry under the mining laws nor would they impact the number of operations.

Vegetation Resources, Including Noxious Weeds

There are no vegetation management decisions considered in Chapter 2; therefore, there would be no impact to locatable minerals.

Water Resources

There are no water resources management decisions considered in Chapter 2; therefore, there would be no impact to locatable minerals.

Wildland Fire Management

There are no wildland fire management decisions considered in Chapter 2; therefore, there would be no impact to locatable minerals.

Cave and Karst Resources

There are no cave and karst resource management decisions considered in Chapter 2; therefore, there would be no impact to locatable minerals.

Special Status Species

There are no special status species management decisions considered in Chapter 2; therefore, there would be no impact to locatable minerals.

Wildlife and Fish

There are no wildlife and fish management decisions considered in Chapter 2; therefore, there would be no impact to locatable minerals.

4.3.1.2.2 Direct and Indirect Impacts

Impacts of Locatable Minerals Actions

Impacts from Management Common to All

Unless withdrawn or segregated from location and entry under the General Mining Laws, the planning area would be available for location of mining claims. This decision would be beneficial for locatable mineral development because it would allow for widespread exploration and development.

Under all alternatives, the BLM would encourage and facilitate the development of public land mineral resources by private industry so that national and local needs are met. Environmentally sound exploration, extraction, and reclamation practices would be used.

Table 4-145 summarizes the locatable mineral allocations on BLM-administered surface lands in the planning area, by alternative. Table 4-146 summarizes the locatable mineral allocations on BLM-administered subsurface estate, also known as split estate. The sections below describe the impacts to locatable minerals from each alternative.

Table 4-145. Locatable Mineral Allocations, by Alternative, on BLM-administered Surface Lands (acres)

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open to mineral entry	2,751,856	2,403,114	2,110,098	2,651,855	2,661,705
Recommended (or previously recommended) for withdrawal	32,374	380,990	673,996	132,249	122,444
Total	**2,784,229**	**2,784,105**	**2,784,094**	**2,784,104**	**2,784,149**

The largest amount of land would be open to mineral entry under the No Action Alternative and Alternative D. The least amount of land would be open under the Alternative B. Under Alternative B, the largest amount of land would be withdrawn or segregated from location and entry under the General Mining Laws, which would be 24% of the total BLM-administered lands available to locatable mineral development. The least amount of land would be withdrawn from mineral entry under the No Action Alternative. Exploration and development would not be curtailed in these lands designated as open, except for stipulations and mitigation to prevent unnecessary or undue degradation of the lands and resources.

Impacts of Land Tenure Actions on Locatable Minerals

Disposal of lands would have a direct adverse impact on locatable mineral development because the lands would no longer be available for sales or permits. If mineral rights are retained, disposal would have no impact on the availability of land for mineral entry and, thus, no impact on locatable mineral development.

Retention zones include those lands specifically identified by the tribes as having special importance related to treaty and/or traditional uses/values; endangered, threatened, proposed, and candidate special status species habitat; NRHP-eligible and -listed properties; wildlife tracts for candidate or special status species; and lands acquired under the LWCF. Although retained lands may be managed with restrictive prescriptions, typically retention of these types of lands would not reduce the amount of land available locatable mineral development. Thus, retention of land would have no impact on locatable mineral development. Table 4-146 summarizes the lands identified for disposal and retention, by alternative.

Table 4-146. Land Tenure Actions (acres), by Alternative

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Disposal	218,318	18,703	26,125	31,536	51,579
Retention	1,872,747	2,070,580	2,063,155	2,057,744	2,037,362

Impacts from the No Action Alternative

Disposal of about 218,318 acres of public land would have a direct adverse impact on locatable mineral development because the lands would no longer be available for sales or permits. This would represent about 10% of BLM-administered lands that would not be available for exploitation under the mining laws.

Impacts from Alternative A

Under this alternative, 18,703 acres in the planning area would be disposed through sale or exchange or other title transfer. This action would remove these lands from location and entry under the mining laws. This would be less than 1% of the total BLM-administered surface lands that would be removed from locatable mineral exploitation.

Impacts from Alternative B

Under Alternative B, 26,125 acres would be disposed and removed from location and entry under the mining laws. This would be 1% of the total BLM-administered lands that would not be available for locatable mineral exploitation.

Impacts from Alternative C

Under Alternative C, 31,536 acres would be disposed and removed from location and entry under the mining laws. This would be 2% of the total BLM-administered lands that would not be available for locatable mineral exploitation.

Impacts from Alternative D

Under Alternative D, 51,579 acres would be disposed and removed from location and entry under the mining laws. This would be 2% of the total BLM-administered lands that would not be available for locatable mineral exploitation.

Impacts of Lands with Wilderness Characteristics Actions on Locatable Minerals

Under all action alternatives, portions of lands with wilderness characteristics that are managed to protect their wilderness characteristics would be withdrawn from location and entry under the mining laws. This decision would have a direct adverse impact on the lands available for location and entry. Table 4-147 summarizes the lands with wilderness characteristics that would be withdrawn from mineral entry, by alternative.

Table 4-147. Lands Managed to Protect Wilderness Characteristics, by Alternative (acres)

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
0	66,666	47,611	5,119	1,221

Under Alternative A, 66,666 acres would be managed to protect wilderness characteristics, and would be withdrawn from location and entry under the mining laws. This would represent 3.1% of BLM-administered lands available to locatable mineral development. Neither exploration nor development would be allowed on these lands. The fewest acres of lands with wilderness characteristics would be withdrawn from mineral entry under the No Action Alternative. Alternative B would result in 2.3% of the total BLM-administered lands withdrawn from mineral entry to protect lands with wilderness characteristics. Alternative C would result in 0.2% and Alternative D would result in 0.1% of the total BLM-administered lands withdrawn from mineral entry to protect lands with wilderness characteristics.

Impacts of Recreation Resources Actions on Locatable Minerals

Table 4-148 shows the locatable mineral allocations for each alternative for SRMAs and ERMAs in the planning area. Lands in the proposed SRMAs and ERMAs may be open to location and entry under the mining laws or withdrawn.

Table 4-148. Locatable Mineral Allocations for Proposed SRMAs and ERMAs, by Alternative (BLM acres)

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	55,185	40,179	52,971	53,53,616	47,062
Withdrawn	14,282	12,786	23,583	13,351	12,066
Total	***69,467***	***52,965***	***76,554***	***66,967***	***59,128***

* Total may not sum correctly due to rounding.

Withdrawing lands from locatable mineral development would have an adverse impact on locatable minerals. Under Alternative B, the greatest number of acres (23,583 acres) would be withdrawn from locatable mineral location and entry, which is less than 1% of BLM-administered lands available to locatable mineral development. Under the No Action Alternative, the second greatest number of acres, approximately 14,282 acres would be recommended for withdrawal. Under Alternatives A, C and D, the BLM would recommend withdrawing 12,786, 13,351, and 12,066 acres from locatable mineral development, respectively.

Impacts of Special Designations Actions on Locatable Minerals

Special designations considered within the RMP include ACECs, WSRs, and WSAs. Previously used special designations include RNAs, SMAs, historic sites, and CRMAs. The designations of RNAs, SMAs, historic sites, and CRMAs would not be used in the new RMP. The areas would be designated as an ACEC or managed without a special designation. ACECs would replace most of the RNAs, SMAs, historic sites, and CRMAs under all action alternatives. WSRs would be recommended as suitable for inclusion in the NWSRS depending on the alternative decisions. WSAs in the planning area are already defined and await Congressional action, so the WSAs would be managed under the non-impairment standard. No wilderness areas exist in the planning area.

It is important to note that if Congress decides not to designate a river segment as part of the NWSRS, the protection management outlined in this section as WSRs would no longer apply. These segments would be managed according to decisions in other sections of the RMP.

Under all alternatives, WSAs would remain open to location and entry under the mining laws but would be managed in accordance with BLM Manual 6330. Mining operations can be authorized by BLM under 43 CFR 3802. Mitigation imposed on mining operations in WSAs would increase the constraints placed on operations. However, no active mining claims exist in the WSAs nor are any locatable mineral operations projected. Further, the total combined acreage under each alternative of the WSAs would be 7,086, which would represent only 0.25% of the total BLM-administered lands (2,784,229 total acres). Presumably, the WSA actions would impact no more than 0.25% of the locatable mineral resource. Only one locatable mineral operation is projected in southwestern Eddy County, however, and the potential for conflict would be unlikely. Since the WSA actions do not impact the availability of land for location and entry and most likely would not affect any locatable mineral operations, the impact on locatable mineral development would be negligible.

If WSAs were not designated as wilderness areas by Congress and were released from WSA status, the lands would be managed as recommended for withdrawal under Alternatives A-C and as open under Alternative D. The impacts of this decision would be negligible because of the small acreage (7,086 acres) included in the WSA lands. The requirement that all WSAs would be managed as VRM Class I areas would have no impact on locatable mineral development. No mining claims or operations exist in the WSAs, and none are projected.

The planning area contains no designated wilderness areas, so no wilderness decisions have been made that would impact locatable mineral development.

Table 4-149 summarizes the locatable mineral allocations in ACECs in the planning area.

Table 4-149. Locatable Mineral Allocations within ACECs, by Alternative (BLM acres)

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	82	398,081	406,383	54,689	2,424
Withdrawn	13,434	96,781	154,915	43,959	26,470
Total	***13,516***	***494,862***	***561,298***	***98,648***	***28,894***

Impacts from the No Action Alternative

As shown in Table 4-149, under the No Action Alternative, 82 acres of ACECs would be open for location and entry under the mining laws. This would be 1% of the specially managed areas. Mitigation may be imposed on these lands to prevent unnecessary or undue degradation. Approximately 13,434 acres of land would be recommended to be withdrawn under this alternative. This would be 99% of the special designations.

Under the No Action Alternative, only a segment of the Delaware River would be nominated for inclusion in the NWSRS (Map 2-58). The Black River would not be managed under this system. The acreage of the Delaware River that would be closed for mining claim location and entry would be less than 1% of the total BLM-administered lands.

Impacts from Alternative A

Under Alternative A, 398,081 acres of ACECs would be open for location and entry under the mining laws. This would be 80% of the special designations and less than 1% of BLM-administered lands available to locatable mineral development. Mitigation may be imposed on these lands to prevent unnecessary or undue degradation. Approximately 96,781 acres of land would be recommended to be withdrawn under this alternative. This would be 20% of the special designations and 14% of BLM-administered lands available to locatable mineral development.

Under this alternative, both the Black and Delaware Rivers would be recommended as suitable for inclusion in the NWSRS (Map 2-54). The combined acreage of both river segments would be less than 1% of the total BLM-administered lands.

Impacts from Alternative B

Under Alternative B, 406,383 acres of the special designations would be open for location and entry under the mining laws. This would be 72% of the ACECs and 15% of BLM-administered lands available to locatable mineral development. Mitigation may be imposed on these lands to prevent unnecessary or undue degradation. Approximately 154,915 acres of land would be recommended to be withdrawn under this alternative. This would be 28% of the special designations and 15% of BLM-administered lands available to locatable mineral development.

Under this alternative, the Black River would be recommended as suitable for inclusion in the NWSRS, but the Delaware River would not (Map 2-60). The acreage of the Black River segment would be less than 1% of the total BLM-administered lands.

Impacts from Alternative C

Under Alternative C, 54,689 acres of ACECs would be open for location and entry under the mining laws. This would be 55% of the special designations and 2% of BLM-administered lands available to locatable mineral development. Mitigation may be imposed on these lands to prevent unnecessary or undue degradation. Approximately 43,959 acres of land would be withdrawn under this alternative. This would be 45% of the special designations and 2% of BLM-administered lands available to locatable mineral development.

Under this alternative, the Black River would be recommended as suitable for inclusion in the NWSRS, but the Delaware River would not (Map 2-61). The acreage of the Black River segment would be less than 1% of the total BLM-administered lands.

Impacts from Alternative D

Under Alternative D, 2,424 acres of ACEC areas would be open for location and entry under the mining laws. This would be 8% of the special designations and less than 1% of BLM-administered lands available to locatable mineral development. Approximately 26,470 acres of land would be withdrawn under this alternative. This would be 92% of the special designations and 1% of BLM-administered lands available to locatable mineral development.

Under this alternative, the Black River would be recommended as suitable for inclusion in the NWSRS, but the Delaware River would not (Map 2-62). The acreage of the Black River segment would be less than 1% of the total BLM-administered lands.

Impacts of Visual Resources Actions on Locatable Minerals

VRM Class I and II severely constrain mineral operations, which may lead to increases in the cost to mineral operations. This cost increase can influence the investment decision whether to explore for locatable minerals. VRM Class III and IV would constrain operations, but the constraints would not impact the numbers of operations. None of the VRM classifications would impact the availability of land open to location and entry under the mining laws.

Under all alternatives, the acreage assigned to VRM Class I would be small compared to the overall planning area acreage (Table 4-150 and Table 4-151). Thus, the impact on locatable mineral exploration and development would be negligible. Decisions under Alternatives A and B would result in VRM Class II restrictions on 10% and 13% of BLM-administered lands available to locatable mineral development, respectively. Because only one locatable mineral operation is projected, the results of these decisions would be negligible.

Overall, the impact on locatable mineral exploration and development of VRM decisions under all alternatives would be negligible because no lands would be withdrawn from location and entry under the mining laws and no operations would be precluded.

Table 4-150. VRM Classes on BLM-administered Surface Lands by Alternative (acres)

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Class III	402,725	367,205	294,177	549,329	546,205
Class IV	2,330,462	2,142,600	2,131,501	2,166,266	2,189,116
Total	***2,783,858***	***2,783,514***	***2,783,481***	***2,783,558***	***2,783,585***

4.3.1.3 Salable Minerals

4.3.1.3.1 Analysis Methods

Indicators

Salable minerals include common variety minerals and building materials such as sand, gravel, and stone; these are generally widespread, of low unit value, and often used for construction or landscaping materials. Salable mineral development refers to the disposal of salable minerals through a contract of sale or a free-use permit. Salable minerals management applies to salable mineral development on federal mineral estate, including split-estate lands.

The impact indicators used in this analysis that can be used to measure the impacts of management decisions on salable mineral development in the reasonably foreseeable future are:

- acres of BLM-administered lands available for sales and free use of salable minerals;
- number of contracts and permits issued for salable mineral operations; and
- number of salable mineral operations predicted to be opened.

Management land use planning decisions may have a direct impact on and result in an increase or reduction of lands available for salable mineral sales or free use or the number of productive mines.

The primary factor within the alternatives that would affect the public's ability to acquire salable minerals through sale or permit is the amount of constraint the alternative would place on salable mineral development in the planning area; this indicator reflects the availability of federal mineral estate for this type of activity. The amount of constraint on salable mineral development within an area can vary widely. Some areas may be closed to salable mineral development entirely, while other areas may be open to salable mineral development, subject to site-specific NEPA analysis, stipulations, and 43 CFR 3600 regulations. Management for other resources within the planning area can constrain salable mineral development as well. Generally, constraints on salable mineral development would reduce flexibility in where salable minerals can be acquired and increase costs in acquiring these materials.

Methods and Assumptions

The BLM manages salable minerals to make them available for the mineral consumption needs of the nation. In the CFO, this includes caliche, sand, gravel, borrow material, stone, and clay. This section describes potential impacts on the salable minerals resource from management actions for other resources.

This section describes potential impacts on the salable minerals resource in the planning area from BLM management of resources and resource uses under the alternatives. The Salable Minerals section of Chapter 3 describes existing salable minerals resource conditions (see Section 3.3.1.4.3). Actions that limit the acres available for salable mineral development are considered adverse. Actions that increase the acres available for salable mineral development are considered beneficial. In general, the greater the number of acres impacted, the greater the impact on the resource. Other actions may impact the accessibility of the salable minerals resource, and these would likely lead to increased project costs by delaying operations or production during certain times. In the extreme example that a number of such limitations resulted in such high projects costs that the project would became uneconomic. In this case, the acreage would still be available, but development would be severely constrained.

Impact analyses and conclusions are based on interdisciplinary team knowledge of the resources and the planning area, information provided by BLM experts or experts from other agencies, and information in pertinent existing literature. The analyses described in this chapter represent the best estimates of impacts because exact locations of development or management often are not known. Effects are quantified to the extent practical based on available data. In the absence of quantitative data, best professional judgment was the basis for the analysis. Effects are sometimes described using ranges of potential impacts or in qualitative terms.

The amount of constraint on salable mineral development in each alternative was quantified through a GIS analysis of the salable mineral allocations and management actions. In this analysis, each land management decision was analyzed for its impact on salable mineral development, as measured by lands available for issuance of contracts and permits, the numbers of contracts and permits, and the numbers of operations affected. Impacts were quantified by comparing the amount of affected land with the total amount of available land. The assumption was used that the percentage of land affected by a specific decision is directly proportional to the amount of resource affected by that decision. For example, if a decision affected 10% of the total available BLM-administered surface lands, then it presumably affected 10% of the mineral resources on that land and 10% of the operations that would be used to develop that resource. Similarly, if a decision would affect 10% of the BLM-administered subsurface estate available to leasable mineral development, then it would affect 10% of the salable operations on split estate lands.

The following assumptions were used to conduct the impact analysis for salable minerals:

- The potential for occurrence of salable minerals exists across almost the entire planning area. However, the occurrence of a salable mineral does not imply that the mineral can be economically developed. Mineral occurrence potential includes both exploitable and potentially exploitable occurrences.
- Any alternative that limits salable minerals activities or acres would have an adverse impact on the potential exploration and development of salable minerals.
- Restrictions on salable minerals activities apply for the duration of the planning period. However, there could be changes through RMP amendments or changes in regulations.
- The disposal of salable mineral resources is discretionary.
- The average number of contracts and permits per year in the CFO based on 2011 to 2013 data is about 574. As of 2015, 287 separate operations are ongoing on BLM-administered lands in the planning area, which is equivalent to 50% of the number of contracts and permits. Since the demand for salable minerals predominantly parallels the oil and gas activity in the planning area, the numbers of salable contracts and permits and numbers of operations would parallel oil and gas development. Based on the RFD scenario, it is assumed that oil and gas development for the life of the plan would remain at least static. Thus, both the numbers of salable mineral contracts and permits processed each year and numbers of operations are assumed to remain about the same each year for the planning period.
- Most of the oil and gas activity and attendant salable mineral operations are in Eddy and Lea Counties. In those counties, the salable mineral operations are relatively evenly distributed on BLM-administered lands. Thus, for purposes of this analysis, the distribution of salable pits and quarries was assumed to be evenly scattered throughout the CFO planning area (see mineral material site Map 3-15) where most of the salable mineral development has taken place. This relationship is less true for BLM-administered lands in Chaves County; however, many of the restrictions on salable mineral development do not apply to Chaves County. Thus, for this analysis, the assumption that the number of contracts and permits per acre are evenly distributed throughout the planning area. In addition, for any given acre, any of the salable mineral commodities could be economically produced and marketed (i.e., caliche, sand, gravel, borrow, building stone, or clay).
- Some salable mineral management decisions cannot be quantified. In these cases, impacts are characterized as increasing or decreasing the amount of constraint on salable mineral development.

Management Actions with No Impacts or Minor Impacts on Salable Minerals

This section briefly addresses management actions would have either minor or no impacts on salable minerals. A brief explanation of the rationale in determining minor or no impact is presented, and the management actions are not carried forward for detailed analysis in the salable minerals subsection.

Air Resources

Requirements under all alternatives for diesel engine emission standards (EPA Tier 4 Nonroad Diesel Engine Emission Standards or equivalent for specific oil and gas production operations) to control fossil fuel emissions, and daily watering of construction areas to control fugitive dust would increase the constraints placed on salable mineral operations. Most likely, no operations would be curtailed because of the air quality requirements.

Backcountry Byways

When Backcountry byways and national recreation trails are designated in the future, they may overlap with existing or planned salable mineral operations. Existing operations would not be impacted; however, mitigation requirements would most likely be imposed on the operations that postdate the backcountry byway designations. It is not anticipated that the conditions would not preclude the salable mineral development under any of the alternatives.

Cultural Resources

Conflicts between salable mineral development and cultural resources would be resolved in accordance with regulations, policy, and the Permian Basin Programmatic Agreement between the SHPO and the BLM, including consultation with tribes concerning mineral development. Some policies may cause minor delay in salable mineral development, but the delays would be minor and would not reduce the land available for location or the number of salable mineral operations.

Cultural resource surveys and consultation would increase the operation costs of salable mineral operations; however, salable mineral development proponents routinely include this cost while making investment decisions. Conducting surveys prior to any surface-disturbing activities tends to delay those activities, which increases the costs of operations. However, the delays are typically temporary, and the costs would be minimal compared to other operations costs.

Leasable Minerals

The locations of wells or existing solid leasable mineral operations may conflict with the location of salable mineral deposits. Therefore, development of leasable minerals could have a direct adverse impact on salable mineral development. However, in practice, the salable mineral deposits, primarily caliche, are widespread in the oil and gas fields. Therefore, salable mineral operations can often avoid location conflicts and vice versa. Overall, leasable mineral development would not result in the loss or reduction of land acreage available for salable mineral development although it may be fragmented. The number of contracts and permits would not likely be impacted by leasable mineral development.

Livestock Grazing

The standards for rangeland health would apply to reclamation of all salable minerals operations in the planning area; however, these standards would not significantly increase the constraints placed on salable mineral operations or impact lands available for contracts or permits.

Locatable Minerals Actions

The only impacts of locatable mineral development on salable mineral development would be the conflict from existing and projected mines. Only one locatable mine exists in the planning area, and no additional mines are projected during the planning period. Ample salable mineral resources occur elsewhere in the vicinity of the one producing mine, so a conflict with location is unlikely. Thus, locatable mineral actions have no impact on salable mineral development.

Paleontological Resources

There are no paleontological resources management decisions considered in Chapter 2; therefore, there would be no impact to salable minerals.

Public Health and Safety

Salable mineral operations already are required to follow all safety regulations and policies, including OSHA and MSHA rules. Management actions to enforce rules have no impact on salable mineral development. Also, development of health and safety databases and monitoring has no impact on salable mineral development. Thus, health and safety decisions have no impact on salable minerals development.

Renewable Energy

Solar and wind projects would encompass significant acreage in the planning area. The wind resource maps (Map 3-28) show that most of the wind potential is in the Guadalupe Mountains. Solar resource maps illustrate that solar projects could be located throughout the planning area, although solar projects would most likely be situated near existing transmission corridors. Locations of both wind and solar projects could conflict with salable mineral deposits; however, ample supplies of salable minerals occur throughout the planning area. Additionally, few deposits have been developed in the Guadalupe Mountains where wind projects are likely. Thus, the chances of location conflicts with wind and solar energy projects would be minimal. The renewable energy sector would require salable minerals for road and well pad construction and for concrete. Therefore, a few existing deposits of salable minerals would be mined to meet these needs of any new renewable energy developments in the planning area.

Travel Management

Implementation of a comprehensive travel management plan would have a beneficial effect on salable mineral development because it would identify roads that would be available for access up front so these routes can be projected during the operation planning phase. The travel management plan would have no impact on the availability of land for salable mineral development or the number of contracts or permits available for salable minerals.

Limiting cross-country travel by motorized vehicles except travel related to a lease or permit would have a beneficial effect for salable mineral development because it would limit the amount of public traffic in the vicinity of facilities and mining operations, which would be a safety concern for salable mineral operations. This requirement would not impact on the availability of land for salable mineral development, the number of contracts or permits, or the number of salable mineral operations.

Travel management decisions can impact salable mineral development because access roads for exploration and development can be closed or their use limited temporarily. These actions can impact access to mineral deposits or limit the type of vehicular traffic, which can constrain salable mineral operations. However, typically haulage routes would coincide with existing roadways, and access roads and haul roads would be authorized under the contract or permit. Furthermore, the areas closed to travel under each alternative are small in comparison to the size of the planning area (Table 4-151).

Table 4-151. Travel Management Decisions, by Alternative (acres)

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
OHV limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737
Total	***2,091,273***	***2,091,326***	***2,091,327***	***2,091,320***	***2,091,321***

Vegetation Management

There are no vegetation management decisions considered in Chapter 2; therefore, there would be no impact to salable minerals.

Water Resources

There are no water resources management decisions considered in Chapter 2; therefore, there would be no impact to salable minerals.

Wildland Fire Management

There are no wildland fire management decisions considered in Chapter 2; therefore, there would be no impact to salable minerals.

Cave and Karst Resources

There are no cave and karst management decisions considered in Chapter 2; therefore, there would be no impact to salable minerals.

Riparian Resources

There are no riparian resources management decisions considered in Chapter 2 that would impact salable minerals.

Soil Resources

There are no soil resources management decisions considered in Chapter 2; therefore, there would be no impact to salable minerals.

Special Status Species

There are no special status species management decisions considered in Chapter 2; therefore, there would be no impact to salable minerals.

Wildlife and Fish

There are no wildlife and fish management decisions considered in Chapter 2; therefore, there would be no impact to salable minerals.

4.3.1.3.2 Direct and Indirect Impacts

Impacts of Salable Minerals Actions

Table 4-152 summarizes the salable mineral allocations for BLM-administered lands in the planning area for each alternative.

Table 4-152. Salable Mineral Allocations for BLM-administered Lands, by Alternative (BLM acres)

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,637,465	1,160,064	1,121,118	1,784,431	2,028,324
Open with special terms and conditions	–	1,062,192	726,270	752,286	602,621
Closed	146,568	561,995	936,799	247,323	153,174
Total	2,784,033	2,784,251	2,784,186	2,784,041	2,784,119

Impacts from the No Action Alternative

Under this alternative, 2,637,465 acres of BLM-administered lands would be open with standard contract or permit terms and conditions. This would represent 95% of total BLM-administered lands available for salable mineral development. 0 acres would be open with special terms and conditions under this alternative and 146,568 acres of BLM-administered lands would be closed to salable mineral development. Areas closed to salable mineral development would be 5% of the total BLM-administered lands. This would impact about 29 contracts or permits per year or about 14 operations.

Impacts from Alternative A

Under Alternative A, 1,160,064 acres of BLM-administered would be open for salable mineral development under this alternative. This would be 42% of total BLM-administered lands available for salable mineral development. Approximately 1,062,192 acres of BLM-administered lands would be open with special terms and conditions, which is 38% of the total BLM-administered lands. This would have an indirect adverse impact on about 103 contracts or permits.

Under this alternative, 561,995 acres of BLM-administered lands would be closed to salable mineral development, which would be 20% of available lands. This would equate to a decrease of about 75 contracts and permits per year or about 37 operations.

Impacts from Alternative B

Under Alternative B, 1,121,118 acres of BLM-administered lands would be open for salable mineral development with standards terms and conditions. Approximately 726,270 acres of BLM-administered lands would be open with special terms and conditions. This acreage would be 26% of total BLM-administered lands available for salable mineral development with special terms and conditions. Thus, the constraints would impact about 109 contracts or permits per year or about 55 operations.

Approximately 936,799 acres of BLM-administered lands would be closed to salable mineral development. This would be 34% of the total BLM-administered land. Thus, this would impact about 80 contracts or permits per year or about 40 mining operations.

Impacts from Alternative C

Under Alternative C, 1,784,431 acres of BLM-administered lands would be open for salable mineral development with standard contract or permit terms and conditions. Approximately 752,286 acres of BLM-administered lands would be open with special terms and conditions. This acreage would be 27% of BLM-administered lands available for salable mineral development. Thus, the constraints would impact about 86 contracts or permits per year or about 43 operations.

Under this alternative, 247,323 acres of BLM-administered lands would be closed to salable mineral development. This would be 9% of the total BLM-administered land. Thus, this would impact about 52 contracts or permits per year or about 26 mining operations.

Impacts from Alternative D

Under Alternative D, 2,028,324 acres of BLM-administered lands would be open for salable mineral development with standard stipulations and conditions. Approximately 602,621 acres of BLM-administered lands would be open with special terms and conditions. This acreage would be 22% of BLM-administered lands available for salable mineral development. Thus, the constraints would impact about 34 contracts or permits per year or about 17 operations.

Approximately 153,174 acres of BLM-administered lands would be closed to salable mineral development. This would be 6% of the total BLM-administered land. Thus, this would impact about 17 contracts or permits per year or about nine mining operations.

Impacts of Land Tenure Actions on Salable Minerals

Disposal of lands reduces the amount of land available for salable mineral development. If mineral rights are retained, disposal would have no impact on the availability of land for development and, thus, no impact on salable mineral development.

Retention zones include those lands specifically identified by tribes as having special importance related to treaty and/or traditional uses/values; endangered, threatened, proposed, and candidate special status species habitat; NRHP-eligible and -listed properties; wildlife tracts for candidate or special status species; and lands acquired under the LWCF. Although retained lands may be managed with restrictive prescriptions, typically retention of these types of lands would not reduce the amount of land available for salable mineral development

Table 4-153 summarizes the lands identified for disposal and retention, by alternative.

Table 4-153. Land Tenure Actions (acres), by Alternative

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Disposal	218,318	18,703	26,125	31,536	51,579
Retention	1,872,747	2,070,580	2,063,155	2,057,744	2,037,362

Impacts from the No Action Alternative

Under the No Action Alternative, disposal of about 218,318 acres of public land would have a direct adverse impact on salable mineral development because the lands would no longer be available for sales or permits. This would represent about 10% of all BLM-administered lands, so it would preclude about 60 contracts and permits or about 30 operations per year.

Impacts from Alternative A

Under Alternative A, disposal of 18,703 acres of land would have a direct adverse impact on salable mineral development because land disposal would contribute to a reduction in available materials from federal lands if mineral estate were disposed. Lands identified for disposal under Alternative A represent 1% of all BLM-administered lands. If mineral rights are retained during the land disposal process, there would be no impact to salable minerals.

Impacts from Alternative B

Under Alternative B, disposal of 26,125 acres would represent 1% of total BLM-administered lands. This would preclude about seven contracts or four operations per year.

Impacts from Alternative C

Under Alternative C, disposal of 31,536 acres would represent 2% of total BLM-administered lands. This would preclude about eight contracts or four operations per year.

Impacts from Alternative D

Under Alternative D, disposal of 51,579 acres would represent 2% of total BLM-administered lands. This would preclude about 14 contracts or seven operations per year.

Impacts of Land Use Authorizations Actions on Salable Minerals

Land authorization actions include issuance of ROWs for pipe lines, power lines, roads, and sites along with stipulations that govern the operations. The primary land authorization action that impacts mineral development is the decision to designate ROW avoidance and exclusion zones to protect sensitive resources, such as visual resources, cave and karst areas, and special status species. Exclusion or avoidance zones do not preclude mineral development from occurring within the zone. Typically, the conflicts would be avoided by rerouting the ROW around the existing operations. Terms and conditions placed on mineral development ROW grants could increase the costs of future operations if salable mineral development is constrained by the terms. However, multiple use conflicts typically would be resolved through movement of the ROW or relocation mines.

Exclusions and avoidance decisions would have an indirect adverse impact on mineral development depending on how much acreage within the planning area is impacted. Table 4-154 summarizes the ROW avoidance and exclusion zones, by alternative.

Table 4-154. ROW Avoidance and Exclusion Zones Located within the Planning Area by Alternative (BLM acres)

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Avoid	30,965	629,149	413,654	313,619	270,360
Exclude	7,056	662,038	918,701	165,378	69,540
Open	2,051,927	798,544	757,380	1,610,692	1,749,782

Impacts from the No Action Alternative

Utility corridors for major interstate electric transmission, pipeline, and communication lines would be designated in the planning area. Establishment of 479 miles of utility corridors would impact 184,201 acres, which would be 8% of BLM-administered lands available for salable mineral development. Salable mineral operations in these corridors would be avoided or highly constrained, which would increase the costs of operations. This action would impact as many as 33 contracts or permits and 16 operations per year.

Impacts from Alternative A

ROW management areas would be designated as shown on Map 2-48. Under Alternative A, 629,149 acres would be designated as a ROW avoidance zone and 662,038 acres as a ROW exclusion zone. Combined, this would be 62% of the total BLM-administered land, so the corridors would impact as many as 212 salable mineral contracts and 106 permits per year. Salable mineral operations in these areas would be avoided or highly constrained.

Impacts from Alternative B

Under Alternative B, 413,654 acres would be designated as a ROW avoidance zone and 918,701 acres as a ROW exclusion zone. Combined, this would be 64% of the total BLM-administered land, so the corridors would impact as many as 230 salable mineral contracts and 115 operations per year. Salable mineral operations in these areas would be avoided or highly constrained.

Impacts from Alternative C

Under Alternative C, 313,619 acres would be designated as a ROW avoidance zone and 165,378 acres as a ROW exclusion zone. Combined, this would be 23% of the total BLM-administered land, so the corridors would impact as many as 201 salable mineral contracts or permits and 100 operations per year. Salable mineral operations in these areas would be avoided or highly constrained.

Impacts from Alternative D

Under Alternative D, 270,360 acres would be designated as a ROW avoidance zone and 69,540 acres as a ROW exclusion zone. Combined, this would be 16% of the total BLM-administered land, so the corridors would impact as many as 172 salable mineral contracts or permits and 86 operations per year. Salable mineral operations in these areas would be avoided or highly constrained.

Impacts of Lands with Wilderness Characteristics Actions on Salable Minerals

Closing lands with wilderness characteristics to salable mineral development would have an adverse impact to salable minerals. Table 4-155 summarizes the lands with wilderness characteristics identified for management to maintain wilderness characteristics under all alternatives.

Table 4-155. Proposed Lands with Wilderness Characteristics Closed to Salable Development, by Alternative (acres)

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Acres closed	0	66,666	47,611	5,119	1,221
% of BLM-administered lands	0	2.4	1.7	.2	0.05
No. of contracts	3	14	5	3	0.1

Under Alternative A, 66,666 acres would be managed as land with wilderness characteristics and closed to salable mineral development. This would represent 3% of BLM-administered lands available to salable mineral development and would lead to 14 fewer contracts for salable mineral operations. The fewest acres of lands with wilderness characteristics would be closed to salable mineral development under the No Action Alternative. Alternative B would result in 2% of the total BLM-administered lands closed to salable mineral development to manage lands with wilderness characteristics. Alternative C would result in 1% and Alternative D would result in 0.05% of the total BLM-administered lands closed to mineral development to manage lands with wilderness characteristics.

Impacts of Recreation Actions on Salable Minerals

Table 4-156 summarizes the salable mineral allocations for SRMAs and ERMAs in the planning area. Lands in the proposed SRMAs and ERMAs may be open with standard contract and permit terms and conditions, open with moderate mitigation constraints, open but to avoid surface disturbance, and closed to salable minerals development.

Table 4-156. Salable Mineral Allocations for Proposed SRMAs and ERMAs by Alternative (acres)

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open with standard terms and conditions	55,965	9	39	17	7
Open with special terms and conditions	–	36,878	36,878	36,882	36,882
Closed	13,504	13,103	13,073	12,772	12,781
Total	***69,469***	***49,991***	***49,991***	***49,670***	***49,670***

Impacts from the No Action Alternative

Under the No Action Alternative, the total land in the SRMAs and ERMAs open with standard terms and conditions for salable mineral development would be 55,965 acres. Approximately 13,504 acres would be closed to salable mineral development. This would represent 0.5% of the total BLM-administered lands. Because a high percentage of lands would be open with standard terms and conditions, this decision would have a negligible impact on salable mineral development. Note that under this alternative any area that would not be managed as a SRMA would be managed as an ERMA.

Impacts from Alternative A

Under Alternative A, 9 acres within SRMAs and ERMAs would be managed as open with standard contract and permit terms and conditions. The total amount of land open with special terms and conditions would be 36,878 acres, which would represent 1.3% of all BLM-administered lands and 74% of the SRMAs and ERMAs. Thus, the constraints would impact about 46 contracts and 23 operations per year. However, this decision would not preclude development. The total amount of land closed to salable mineral development would be 13,103 acres, which would be 0.5% of the total BLM-administered lands and 74% of the SRMAs and ERMAs.

Impacts from Alternative B

Under Alternative B, the total amount of land open with standard terms and conditions would be 39 acres. The total amount of land open with special terms and conditions would be 36,878 acres, which is the same as Alternative A. The total amount of land closed under this alternative would be 13,073 acres, which would be 1.3% of the total BLM-administered land and 0.5% of the SRMAs and ERMAs. This decision would preclude about 5 contracts and 3 operations per year.

Impacts from Alternative C

Under Alternative C, 17 acres would remain open with standard terms and conditions. Approximately 36,882 acres of the SRMAs and ERMAs would be open with special terms and conditions, which is 1.3% of the total BLM-administered lands and 74% of the SRMAs and ERMAs. The decision would have an indirect adverse impact on about 46 contracts or permits per year or about 23 operations. The total amount of land closed under this alternative would be 12,772 acres, which would be 0.5% of the total BLM-administered lands and 0.5% of the SRMAs and ERMAs.

Impacts from Alternative D

Under Alternative D, 7 acres would be open with standard terms and conditions. A total of 36,882 acres would be open with special terms and conditions, which is 1.3% of the total BLM-administered lands and 74% of the SRMAs and ERMAs, which represents 11 contracts or permits per year or 6 operations. Under this alternative, 12,781 acres would be closed, which would be less than 0.5% of the total BLM-administered land and 0.5% of the SRMAs and ERMAs.

Impacts of Special Designation Actions on Salable Minerals

Special designations considered within the RMP include ACECs, WSRs, WSAs, and wilderness. Previously used special designations include RNAs, SMAs, historic sites, and CRMAs. The designations of RNAs, SMAs, historic sites, and CRMAs would not be used in the new RMP. The areas would be designated as an ACEC or managed without a special designation. ACECs would replace most of the RNAs, SMAs, historic sites, and CRMAs under all action alternatives. WSRs would be recommended as suitable for inclusion in the NWSRS depending on the alternative decisions. WSAs in the planning area are already defined and await Congressional action, so the WSAs would be managed under the non-impairment standard. No wilderness areas exist in the planning area.

It is important to note that if Congress decides not to designate a river segment as part of the NWSRS, the protection management outlined in this section as WSRs would no longer apply. These segments would be managed according to decisions in other sections of the RMP.

Under all alternatives, WSAs would be closed to salable mineral operations. The total combined acreage under each alternative of the WSAs would be 7,086, which would represent only 0.3% of BLM-administered lands available to salable mineral development. The impacts of this decision would be negligible because of the small acreage included in the WSA lands. If WSAs were not designated as wilderness areas by Congress and were released from WSA status, the lands would be managed as closed to salable development under Alternatives A through C and as open with moderate constraints under Alternative D.

The planning area contains no designated wilderness areas, so no wilderness decisions have been made that would impact salable mineral development.

Table 4-157 summarizes the salable mineral acreage allocations for the proposed ACECs in the planning area, by alternative.

Table 4-157. Salable Mineral Allocations for ACECs by Alternative (acres)

Management Decision	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	822	71,286	64,536	33,973	0
Open with special terms and conditions	–	226,119	198,518	19,766	2,424
Closed	12,613	197,644	298,343	44,824	26,468
Total	***11,080***	***158,551***	***156,869***	***81,130***	***27,224***

Impacts from the No Action Alternative

Under the No Action Alternative, 822 acres of ACECs would be open with standard contract or permit terms and conditions and no lands would be have moderate constraints applied. Approximately 12,613 acres would be closed to salable mineral development. This would represent 0.5% of BLM-administered lands available to salable mineral development. This would have a direct adverse impact on operations and would impact about 17 contracts and permits per year or about eight proposed operations.

Under the No Action Alternative, only a segment of the Delaware River would be nominated for inclusion in the NWSRS (Map 2-58). The acreage of the Delaware River that would be closed for salable mineral development would be less than 1% of the total BLM-administered lands.

Impacts from Alternative A

Under this alternative, 71,286 acres would be open with standard contract or permit terms and conditions; 226,119 acres would be open with special terms and conditions. This would represent 11% of BLM-administered lands available to salable mineral development. These constraints would impact 86 contracts or permits per year or 43 operations. Approximately 8197,644 acres would be closed to salable mineral development, which would be 7% of BLM-administered lands available to salable mineral development. This would translate to a direct adverse impact on about 28 contracts or permits per year or about 14 operations.

The Black and Delaware Rivers would be nominated as WSRs. The Delaware would be managed for VRM Class II. Both designations would have a direct adverse impact on salable mineral development; however, the acreage encompassed by both the Black and Delaware Rivers would be small. Thus, this decision would have a negligible adverse impact on salable mineral development.

Impacts from Alternative B

Under Alternative B, 64,536 acres of land would be open with standard contract or permit terms and conditions and 198,518 acres acreage would be open with special terms and conditions. Approximately 298,343 acres would be closed to salable mineral development, which would be 11% of BLM-administered lands available to salable mineral development. This would translate to 29 contracts or permits per year or about 14 operations.

The Black River would be nominated as a WSR, which would be an adverse impact on salable mineral development because, if designated by Congress, the area would be closed to salable mineral development.

Impacts from Alternative C

Under Alternative C, 33,973 acres would be open with standard contract or permit terms and conditions.

19,766 acres would be open with special terms and conditions. Approximately 44,824 acres would be closed to salable mineral development under this alternative, which would be 2% of the total BLM-administered land. This would translate to 17 contracts or permits per year or about nine operations.

The Black River would be nominated as a WSR, which would be an adverse impact on salable mineral development because, if designated by Congress, the area would be closed to salable mineral development.

Impacts from Alternative D

Under Alternative D, no acreage would be open with standard contract or permit terms and conditions; 2,424 acres would be open with special terms and conditions. Approximately 26,468 acres would be closed to salable mineral development, which would be 1% of the total BLM-administered land.

The Black River would be nominated as a WSR, which would be an adverse impact on salable mineral development because, if designated by Congress, the area would be closed to salable mineral development.

Impacts of Visual Resources Actions on Salable Minerals

Table 4-158 summarizes the VRM classes, by alternative. VRM Class I and II constrain salable mineral operations by placing mitigation measures on mineral development on BLM-administered lands to ensure the activities blend into the surrounding landscape. The costs associated with visual resource mitigation measures in Class I and II areas could influence the decision whether to mine. Under all alternatives, the acreage assigned to VRM Class I would be small compared to the overall planning area. VRM Class II acreages would be greatest under Alternative B, thereby increasing constraints on the largest number salable mineral operations.

VRM Class III and IV restrictions would not impact the numbers of salable mineral operations, but would still require some mitigation measures to be applied to meet visual resource objectives. VRM Class III and IV acreages are greatest under Alternatives D and C, respectively.

Table 4-158. VRM Management Decisions for BLM-administered Lands by Alternative (acres)

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Class III	402,725	367,205	294,177	549,329	546,205
Class IV	2,330,462	2,142,600	2,131,501	2,166,266	2,189,116
Total	***2,783,858***	***2,783,514***	***2,783,481***	***2,783,558***	***2,783,585***

4.3.2 Renewable Energy

The following analysis generally discusses likely reductions in land area available for wind, solar, and geothermal renewable energy as a result of land use allocations. The future development and use of solar, wind, and geothermal resources in the planning area would be driven primarily by the economic viability of developing a particular area. Many areas may be considered unsuitable for renewable energy development because of visual resource impacts, sensitive soil, biological or cultural resources, or other factors for exclusion. Exclusion areas (wind and solar) and closed areas (geothermal) directly remove acreage available for renewable energy development, while avoidance areas may result in the loss of acreage available to development if a proposed renewable energy project results in adverse impacts to other resources and cannot be accommodated in the proposed location. These areas are included in a renewable energy assessment completed in 2009 for all New Mexico BLM-administered land (Ramakka 2009). Most resource use categories, such as air resources, health and safety, oil and gas leasing, livestock grazing, minerals, noxious weeds, cultural resources, wildland fire management, paleontological resources, recreation, travel management, and vegetation management, are unlikely to have any effect on renewable energy development and have been dismissed from further analysis as discussed below. The resources that may impact renewable energy development are listed in Table 4-159.

Currently, no renewable energy projects have been constructed in the planning area. The CFO received a number of applications for potential wind and solar development that were subsequently withdrawn. Several meteorological towers have been erected to evaluate the potential for wind development.

4.3.2.1 Analysis Methods

Renewable energy development, such as wind and solar, would be limited to where transmission corridors are located. Without transmission access renewable energy development is not feasible. Solar resources are generally considered poor throughout the CFO, compared with other regions of the state. Based on the NREL analysis, solar energy resources in the CFO planning area do not appear to be sufficient, unlike in other parts of the state. Annual average direct normal solar resources fall in the range of 6.0 to 6.5 $kWh/m^2/day$, which may not attract commercial developers (U.S. Department of Energy 2012). As noted, local conditions may be suitable for solar, but an analysis would require adequate collection of meteorological data.

There are few Identified hydrothermal sites and deep enhanced geothermal systems (EGSs) in southeastern New Mexico. NREL maps show the CFO has been designated as least favorable for EGS resources (U.S. Department of Energy 2009).

A similar financial investment is required to develop wind energy. However, NREL analyses indicate that portions of the planning area may have suitable wind resources to attract potential developers (U.S. Department of Energy 1986). Two areas within the planning area have potential for commercial-scale wind development: along the Mescalero Ridge of the Caprock and the area east of the Guadalupe Mountains (Map 3-28). The latter may have limitations because of other management actions as described in this section. The former would have fewer restrictions since it occurs in an area with heavy oil and gas development, where the likelihood of affecting sensitive resources is reduced because it occurs within existing development.

4.3.2.1.1 Indicators

Areas that may be considered for wind and solar development are compared with other management actions in those areas where the renewable resource has potential for development, based on NREL assessments. Because of the lack of specific meteorological data, the effects analysis is based only on CFO acreage where the wind power class rating of good (5) or higher exists.

For solar, the analysis should be based only on planning area acreage where the solar resources potential is 7.0 Kwh/m^2/day. According to the NREL analysis, there are currently no areas in the CFO that meet this minimum criterion.

4.3.2.1.2 Methods and Assumptions

The analysis relies on general NREL assessments of renewable energy potential, but local areas may exceed indicator criteria assigned by NREL at a landscape level. Local areas may be suitable for wind or solar, but would require specific meteorological data be collected to determine whether sufficient resources are present.

The area covered by the CFO is considered least favorable for geothermal energy; however, as with solar energy, locally, EGS resources may be present. Therefore, its development as a resource and relationship with other management actions have been carried through the section.

> The CFO would cooperate with stakeholders to assess local areas for renewable energy in accordance with other management actions and where corridors exist to facilitate energy transmission. Renewable energy development has extensive benefits to the public, but resources must be sufficient to support a commercial operation. Also, transmission must be available or new power lines must be built to distribute the energy.

Management Actions with No Impacts or Minor Impacts on Renewable Energy Development

Air Resources

Air resources would have no adverse impacts on wind, solar, or geothermal energy development. Renewable energy development would not result in emissions that would violate ambient air quality standards. Local dust may be created during construction, but is controlled using water on all construction areas and roads. This would increase the construction cost because of the lack of available water and the need to transport it from potentially distant sources. No further analysis of air resources relative to renewable energy is warranted.

Cultural Resources

Conflicts between renewable energy development and cultural resources would be resolved in accordance with regulations, policy, and the New Mexico BLM Protocol between the New Mexico SHPO and BLM, including consultation with tribes concerning energy development. Some policies may cause minor delay in energy development by requiring surveys to ensure that resources are avoided. Wind and geothermal projects may be less affected than solar projects because of flexibility in siting turbine pads, collection lines, and other infrastructure, which can be located to avoid cultural resource sites. Solar energy requires a larger area and more intensive disturbance, which makes it more difficult to avoid cultural resource sites.

Livestock Grazing

The standards for rangeland health apply to reclamation of renewable energy development; however, these standards would not significantly increase the costs or prohibit the development of energy projects. Livestock grazing is compatible with geothermal and wind development, since a large portion of the range would still be available to cattle. Some areas would be cleared of vegetation, resulting in the loss of grazing acreage. Depending on the extent of these developments, grazing permit numbers may be reduced. Most forage would be removed during the development of solar energy, and commercial solar farms may be extensive. Solar energy development would remove considerably more grazing land than either wind or geothermal development. Livestock grazing would have minor impacts on renewable energy development.

Leasable Minerals

There is no potential for leasable mineral development in the vicinity of the Guadalupe Mountains, where wind resources are favorable. Areas along the Mescalero Ridge may be suitable for oil and gas, which already occurs where wind energy is present. The disturbance and need for access roads make these two developments compatible. Solar and geothermal energy development is not likely to occur in either area. Thus, fluid and solid leasable mineral development would have no impact on wind development.

Solar energy development could occur across Eddy and Lea Counties. However, the solar resources generally do not support large commercial development, and this may create conflicts with mineral development. Should local solar resources be determined to be adequate for development, conflicts with leasable mineral operations could occur. Geothermal development is not likely to occur.

Locatable Minerals

Locatable mineral mining operations could conflict with the location of renewable energy development. However, the low potential for development for locatable mineral deposits and the projection of only one locatable mineral operation during the planning period make the likelihood of conflict very remote. More likely, the two would be compatible because locatable mineral actions would not affect the availability of land for renewable energy, nor would operations conflict.

Paleontological Resources

Surveys for fossil resources would have to be performed prior to surface-disturbing activities, and significant fossils would be identified and mitigated. This would cause delays in permitting and increase the costs of permitting for renewable energy projects, but the delays would be minor and the costs minimal. None of the paleontological resources decisions would likely impact the amount of land available for renewable energy development. Thus, no further analysis is needed.

Public Health and Safety

Renewable energy development and operations already are required to follow all safety regulations and policies, including OSHA. Open-loop geothermal energy projects may emit hydrogen sulfide and other gases as steam is released (Kagel 2008). This may cause a health risk for workers who work in close proximity to the facility. A small amount of mercury may also be produced, requiring expensive filter technology. Closed-loop systems pose no additional health or safety issues.

Construction and operation of renewable energy projects are not likely to pose safety and health issues that are not already addressed in mining and oil and gas development. Thus, no further analysis is needed.

Salable Minerals

As with other mineral resources, there may be minor or rare conflicts over location with renewable energy development, but the two are generally compatible. The addition of roads and the need for transmission might be shared and therefore present a positive relationship. Thus, salable mineral decisions would have no effect on renewable energy development, and no further analysis is warranted.

Travel Management

Implementation of a comprehensive travel management plan would have a minor impact on renewable energy development. Identifying roads that would be available for access might have a beneficial effect on renewable energy development, such that costs for road improvement can be estimated. However, the closure of roads might exclude some areas from development.

Typically, only very primitive roads would be closed to access, whereas more established routes that would likely be used for renewable energy development would remain open. Improvement of more remote roads to accommodate large trucks for transporting wind turbines, for example, would be costly and not likely cost effective for anything but the largest commercial development. Since transmission is not likely to be present or permitted, use of these remote roads for renewable development is also unlikely. Furthermore, the areas closed to travel under each alternative are small, compared with the size of the planning area (Table 4-159). Thus, travel management decisions would have a minor effect on renewable energy development. No further analysis is warranted.

Vegetation Management, Including Noxious Weeds

Vegetation management decisions under all alternatives focus on maintaining and restoring desired plant communities to rangeland health standards for the protection of watersheds and plant and wildlife habitat. The impact on habitat loss or modification from wind and geothermal is minimal, compared with the total acreage in the CFO. Except for the small area occupied by pads/turbines and roads, collection lines and other disturbance for wind energy is temporary, and restoration of native plant communities is completed following the construction period. Solar development results in a greater area of disturbance. But under all alternatives, lease stipulations, COAs, and BMPs would be applied to restore native plant communities and control the spread of noxious weeds. Thus, vegetation management decisions would have no impact on renewable energy development. No further analysis is needed.

Water Resources

Water resources management decisions would focus on protection of surface water and groundwater quality from the impacts of renewable energy development. Although solar energy may require surface water or groundwater during operation, the development is unlikely to affect surface water or groundwater quality. Lack of water availability would limit where solar energy could be developed. Wind energy development would require little water and would have no impacts to surface water or groundwater quality. Geothermal development uses groundwater that may have high levels of minerals. However, the pumping system usually employs a closed-loop system that prevents extracted water from being released. Some water is released as steam, but it poses no threat to water quality. No water contamination from geothermal sites has been reported in the United States (NREL 2012). The availability of water would limit where geothermal energy could be developed.

Wildland Fire Management

Fire suppression strategies and management of fuels would have a beneficial effect on renewable energy development by reducing the danger of wildfires that could damage expensive technology. Wildland fire management actions would not impact the land available for renewable energy projects. Thus, no further analysis is needed.

Direct and Indirect Impacts

Direct impacts to renewable energy include management actions permitting or prohibiting renewable energy development (see Table 4-159). Market demand and availability of the resource would ultimately drive the development of renewables in the planning area in areas where renewable energy development is allowed. Indirect beneficial impacts to renewable energy sources include management actions for other resources and resources uses that would encourage or facilitate renewable energy development. These would include transmission ROWs.

Indirect adverse impacts include management actions constraining renewable energy development such as sensitive habitat or species, visual resources, and lands and realty. Other indirect impacts of wind would include habitat loss, but to a lesser degree than solar development. For example, some recreation, grazing, wildlife, and other management actions may not be as restrictive regarding wind development since there is less habitat disturbance and fewer access restrictions than for solar development. Direct effects include the mortality of birds and bats from the wind development operation, and in some cases from the presence of solar farms. Locations of sensitive bird and/or bat species could restrict wind development. Indirect impacts to LPC occur through the placement of tall structures that may cause LPC to abandon breeding sites. Transmission lines that accompany energy would have a similar effect. Therefore, restrictions on energy ROW corridors would limit where solar and wind energy resources could be developed. Road improvements needed for both wind and solar development could result in habitat fragmentation and further impact sensitive species. The existence of cave/karst areas may also restrict renewable energy development, especially for the construction of heavy turbines, which may be threatened from potentially unstable geology. Erodible soils would also limit some renewable energy development, especially solar, because the large extent of vegetation removal would make soil resources vulnerable to erosion. However, solar projects are generally built on level terrain and include soil stabilization.

Geothermal energy developments result in surface disturbance similar to oil and gas extraction. Numerous roads and pipelines would result in indirect impacts through habitat loss and fragmentation. This energy development would have restrictions from other management actions that are similar to those for oil and gas.

Vegetation

Direct and indirect impacts from management actions may vary by renewable resource. For example, solar projects are generally incompatible with other management since the development consumes considerable acreage by a single use. This intense development results in almost complete loss of habitat from the clearing and shade created by solar panels. Therefore, other management concerns, such as impacts to vegetation (loss) causing indirect effects on wildlife and direct effects on wildlife as a result of potential mortality, would restrict this development.

Special Status Species

The location of occupied habitat by special status species would have considerable influence on where renewable energy could be developed. Renewable energy development requires land disturbance that could result in long-term displacement of rare species.

Because of the sensitivity of LPCs to vertical structures, a greater buffer would be required for turbine placement and transmission lines associated with energy projects. The Western Association of Fish and Wildlife Agencies' Range-wide Conservation Plan for the LPC has established a minimum 1.25-mile buffer distance from active leks. Future areas for population expansion, as designated by the LPC Southern Great Plains Crucial Habitat Assessment Tool, for example, could also be restricted from renewable energy development, since that habitat may be critical in future recovery of the species. Lek surveys and additional habitat analysis may be required for any renewable energy or related transmission projects that overlap LPC Southern Great Plains Crucial Habitat Assessment Tool categories. Poor placement of such infrastructure could have a direct impact on LPC by causing abandonment of breeding sites.

Direct mortality from collisions with solar panels and wind turbines are possible, more so for the latter. Consequently, movement of birds, such as during migration, must also be considered for locating projects relative to the occurrence of these species.

Solar projects require considerable land clearing; therefore, habitat fragmentation must be considered for development within or near special status species' habitat. Habitat fragmentation may have an indirect impact by preventing special status species from expanding their range. For example, development of habitat between areas occupied by DSL may restrict population expansion to other potential occupied habitat.

Aplomado falcons may fly into the rotor-swept area of wind turbines, increasing the potential for fatalities. Therefore, the presence of these birds could restrict the development of wind in breeding areas and also in areas where the birds hunt.

Gypsum wild buckwheat occurs in specialized habitat that is rare, and conflicts with energy development are less likely. Surveys for Kuenzler's hedgehog cactus and Lee's pincushion cactus should determine whether they are present in a potential energy development area. Wind development, with its low surface area disturbance, may be more compatible than solar development with special status plant species, since populations can be more easily avoided in project planning and construction.

Recreation

Restrictions from recreation may occur because areas open to hunting, hiking, bird watching, and other types of recreation would be incompatible with solar development since it requires clearing of habitat and fencing, which would restrict access.

Water Resources (Quantity)

Although renewable energy has little impact on water quality, certain types of solar development require substantial water resources, which may impact this resource quantity and limit suitability of locations as a result of competition for limited water resources. Concentrated solar thermal plants using cooling towers can use as much as 600 to 650 gallons of water per megawatt hour (U.S. Department of Energy 2012). Photovoltaic solar systems require water only for cleaning of the panels. Therefore, desert aquifers, springs, seeps, and other aquatic systems could be impacted from the withdrawal of water.

Backcountry Byways

Designations of backcountry byways would have a direct impact on renewables development because of the level of planning required to implement adequate buffer zones to prevent energy development from being visible. Those using byways would expect a natural level of experience that could be impaired by the presence of renewable energy projects. Therefore, additional visual analysis would be required of wind energy projects relative to the location of byways.

Visual Resources

The three types of renewable energy may have different impacts or restrictions from visual resources. The indirect impacts of wind energy development are less restrictive. However, wind turbines are highly visible from great distances in relatively flat terrain, particularly if the project is placed on ridges or caprock. Therefore, management of important visual resources can effectively preclude wind development in some areas (typically areas managed as VRM Class I and II). It is assumed that VRM Class I and II would restrict all renewable energy, but wind projects may also result in visual impairment for either class if built in a Class III area. Even in the latter, it may be difficult to maintain a moderate level of change to the landscape and avoid having wind turbines not dominate the view of the casual observer. As noted in Table 4-159, a specific VRM analysis may be needed for wind projects, even in Class III areas, to determine whether an additional buffer is warranted.

Lands with Wilderness Characteristics

Closing lands with wilderness characteristics to renewable energy development would have a direct adverse impact. Table 4-159 summarizes the lands with wilderness characteristics and WSAs identified for management to maintain wilderness characteristics under all alternatives. Even under the most restrictive alternative, only about 66,666 acres of the planning area would be excluded. To maintain wilderness characteristics, wind and solar development would not be compatible. Geothermal wells could be compatible if directionally drilled to develop the resource in these areas. Wind and solar development would have to be developed outside the lands with wilderness characteristics and would likely need additional analysis to ensure that buffers meet VRM standards and maintain wilderness characteristics.

Table 4-159. Summary of Resource Categories by Alternative that Result in Exclusion, Closure, Avoidance, or Variance of Renewable Energy Development

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
Lands with wilderness characteristics	No acres specifically excluded for management of lands with wilderness characteristics.	66,666 acres managed for wilderness characteristics as a priority; 64,535 acres excluded for solar and 66,661 acres excluded for wind	47,611 acres managed for wilderness characteristics as a priority, which include wind exclusions and avoidance areas and solar variance or exclusion areas.	5,119 acres managed for wilderness characteristics as a priority, which include wind exclusions and avoidance areas and solar variance or exclusion areas.	1,221 managed for wilderness characteristics as a priority, which include wind exclusions and avoidance areas and solar variance or exclusion areas.	Excluded to protect wilderness characteristics
WSAs	7,086 acres excluded	7,086 acres excluded	7,086 acres excluded	7,086 acres excluded	7,086 acres excluded	Excluded by law or regulation
Proposed WSRs	No acres specifically excluded for the management of WSRs.	11.9 miles (4,100 acres) excluded	11.9 miles (4,100 acres) excluded	11.9 miles (4,100 acres) excluded	11.9 miles (4,100 acres) excluded	Plan amendments for New Mexico should consider whether a buffer zone is appropriate and, if so, how wide it should be, or what site-specific criteria might be applied to determine variable widths. Geothermal PEIS places a 0.25-mile buffer.
Backcountry byways	85 miles excluded	30 miles excluded	30 miles excluded	30 miles excluded	30 miles excluded	Programmatic plan amendments for New Mexico should consider whether a buffer zone is appropriate and, if so, how wide it should be, or what site-specific criteria might be applied to determine variable widths. Consideration should also be made as to whether exceptions may be made for linear projects that may cross trails.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
ACECs	9,216 acres would be excluded for wind and 3,479 acres would be avoidance for wind. 12,613 acres would be excluded for solar.	423,408 acres would be closed for geothermal and 71,618 acres would be open for geothermal. 410,680 acres would be excluded for wind and 69,275 acres would be open for wind. 410,776 acres would be excluded for solar and 69,178 acres would be variance for solar.	494,594 acres would be closed for geothermal and 66,847 acres would be open for geothermal. 481,251 acres would be excluded for wind, 1,633 acres would be avoidance for wind, and 63,966 acres would be open for wind. 481,895 acres would be excluded for solar and 64,953 acres would be variance for solar.	63,755 acres would be closed for geothermal and 34,815 acres would be open for geothermal. 4,657 acres would be excluded for wind, 14,563 acres would be avoidance for wind, and 32,493 acres would be open for wind. 63,997 acres would be excluded for solar and 29,627 acres would be variance for solar.	28,022 acres would be closed for geothermal and 871 acres would be open for geothermal. 27,224 acres would be excluded for wind and solar	Most ACECs have management objectives and/or prescriptions that would exclude or be closed to renewable energy development. However, those with prescriptions that would allow new ROWs on a case-by-case basis or new oil and gas development with CSU suggest that some development may be allowed. Where an NSO prescription is applied, present interpretations may allow geothermal leasing under the ACEC, with the resource accessed by directional drilling.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
VRM Class I	7,061 would be excluded for wind and 2 acres would be avoidance for wind. 7,058 acres would be excluded for solar.	37,764 acres would be excluded for wind. 35,645 acres would be excluded for solar and 2,119 acres would be variance for solar.	803 acres would be open for geothermal. 41,289 acres would be excluded for wind and 10 acres would be open for wind. 39,169 acres would be excluded for solar and 2,130 acres would be variance for solar.	7,171 acres would be excluded for wind and 9,450 acres would be avoidance for wind. 7,171 acres would be excluded for solar.	7,171 acres would be excluded for wind. 7,171 acres would be excluded for solar.	–

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
VRM Class II	32,497 acres would be avoidance for wind and 5,122 acres would be open for wind. 37,567 acres would be excluded for solar and 27 acres would be variance for solar.	24,576 would be closed for geothermal. 119,783 acres would be excluded for wind, 73,448 acres would be avoidance for wind, and 15,007 would be open for wind. 191,322 acres would be excluded for solar and 16,119 acres would be variance for solar.	36,148 acres would be closed for geothermal and 7,438 acres would be open for geothermal. 156,248 acres would be excluded for wind, 89,355 acres would be avoidance for wind, and 26,458 acres would be open for wind. 243,124 acres would be excluded for solar and 28,136 acres would be variance for solar.	3,142 acres would be closed for geothermal and 1,426 acres would be open for geothermal. 43,976 acres would be excluded for wind and 2,790 acres would be open for wind. 52,031 would be excluded for solar and 3,382 would be variance for solar.	3,053 acres would be closed for geothermal and 1,355 acres would be open for geothermal. 30,053 acres would be excluded for wind, 1,702 acres would be avoidance for wind, and 4,924 acres would be open for wind. 29,607 acres would be excluded for solar and 5,574 would be variance for solar.	New developments likely excluded except in rare cases. Consideration should be given to additional buffer to prevent visual impairment from wind projects.
Wetlands and riparian areas	7,278 acres excluded	7,278 acres excluded	7,278 acres excluded	7,278 acres excluded	7,278 acres excluded	Leasing of geothermal may be allowed with an NSO stipulation within designated wetland/riparian areas. Transmission lines may be allowed to cross wetland/riparian areas, depending upon results of case-by-case analysis.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
Active floodplains	No acres excluded	All acres excluded (wind and solar) or closed (geothermal)	All acres excluded (wind and solar) or closed (geothermal)	All acres excluded (wind and solar) or closed (geothermal)	All acres excluded (wind and solar) or closed (geothermal)	Geothermal programmatic allows leasing in floodplains but requires NSO stipulation. Considering the long-term nature of wind and solar projects, exclusion would appear appropriate for power sites, but transmission lines may be allowed to cross, depending on the specific situation and location of structures such as poles or towers outside of the floodplain.
100-year floodplains	No acres specifically excluded	All acres excluded (wind and solar) or closed (geothermal)	All acres excluded (wind and solar) or closed (geothermal)	All acres excluded (wind and solar) or closed (geothermal)	All acres excluded (wind and solar) or closed (geothermal)	Development may be allowed, provided that adequate mitigation measures are developed. Transmission lines may be allowed to cross, depending on specific situation and location of structures such as poles or towers outside the floodplain.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
Aplomado falcon	40,656 acres of Level I aplomado falcon habitat would be open for geothermal, 35,498 acres of Level II aplomado falcon habitat would be open for geothermal, and 6,303 acres of Level III aplomado falcon habitat would be open for geothermal. 4,626 acres of habitat would be open (variance) for solar and 215,944 acres would be excluded. 80,419 acres of habitat would be open for wind and 139,666 acres would be avoidance area.	10 acres of Level I aplomado falcon habitat would be open for geothermal, 26 acres of Level II aplomado falcon habitat would be open for geothermal, and zero acres of Level III aplomado falcon habitat would be open for geothermal. 12,363 acres of habitat would be open (variance) for solar and 208,202 acres would be excluded. 980 acres of habitat would be open for wind, 22 acres would be avoidance area, and 219,084 acres would be excluded.	10 acres of Level I aplomado falcon habitat would be open for geothermal, 26 acres of Level II aplomado falcon habitat would be open for geothermal, and zero acres of Level III aplomado falcon habitat would be open for geothermal. 12,363 acres of habitat would be open (variance) for solar and 208,202 acres would be excluded. 980 acres of habitat would be open for wind, 22 acres would be avoidance area, and 219,084 acres would be excluded.	97,329 acres of Level I aplomado falcon habitat would be open for geothermal, 657 acres of Level II aplomado falcon habitat would be open for geothermal, and zero acres of Level III aplomado falcon habitat would be open for geothermal. 16,348 acres of habitat would be open (variance) for solar and 204,113 acres would be excluded. 976 acres of habitat would be open for wind and 219,004 acres would be avoidance area.	97,345 acres of Level I aplomado falcon habitat would be open for geothermal, 1,188 acres of Level II aplomado falcon habitat would be open for geothermal, and zero acres of Level III aplomado falcon habitat would be open for geothermal. 16,445 acres of habitat would be open (variance) for solar and 204,019 acres would be excluded. 16,244 acres of habitat would be open for wind and 203,724 acres would be avoidance area.	Depending upon species' characteristics and nature of essential primary constituent elements listed for the designated critical habitat as well as results of consultation with FWS, exclusion or avoidance may be appropriate. Depending upon project-specific coordination with the USFWS, habitat areas may be excluded or avoided. Individual review may be necessary to determine whether exclusion or avoidance for specific types of development is most appropriate. The New Mexico Comprehensive Wildlife Conservation Strategy (2006) should be reviewed in coordination with NMDGF as appropriate.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
Pecos bluntnose shiner	73 acres of habitat would be avoidance area for wind.	21 acres of habitat would be closed for geothermal. 92 acres of habitat would be excluded for solar. 73 acres of habitat would be excluded for wind.	21 acres of habitat would be closed for geothermal. 4 acres of habitat would be open (variance) for solar and 88 acres would be excluded for solar. 73 acres of habitat would be excluded for wind.	21 acres of habitat would be closed for geothermal. 4 acres of habitat would be open (variance) for solar and 88 acres would be excluded for solar. 73 acres of habitat would be excluded for wind.	21 acres of habitat would be closed for geothermal. 4 acres of habitat would be open (variance) for solar and 88 acres would be excluded for solar. 73 acres of habitat would be excluded for wind.	Depending upon species' characteristics and nature of essential primary constituent elements listed for the designated critical habitat as well as results of consultation with FWS, exclusion or avoidance may be appropriate. Depending upon project-specific coordination with the USFWS, habitat areas may be excluded or avoided. Individual review may be necessary to determine whether exclusion or avoidance for specific types of development is most appropriate. The New Mexico Comprehensive Wildlife Conservation Strategy (2006) should be reviewed in coordination with NMDGF as appropriate.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
Dune sagebrush lizard	34,824 acres of habitat would be open for geothermal, and 161,483 acres would be closed for geothermal. 584 acres of habitat would be open (variance) for solar and 161,486 acres would be excluded. 148,895 acres of habitat would be open for wind and 13,172 acres would be avoidance area.	152,991 acres of habitat would be open for geothermal, and 43,316 acres would be closed for geothermal. 125,787 acres of habitat would be open (variance) for solar and 36,277 acres would be excluded. 36 acres of habitat would be open for wind, 128,699 acres would be avoidance area, and 33,328 acres would be excluded.	243 acres of habitat would be open for geothermal, and 186,062 acres would be closed for geothermal. 122,653 acres of habitat would be open (variance) for solar and 39,409 acres would be excluded. 870 acres of habitat would be open for wind, 48,284 acres would be avoidance area, and 112,907 acres would be excluded.	152,389 acres of habitat would be open for geothermal, and 43,915 acres would be closed for geothermal. 125,188 acres of habitat would be open (variance) for solar and 36,869 acres would be excluded. 128,138 acres of habitat would be avoidance area for wind and 33,920 acres would be excluded.	152,984 acres of habitat would be open for geothermal, and 43,323 acres would be closed for geothermal. 125,188 acres of habitat would be open (variance) for solar and 36,876 acres would be excluded. 161,271 acres of habitat would be avoidance area for wind and 793 acres would be excluded.	Depending upon species' characteristics and nature of essential primary constituent elements listed for the designated critical habitat as well as results of consultation with FWS, exclusion or avoidance may be appropriate. Depending upon project-specific coordination with the USFWS, habitat areas may be excluded or avoided. Individual review may be necessary to determine whether exclusion or avoidance for specific types of development is most appropriate. The New Mexico Comprehensive Wildlife Conservation Strategy (2006) should be reviewed in coordination with NMDGF as appropriate.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
Lesser prairie chicken (LPC)	160,644 acres of isolated population area (IPA) would be open for geothermal, and 469,086 acres would be closed for geothermal.	188,319 acres of occupied range would be open for geothermal, and 112,273 acres would be closed. 616,470 acres of IPA would be open for geothermal, and 13,261 acres would be closed. 270,711 acres of habitat with timing restrictions would be open for geothermal and 135,950 acres would be closed.	22,741 acres of occupied range would be open for geothermal, and 277,850 acres would be closed. 294,947 acres of IPA would be open for geothermal, and 334,740 acres would be closed. 11,045 acres of habitat with timing restrictions would be open for geothermal, and 395,576 acres would be closed.	187,687 acres of occupied range would be open for geothermal, and 112,904 acres would be closed. 614,6123 acres of IPA would be open for geothermal, and 15,107 acres would be closed. 270,077 acres of habitat with timing restrictions would be open for geothermal, and 136,581 acres would be closed.	188,312 acres of occupied range would be open for geothermal, and 112,280 acres would be closed. 13,266 acres of IPA would be open for geothermal, and 616,462 acres would be closed. 135,955 acres of habitat with timing restrictions would be open for geothermal, and 270,704 acres would be closed.	Depending upon species' characteristics and nature of essential primary constituent elements listed for the designated critical habitat as well as results of consultation with FWS, exclusion or avoidance may be appropriate. Depending upon project-specific coordination with the USFWS, habitat areas may be excluded or avoided. Individual review may be necessary to determine whether exclusion or avoidance for specific types of development is most appropriate. The New Mexico Comprehensive Wildlife Conservation Strategy (2006) should be reviewed in coordination with NMDGF as appropriate.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
LPC (continued)	1,023 acres of occupied range would be open (variance) for solar and 204,146 acres would be excluded. 53,760 acres of IPA would be open (variance) for solar and 469,086 acres would be excluded. 276,994 acres of habitat with timing restrictions would be excluded for solar.	150,719 acres of occupied range would be open (variance) for solar and 54,428 acres would be excluded. 509,381 acres of IPA would be open (variance) for solar and 13,258 acres would be excluded. 206,990 acres of habitat with timing restrictions would be open for solar and 69,986 acres would be excluded.	139,962 acres of occupied range would be open (variance) for solar and 65,180 acres would be excluded. 485,316 acres of IPA would be open (variance) for solar and 37,318 acres would be excluded. 197,411 acres of habitat with timing restrictions would be open for solar and 79,559 acres would be excluded.	150,088 acres of occupied range would be open (variance) for solar and 55,053 acres would be excluded. 507,535 acres of IPA would be open (variance) for solar and 15,098 acres would be excluded. 206,359 acres of habitat with timing restrictions would be open for solar and 70,610 acres would be excluded.	150,088 acres of occupied range would be open (variance) for solar and 55,059 acres would be excluded. 507,534 acres of IPA would be open (variance) for solar and 15,105 acres would be excluded. 206,359 acres of habitat with timing restrictions would be open for solar and 70,614 acres would be excluded.	–

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
LPC (continued)	200,804 acres of occupied range would be open for wind and 4,361 acres would be avoidance area. 499,585 acres of IPA would be open and 23,073 acres would be avoidance area. 267,458 acres of habitat with timing restrictions would be open for wind and 9,536 acres would be avoidance area.	1,333 acres of occupied range would be open for wind, 151,427 acres would be avoidance area, and 52,385 acres would be excluded. 153 acres of IPA would be open, 516,350 acres would be avoidance area, and 6,774 acres would be excluded. 387 acres of habitat with timing restrictions would be open for wind, 206,250 acres would be avoidance area, and 70,337 acres would be excluded.	1,319 acres of occupied range would be open for wind, 20,280 acres would be avoidance area, and 183,542 acres would be excluded. 202 acres of IPA would be open, 298,171 acres would be avoidance area, and 224,901 acres would be excluded. 821 acres of habitat with timing restrictions would be avoidance area for wind and 278,148 acres would be excluded.	1,320 acres of occupied range would be open for wind, 150,810 acres would be avoidance area, and 53,009 acres would be excluded. 167,424 acres of IPA would be open, 349,300 acres would be avoidance area, and 6,548 acres would be excluded. 2 acres of habitat with timing restrictions would be open for wind, 206,006 acres would be avoidance area, and 70,961 acres would be excluded.	1,319 acres of occupied range would be open for wind, 197,381 acres would be avoidance area, and 6,447 acres would be excluded. 167,427 acres of IPA would be open, 349,305 acres would be avoidance area, and 6,548 acres would be excluded. 272,217 acres of habitat with timing restrictions would be avoidance area for wind and 4,758 acres would be excluded.	–

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
Gypsum wild buckwheat	175 acres of habitat would be excluded for solar and closed to geothermal. 175 acres of habitat would be avoidance area for wind.	0 acres of habitat would be open for geothermal. 38 acres of habitat would be open (variance) for solar and 136 acres would be excluded. 38 acres of habitat would be open for wind and 136 acres would be excluded.	0 acres of habitat would be open for geothermal. 12 acres of habitat would be open (variance) for solar and 163 acres would be excluded. 12 acres of habitat would be open for wind and 163 acres would be excluded.	0 acres of habitat would be open for geothermal. 12 acres of habitat would be open (variance) for solar and 163 acres would be excluded. 12 acres of habitat would be open for wind, 125 acres would be avoidance area, and 38 acres would be excluded.	0 acres of habitat would be open for geothermal. 137 acres of habitat would be open (variance) for solar and 38 acres would be excluded. 136 acres of habitat would be open for wind and 38 acres would be excluded.	Depending upon species' characteristics and nature of essential primary constituent elements listed for the designated critical habitat as well as results of consultation with FWS, exclusion or avoidance may be appropriate. Depending upon project-specific coordination with the USFWS, habitat areas may be excluded or avoided. Individual review may be necessary to determine whether exclusion or avoidance for specific types of development is most appropriate. The New Mexico Comprehensive Wildlife Conservation Strategy (2006) should be reviewed in coordination with NMDGF as appropriate.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
Kuenzler's hedgehog cactus	46 acres of habitat would be open (variance) for solar and 53,865 acres would be excluded. Depending upon project-specific coordination with the USFWS, habitat areas may be excluded or avoided. 1,509 acres of habitat would be open for wind, 49,399 acres would be avoidance area, and 2,985 acres would be excluded. Depending upon project-specific coordination with the USFWS, habitat areas may be excluded or avoided.	39,939 acres of habitat would be open for geothermal and 2,884 acres would be closed. 22,930 acres of habitat would be open (variance) for solar and 30,980 acres would be excluded. 21,134 acres of habitat would be open for wind, 1,198 acres would be avoidance area, and 31,579 acres would be excluded.	39,939 acres of habitat would be open for geothermal and 2,869 acres would be closed. 22,930 acres of habitat would be open (variance) for solar and 30,980 acres would be excluded. 21,126 acres of habitat would be open for wind, 1,198 acres would be avoidance area, and 31,587 acres would be excluded.	41,587 acres of habitat would be open for geothermal and 1,226 acres would be closed. 22,994 acres of habitat would be open (variance) for solar and 30,910 acres would be excluded. 21,163 acres of habitat would be open for wind, 11,054 acres would be avoidance area, and 21,652 acres would be excluded.	42,261 acres of habitat would be open for geothermal and 547 acres would be closed. 39,928 acres of habitat would be open (variance) for solar and 13,979 acres would be excluded. 22,951 acres of habitat would be open for wind, 27,284 acres would be avoidance area, and 3,672 acres would be excluded.	Depending upon species' characteristics and nature of essential primary constituent elements listed for the designated critical habitat as well as results of consultation with FWS, exclusion or avoidance may be appropriate. Depending upon project-specific coordination with the USFWS, habitat areas may be excluded or avoided. Individual review may be necessary to determine whether exclusion or avoidance for specific types of development is most appropriate. The New Mexico Comprehensive Wildlife Conservation Strategy (2006) should be reviewed in coordination with NMDGF as appropriate.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
Lee's pincushion cactus	127 acres of habitat would be excluded for solar. 127 acres of habitat would be avoidance area for wind.	127 acres of habitat would be excluded for solar. 127 acres of habitat would be excluded for wind.	127 acres of habitat would be excluded for solar. 127 acres of habitat would be excluded for wind.	127 acres of habitat would be excluded for solar. 127 acres of habitat would be excluded for wind.	127 acres of habitat would be excluded for solar. 127 acres of habitat would be excluded for wind.	Depending upon species' characteristics and nature of essential primary constituent elements listed for the designated critical habitat as well as results of consultation with FWS, exclusion or avoidance may be appropriate. Depending upon project-specific coordination with the USFWS, habitat areas may be excluded or avoided. Individual review may be necessary to determine whether exclusion or avoidance for specific types of development is most appropriate. The New Mexico Comprehensive Wildlife Conservation Strategy (2006) should be reviewed in coordination with NMDGF as appropriate.

Land Designation	Alternatives					Comments
	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D	
SRMAs and ERMAs	13 acres would be closed for geothermal. 7,887 acres would be excluded for wind and 59,196 acres would be avoidance for wind. 67,083 acres would be excluded for solar.	13 acres would be closed for geothermal and 3 acres would be open for geothermal. 14,552 acres would be excluded for wind, 36,892 acres would be avoidance for wind, and 1,534 acres would be open for wind. 49,539 acres would be excluded for solar and 2,633 acres would be variance for solar.	117 acres would be closed for geothermal. 26,089 acres would be excluded for wind, 44,846 acres would be avoidance for wind, and 5,631 acres would be open for wind. 67,048 acres would be excluded for solar and 8,714 acres would be variance for solar.	117 acres would be closed for geothermal. 18,289 acres would be excluded for wind, 44,840 acres would be avoidance for wind, and 3,851 acres would be open for wind. 61,556 acres would be excluded for solar and 4,629 acres would be variance for solar.	79 acres would be closed for geothermal and 122 acres would be open for geothermal. 12,691 acres would be excluded for wind, 44,903 acres would be avoidance for wind, and 1,546 acres would be open for wind. 55,466 acres would be excluded for solar and 2,872 acres would be variance for solar.	–
Highly erodible soils	Renewable energy excluded (wind and solar) or closed (geothermal) on 245,854 acres with slopes greater than 10%	Renewable energy excluded (wind and solar) or closed (geothermal) on 245,854 acres with slopes greater than 10%	Renewable energy excluded (wind and solar) or closed (geothermal) on 245,854 acres with slopes greater than 10%	Renewable energy excluded (wind and solar) or closed (geothermal) on 245,854 acres with slopes greater than 10%	Renewable energy excluded (wind and solar) or closed (geothermal) on 245,854 acres with slopes greater than 10%	–

Impacts from Renewable Energy Actions

Applications to permit either solar or wind energy development on public land within the planning area would be considered if the applicant can demonstrate no negative impacts on occupied and suitable LPC or DSL habitat. Programmatic policies and BMPs in the Wind Energy Development Programmatic EIS ROD (BLM 2014) or Solar Energy Development Programmatic EIS (BLM 2012a) would be adopted.

The Solar Programmatic EIS identifies only one solar energy zone in New Mexico, which is in the Las Cruces Field Office planning area. The EIS does not designate any solar energy zones in the CFO planning area. Other areas that are not identified for exclusion would be managed as variance areas that may be available for a utility-scale solar energy ROW with special stipulations or considerations. The BLM would consider ROW applications for utility-scale solar energy development in variance areas on a case-by-case basis based on environmental considerations.

In general, under the No Action Alternative, fewer acres are open to renewable energy development than for any of the action alternatives, especially for geothermal and solar development (Table 4-160). All of the action alternatives have more acreage open to wind development while also excluding more areas to development than the No Action Alternative.

Table 4-160. Renewable Energy Development Management Decisions on BLM-administered Lands

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Geothermal – open	964,322	1,788,890	1,411,281	2,175,070	2,319,907
Solar – variance	271,316	1,323,157	1,257,870	1,356,451	1,460,801
Wind – open	1,134,948	800,762	760,560	1,002,986	1,092,311
Wind – avoid	949,539	624,734	418,812	883,051	926,749
Geothermal – close	1,819,929	995,285	1,372,791	608,850	464,187
Solar – exclude	1,820,409	768,020	833,305	734,636	630,302
Wind – exclude	7,056	666,783	912,860	206,184	73,143

Impacts from Management Common to All Action Alternatives

Wind development would be encouraged in areas where transmission corridors or systems are already located, but it would not be proposed for any exclusion and avoidance areas. Renewable energy would not be impacted for any of the alternatives by state listed species or crucial habitat or for species that are candidates for federal listing. However, some restrictions for the latter could occur through consultation with the USFWS during site-specific analysis.

4.3.3 Livestock Grazing

This section discusses impacts to livestock grazing from management decisions for resources and resource uses discussed in Chapter 2. Existing conditions and trends concerning livestock grazing are described in Chapter 3 (see Section 3.3.3). Impacts to resources and resource uses resulting from implementation of the livestock grazing program are discussed in those particular resource sections of this chapter.

4.3.3.1 Analysis Methods

4.3.3.1.1 Indicators Used to Determine Impacts

- Number of acres of available forage
- Number of available AUMs

4.3.3.1.2 Methods and Assumptions

Management actions related to the following resources and resource uses were analyzed in detail with respect to their impacts to livestock grazing: recreation, minerals, livestock grazing land use authorizations, lands with wilderness characteristics, renewable energy, and special designations. Management actions related to the following resources and resource uses are not expected to result in surface disturbance and would, therefore, neither increase nor decrease the amount of available forage or number of available AUMs across the planning area. Thus, livestock grazing would not be impacted. These are air resources, wildlife and fish, special status species, vegetation, public safety, cultural resources, paleontological resources, visual resources, karst resources, land tenure, and social and economic conditions.

The following are the general assumptions used for assessment under all the alternatives:

- All management decisions would meet the Standards and Guidelines.
- When allotments are not meeting standards or resource objectives, AUMs or grazing systems may be adjusted to improve rangeland health.
- The differences in the amount of AUMs by alternative were calculated by pro-rating the available number of AUMS by the acres open to grazing.

4.3.3.2 Direct and Indirect Impacts

4.3.3.2.1 Impacts of Livestock Grazing Actions

As discussed in Section 3.3.3, Livestock Grazing, the BLM currently manages livestock grazing on approximately 2 million acres. This acreage authorizes 367,656 active AUMs of livestock forage in 265 grazing allotments. These numbers are determined through quantitative field monitoring of vegetative production. Impacts on livestock grazing activities are generally the result of activities that affect the amount of land open to livestock grazing, forage levels and available AUMs, or range improvements that are used to manage grazing systems. Conducting vegetation treatments would likely have the greatest effect on livestock grazing, as such treatments would ultimately increase vegetation production and available forage for livestock. Activities that result in surface disturbance (e.g., mineral development, ROW construction, and recreation) would adversely impact livestock grazing through a reduction in the amount of available forage and number of AUMs.

There would be beneficial and adverse impacts to livestock grazing from the various resource and resource use decisions proposed depending on the specific management actions. Beneficial impacts would result if an increase in the amount of forage and acres available for livestock grazing occurs as a result of management decisions. Any management decisions that minimize surface disturbance would benefit livestock grazing through the preservation and maintenance of native vegetative communities, which would, in turn, contribute to overall rangeland health. In the long term, these management actions would result in an increase in the amount of available forage and the number of available AUMs, although short-term impacts would be adverse as vegetation and available forage is initially reduced and/or treated pastures would not be available for use until rest periods had allowed the area to recover. Adverse impacts would be the result of a decision to close portions of or entire active grazing allotments. Adverse impacts would also result from any use or activity that reduces the amount of available forage or restricts livestock movement and/or access to forage, such as fencing or other types of exclosures. The number of acres open to livestock grazing and number of available AUMs vary by alternative and are represented in Table 4-161 below. This table also summarizes the acres that would be closed to livestock grazing under each alternative considered in this RMP as well as the number of grazing allotments with 1% of the total allotment acreage closed to grazing. A complete list of grazing allotments either partially or completely closed to livestock grazing is provided in Appendix F.

Table 4-161. Comparison of Proposed Livestock Grazing Actions by Alternative

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open (acres)	2,086,107	1,598,198	1,937,725	2,083,232	2,087,759
Closed (acres)*	5,226	493,120	153,583	8,115	3,594
Total	***2,091,333***	***2,091,318***	***2,091,308***	***2,091,347***	***2,091,353***
% Open	***99.7%***	***76.4%***	***92.7%***	***99.6%***	***99.8%***
# of available AUMs (prorated by % of area open to grazing)	***372,519***	***280,965***	***340,656***	***366,229***	***367,024***
# of allotments 100% closed to livestock grazing	***–***	***29***	***1***	***–***	***–***
# of allotments with 1% or more of allotment closed	***2***	***97***	***36***	***10***	***2***

* Closed in this context means that the lands would be unavailable to all forms of grazing.

Per 40 CFR 4110.4-2, when there is a decrease in public land acreage which precludes livestock grazing, the permittees and lessees would be given notification 2 years in advance before the grazing permit, lease, or preference is cancelled, except in cases of emergency. As shown in Table 4-161, each alternative considers a reduction in public land available to livestock grazing, with the greatest number of allotments effected under Alternative A and the least number of allotments effected under the No Action Alternative. More information is provided under the discussion of each alternative below.

Impacts from the No Action Alternative

Under the No Action Alternative, there would be 2,086,107 acres open to livestock grazing and 5,226 acres closed; less than 1% of the entire planning area. No allotments would be 100% closed to livestock grazing under the No Action Alternative, although two allotments would be reduced in size by 1 to 3% of their total size. There would be 372,519 active AUMs available for livestock use across the planning area.

Impacts from Alternative A

Under Alternative A, there would be 1,598,198, acres open to grazing and 280,965 available AUMs. Around 23% of the planning area would be closed to grazing (493,120 acres), resulting in a 23.5% decrease in the amount of available forage and 86,350 fewer available AUMs compared to the No Action Alternative (see Table 4-161). Twenty-nine allotments would be 100% closed to livestock grazing under Alternative A, with 97 allotments being reduced by 1% or more of their total allotment size. Most of these closed acres would come from acreage designated under ACECs and is discussed further in Chapter 2 and in the Special Designations subsection below.

BLM Instruction Memorandum No. 2012-169 states, “The BLM will develop a range of alternatives for an RMP/EIS by varying which lands in the planning area are available for grazing, by varying the amount of forage available for livestock grazing, or both” (BLM 2012d). For this RMP, after consideration of alternative themes and resource conflicts, a range was established that includes a significantly reduced grazing alternative. Alternative A was developed to address watershed management and restoration-related planning issues and given the adverse impacts to watershed health that grazing can incur a significant portion (23.5%) of the planning area was proposed to be closed to grazing in Alternative A. This alternative thereby satisfies Instruction Memorandum No. 2012-169.

Impacts from Alternative B

Under Alternative B, there would be 1,937,725 acres open to grazing and 340,656 available AUMs. Approximately 7% of the planning area (153,583 acres) would be closed to grazing (see Table 4-161).

Under this alternative, an additional 151,644 acres would be closed compared to the No Action Alternative, resulting in a 17% reduction in the amount of available forage and 26,659 fewer available AUMs. One allotment would be 100% closed to livestock grazing under Alternative B, with 36 allotments being reduced by 1% or more of their total allotment size.

Impacts from Alternative C

Under Alternative C, there would be a total of 2,083,232 acres open to grazing (see Table 4-161). As with the No Action Alternative, less than 1% of the planning area would be closed to livestock grazing. No allotments would be 100% closed to livestock grazing under Alternative C and 10 allotments would be reduced by 1% or more of their total allotment size. Adverse impacts to livestock grazing under these this alternative would be comparable to those under the No Action Alternative.

Impacts from Alternative D

Under Alternative D, there would be a total of 2,087,759 acres open to grazing (see Table 4-161). As with the No Action Alternative, less than 1% of the planning area would be closed to livestock grazing. No allotments would be 100% closed to livestock grazing under Alternative D and two allotments would be reduced by 1% or more of their total allotment size. Adverse impacts to livestock grazing under these this alternative would be comparable to those under the No Action Alternative.

4.3.3.2.2 Impacts of Minerals Actions on Livestock Grazing

Mineral development activities, such as the construction of roads, pads, and facilities with caliche surfacing, hydraulic fracturing ponds, and mineral material pits, would result in surface disturbance and the removal of desirable native plant species, as well as alterations in the overall vegetation composition. Soil erosion and spread of invasive species would also potentially increase. Subsequently, these activities would affect the amount of available forage and therefore the number of available AUMs across the planning area.

Alternatives Impacts

Proposed management decisions for many resource programs within the planning area vary by alternative. The potential impacts of these varying decisions are discussed in the following section. The RFD scenario presented surface disturbance projections that would occur in the next 20 years as a result of oil and gas development across the planning area. These vary by alternative and are depicted in Table 4-162.

Table 4-162. The Reasonably Foreseeable Development Scenario of Surface Disturbance in the Planning Area by Alternative for BLM Surface Lands

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total predicted surface disturbance in acres after reclamation	8,636	6,565	5,202	8,575	8,887
Number of AUMs lost	2,071	1,516	1,463	1,725	1,868

Impacts from the No Action Alternative

Under the No Action Alternative, 8,636 acres are predicted for surface disturbance as a result of oil and gas activities across the planning area. This would mean a reduction in the number of acres of available forage representing 2,071 AUMs (see Table 4-162). This forage and the associated AUMs would be unavailable for livestock use from the time surface-disturbing activities occur until reclamation and revegetation are successful.

Impacts from Alternative A

Under Alternative A, 6,565 acres are predicted for surface disturbance, which would translate into 1,516 AUMs that would not be available (see Table 4-162). The nature of impacts to livestock grazing use is the same under Alternative A as under the No Action Alternative because both alternatives would involve the same types of surface-disturbing activities from minerals development. However, under Alternative A there would be approximately 2,071 fewer acres of surface disturbance than under the No Action Alternative, translating into 555 fewer AUMs lost (27% decrease compared to the No Action Alternative).

Impacts from Alternative B

Under Alternative B, 5,202 acres are predicted for surface disturbance, which translates to approximately 608 fewer AUMs lost (30% decrease compared to the No Action Alternative). The magnitude of impacts to livestock grazing under this alternative would be very similar to those associated with Alternative A. Compared to the No Action Alternative, beneficial impacts to livestock grazing would be greater under this alternative due to fewer acres of surface disturbance and greater available forage.

Impacts from Alternatives C and D

Under Alternative C, 8,575 acres are predicted for surface disturbance, which translates to approximately 346 fewer AUMs lost. The number of acres predicted for surface disturbance differs only by about 394 acres (less than 1%) between the No Action Alternative and Alternative C. Under Alternative D, 8,887 acres are predicted for surface disturbance, a difference of only 251 acres (less than 1%) compared to those acres predicted for surface disturbance under the No Action Alternative (see Table 4-162). When compared to the No Action Alternative, the magnitude of impacts to livestock grazing from Alternatives C and D would be similar.

4.3.3.2.3 Impacts of Special Designations on Livestock Grazing

There would be a potential for adverse impacts to livestock grazing where special designations prohibit or restrict grazing within their designated areas and, therefore, reduce the number of acres of available forage and number of AUMs available for livestock grazing use.

Areas of Critical Environmental Concern

The following table shows the number of acres closed to grazing in each ACEC under the alternatives. Those ACECs that do not have any acres proposed for closure to livestock grazing are not included in the table and are the following: Boot Hill District (1,065 acres), Dark Canyon Scenic Area (1,525 acres), Lonesome Ridge (3,021 acres), Serpentine Bends (4,216 acres), Seven Rivers Hills (954 acres) and Six Shooter (735 acres).

Table 4-163. Area of Critical Environmental Concern Acreages Closed to Livestock Grazing

ACECs	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Birds of Prey	0	340,511	1,450	0	0
Pecos Bluntnose Shiner Habitat	0	201	201	201	201
Cave Resources ACEC	0	4,516	4,681	0	0
Carlsbad Chihuahuan Desert Rivers*	0	103,815	62,300	4,896	0
Desert Heronries	0	0	48,474	0	0
Laguna Plata	0	0	4,496	0	0
Maroon Cliffs	0	0	8,659	0	0
Pecos River/ Canyons Complex	0	704	641	638	0
Pope's Well	0	0	81	0	0
Salt Playas	0	0	4,496	0	0
Total acreage closed to livestock grazing	***0***	***449,747***	***130,902***	***5,735***	***201***
Total number of AUMs lost	***0***	***79,180***	***23,047***	***1,009***	***36***

*Total acreage includes those acres in the proposed Gypsum Soils ACEC, which is located within the Carlsbad Chihuahuan Desert Rivers ACEC.

Impacts from the No Action Alternative

Under the No Action Alternative, no acres would be closed to livestock grazing within designated ACECs. Under this alternative, livestock grazing would receive beneficial impacts as a result (see Table 4-163).

Impacts from Alternative A

Under this alternative, a total of 449,747 acres would be closed to livestock grazing within designated ACECs. The magnitude of adverse impacts to livestock grazing would be the greatest under this alternative due to the largest increase in the number of acres closed to grazing compared to the number of closed acres under the No Action Alternative (see Table 4-163). Approximately 79,180 AUMs would not be issued. The amount of available forage and available AUMs would be greatly reduced under this alternative.

Impacts from Alternative B

Under this alternative, 130,902 acres would be closed to livestock grazing within designated ACECs. This would translate into the loss of approximately 23,047 AUMs compared to the zero AUMs lost under the No Action Alternative. The magnitude of impact to livestock grazing would be larger under Alternative B than under the No Action Alternative due to the number of acres closed to grazing under this alternative (see Table 4-163). The amount of available forage and the number of AUMs within designated ACECs would be greatly reduced under this alternative.

Impacts from Alternative C

Under this alternative, 5,735 acres would be closed to grazing within designated ACECs. This would translate to the loss of 1,009 AUMs (see Table 4-163). Under Alternative C, 1,0009 more AUMs would be lost than under the No Action Alternative.

Impacts from Alternative D

Under this alternative, 201 acres would be closed to grazing within designated ACECs. This would translate to the loss of 36 AUMs (see Table 4-163). Under Alternative D, 36 more AUMs would be lost than under the No Action Alternative.

Impacts of Recreation Actions on Livestock Grazing

Livestock grazing would be adversely impacted if proposed recreation decisions prohibited grazing activities and contributed to a decrease in the amount of available forage and available AUMs.

Those acres closed to livestock grazing within each designated SRMA and ERMA varies by alternative and is shown in Table 4-164. The following ERMAs and SRMAs do not have any acres proposed for closure to livestock grazing and, therefore, were not included in the table: Alkali Lake (1,341 acres), La Cueva SRMA (1,564 acres), Square Lake ERMA (6,951 acres), and West Dunes ERMA (624 acres).

Table 4-164. Acres Closed to Grazing within Each Special Recreation Management Area and Extended Recreation Management Area by Alternative

SRMAs and ERMAs	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Black River SRMA	1,275	1,275	1,275	1,275	1,275
Conoco Lake SRMA	0	7	7	7	7
Hackberry Lake SRMA	0	0	255	0	0
Hay Hollow ERMA	0	0	12,911	0	0
Pecos River Corridor SRMA	123	9,094	3,960	520	298
Pecos River Equestrian ERMA	0	0	64	0	0
Total acres closed to grazing	***1,398***	10,376	18,473	1,803	1,581
Total AUMs lost	***246***	***1,826***	***3,252***	***317***	***278***

Impacts from Management Common to All

Conoco Lake SRMA (7 acres) and Red Bluff Reservoir area in the Pecos River Corridor SRMA (120 acres) would be closed to grazing, which would adversely impact livestock grazing, as the amount of available forage would decrease. The Trails RMZ of the Hackberry Lake SRMA, Hay Hollow Equestrian ERMA, and La Cueva SRMA would be open to grazing. This would provide beneficial impacts to livestock grazing through an increase in the amount of available forage.

Impacts from Management Common to All Action Alternatives

There would be no impacts to livestock grazing from proposed decisions under management common to all action alternatives. Decisions listed address camping requirements, specific requirements for rock climbing, and areas designated for interpretation and education activities, all of which would not affect amount of available forage or AUM numbers.

Impacts from the No Action Alternative

Under the No Action Alternative, a total of 1,398 acres within the designated SRMAs and ERMAs would be closed to livestock grazing. The number of available AUMs lost under this alternative would remain 246.

Impacts from Alternative A and Alternative B

Under Alternative A, a total of 10,376 acres would be closed to livestock grazing. Under Alternative B, a total of 18,473 acres would be closed. The magnitude of adverse impacts to livestock grazing would be greater under both of these alternatives, as the amount of available forage would be reduced. Both alternatives would result in approximately 1,000 to 3,000 unavailable AUMs. This would represent a substantial increase from the 246 AUMs unavailable under the No Action Alternative (see Table 4-164).

Impacts from Alternatives C and D

Under Alternative C, a total of 1,803 acres would be closed to livestock grazing. Under Alternative D, 1,581 acres would be closed. Beneficial impacts to livestock grazing would be similar compared to the No Action Alternative because the number of unavailable AUMs would be roughly the same (see Table 4-164).

Impacts of Land Use Authorizations Actions on Livestock Grazing

The designation of ROW corridors on public rangelands would affect the number of acres of forage available for livestock grazing. Livestock grazing would receive long-term adverse impacts from construction and development of ROWs, as amount of available forage would decrease.

Those areas that are classified as ROW avoidance, exclusion, or withdrawal areas would minimize surface disturbances and, therefore, beneficially impact livestock grazing as available forage would increase. The number of acres under each of these categories varies across the alternatives and is depicted in Table 4-165.

Table 4-165. Right-of-way Avoidance, Exclusion, and Withdrawals by Alternative (acres)

Status	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Avoid	30,965	629,149	413,654	313,619	270,360
Exclude	7,056	662,038	918,701	165,378	69,540
Open	2,051,927	798,544	757,380	1,610,692	1,749,782
***Total*[2]**	***2,089,949***	***2,089,731***	***2,089,735***	***2,089,689***	***2,089,682***

Impacts from the No Action Alternative

Under the No Action Alternative, current management pertaining to land use authorizations would continue, as specified in the guidelines in Appendix 2 of the 1997 Carlsbad RMP Amendment. Approximately 184,201 acres, encompassing six ROW corridors, would remain designated for major new utility and transportation facility alignments across the planning area. A total of 30,965 acres, primarily within SMAs, would remain designated as avoidance and 7,056 acres as exclusion areas. Approximately 2,051,927 acres would remain open (see Table 4-165). Adverse impacts to livestock grazing, as those described at the beginning of this section, would potentially continue as ROW applications are granted. Mitigation and remediation actions in place, however, would help minimize these impacts.

Impacts from Alternative A

Under Alternative A, 629,149 acres would be designated as avoidance and 662,038 as exclusion. Approximately 798,544 acres would remain open across the planning area (see Table 4-165). Compared to the No Action Alternative, which proposes 35,063 acres designated as avoidance and 7,056 acres as exclusion areas, the magnitude of and potential for adverse impacts to livestock grazing, as those described above, would be smaller under this alternative, as the amount of available forage would be greater.

Impacts from Alternative B

Under Alternative B 413,654 acres would be designated as avoidance and 918,701 acres as exclusion. Approximately 2,089,735 acres would remain open across the planning area (see Table 4-165). Compared to the No Action Alternative, which proposes 35,063 acres designated as avoidance and 7,056 acres as exclusion areas, the magnitude of and potential for adverse impacts to livestock grazing, as those described above, would be smaller under this alternative, as the amount of available forage would be greater.

Impacts from Alternative C

Under Alternative C, 505,975 acres would be designated as avoidance and 228,642 acres as exclusion. Approximately 1,356,446 acres would remain open across the planning area (see Table 4-165).

Compared to the No Action Alternative, which proposes 35,063 acres designated as avoidance and 7,056 acres as exclusion areas, the magnitude of and potential for adverse impacts to livestock grazing, as those described above, would be smaller under this alternative, as the amount of available forage would be greater.

[2] Note: Total may not sum correctly due to rounding.

Impacts from Alternative D

Under Alternative D, 505,682 acres would be designated as avoidance and 69,610 acres as exclusion. Approximately 1,460,798 acres would remain open across the planning area (see Table 4-165). Compared to the No Action Alternative, which proposes 35,063 acres designated as avoidance and 7,056 acres as exclusion areas, the magnitude of and potential for adverse impacts to livestock grazing, as those described above, would be smaller under this alternative, as the amount of available forage would be greater.

Impacts of Lands with Wilderness Characteristics Actions on Livestock Grazing

Management goals for lands with wilderness characteristics would include maintaining wilderness characteristics as appropriate while also considering the manageability and the context of competing resource demands. Management decisions under lands with wilderness characteristics would adversely impact livestock grazing if they included exclusions to livestock grazing. Managing for wilderness characteristics generally does not preclude livestock grazing, although, as addressed in Section 2.22, Livestock Grazing, there are a few portions of lands with wilderness characteristics units that are closed to livestock grazing within some alternatives. Overall, there are 11 lands with wilderness characteristics units across the planning area, comprising a total of approximately 66,666 acres.

Table 4-166. Acres Closed to Livestock Grazing within Lands with Wilderness Characteristics

Lands with Wilderness Characteristics (total acres = approx. 81,000)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres closed	0	47,488	19,026	0	0
Total available AUMs	0	11,736	11,720	11,721	11,543
Total AUMs lost	0	8,360	3,349	0	0

Impacts from Management Common to All Action Alternatives

Livestock grazing would benefit from various management prescriptions that are common to all action alternatives. These would minimize surface disturbance and contribute to greater forage availability. These would include closures within lands with wilderness characteristics to new road construction, a recommendation for withdrawal from mineral entry, closure to mineral material sales, and restrictions on construction on new structures and facilities.

Impacts from the No Action Alternative and Alternatives C and D

Under the No Action Alternative and Alternatives C and D, 0 acres would be closed to grazing. The current amount of available forage and available AUMs for livestock grazing would be maintained.

Impacts from Alternative A

Under Alternative A, all of the approximately 47,488 acres within lands with wilderness characteristics units would be closed to livestock grazing, thereby imparting reduced beneficial impacts to livestock grazing compared to the No Action Alternative. Livestock would not have access to as much available forage and the number of AUMs lost would increase compared to the No Action Alternative (see Table 4-166).

Impacts from Alternative B

Under this alternative, 19,026 acres would be closed to livestock grazing within four units of lands with wilderness characteristics units. The magnitude of adverse impacts to livestock grazing would be greater under this alternative. Compared to the No Action Alternative, 19,026 additional acres would be closed, translating to the loss of 3,349 unavailable AUMs (see Table 4-166).

Impacts of Renewable Energy on Livestock Grazing

Adverse impacts to livestock grazing would potentially occur in those areas where renewable energy projects that include surface-disturbing activities are allowed. Solar projects would result in direct removal of vegetation created by solar panels. This would potentially have adverse impacts on livestock grazing, as amount of available forage across the planning area would decrease.

Wind energy, comprising the placement of wind turbines, would also result in surface disturbances that could adversely impact livestock grazing through a reduction in amount of available forage.

Impacts from Management Common to All Action Alternatives

Impacts from management decisions common to all action alternatives would include the exclusion of wind and solar, and closure to geothermal development in areas that are within known karst areas. In addition, all action alternatives encourage the placement of wind development projects in areas where transmission corridors are already located and where transmission systems are already in place.

As a result, adverse impacts to livestock grazing would be greatly minimized, as amount of available forage would potentially increase.

Impacts from the No Action Alternative

Under the No Action Alternative, the BLM would close and exclude 1,819,929 acres from geothermal and solar development projects, respectively. Wind development would be excluded from 7,056 acres. Restrictions on the location of solar or wind energy sites would continue to be implemented on specific sites across the planning area, with the majority of the planning area excluded for solar development, as identified by the Solar Energy Development Programmatic EIS ROD (BLM 2012a). Those sites restricted from wind development projects include WSAs, WSRs, VRM Class I and II areas, and areas with known karst occurrences (for complete list of restrictions, see Chapter 2, Alternatives Matrix). Wind energy development would be restricted in designated SMAs to protect sensitive soils. In addition, applications to permit either solar or wind energy sites on public land within the planning area would be considered only if the applicant can demonstrate no negative impacts on avian and bat species. All of these management prescriptions would benefit livestock grazing by minimizing surface disturbance reducing the amount of available forage.

Impacts from Alternative A

Under Alternative A, the BLM would exclude approximately 666,783 acres from wind development, exclude 768,020 acres from solar development, and close 995,285 acres from geothermal development.

Compared to the No Action Alternative, the magnitude of beneficial impacts to livestock grazing would be potentially less because wind energy development would be prohibited on a substantially larger number of acres under this alternative. Though the No Action Alternative prohibits solar development projects on a larger number of acres, the Solar Energy Development Programmatic EIS ROD (BLM 2012a) states most of the planning area would not be suitable to support solar development, thus greater number of acres closed to solar development is irrelevant.

Impacts from Alternative B

Under Alternative B, the BLM would exclude approximately 912,860 acres from wind development. An estimated 833,300 acres would be excluded from solar development and 1,372,791 acres would be closed to geothermal development.

Compared to the No Action Alternative, the magnitude of beneficial impacts to livestock grazing would be potentially greater because wind energy development would be prohibited on a substantially larger number of acres under this alternative.

Impacts from Alternatives C and D

Under Alternative C, the BLM would exclude approximately 206,184 acres from wind development. Under Alternative C, approximately 734,630 acres would be excluded from solar development and 608,850 would be closed to geothermal development. Under Alternative D, 73,143 acres would be excluded from wind development and approximately 630,300 acres would be excluded from solar development and 464,187 would be closed to geothermal.

Compared to the No Action Alternative, the magnitude of beneficial impacts to livestock grazing would be potentially greater because wind energy development would be prohibited on a substantially larger number of acres under this alternative.

4.3.4 Travel and Transportation Management

This section analyzes the impacts to BLM travel and transportation management, BLM-maintained travel routes and trails, OHV travel (aka ORV travel) caused by the management actions of other resources and resource uses within the planning area. As discussed in the Chapter 3 Travel and Transportation Management section (see Section 3.3.4), travel management encompasses all forms of transportation within the planning area, including bicycle and motorcycle use, automobiles, trucks, and OHVs. Off-highway vehicles (OHVs) and off-road vehicles (ORVs) are the same under BLM definitions: ORVs are any motorized vehicles capable of, or designed for, travel over land, water, or other natural terrain; OHVs generally include dirt motorcycles, dune buggies, jeeps, four-wheel drive vehicles, sport utility vehicles, over-snow vehicles, and ATVs (all-terrain vehicles) (BLM 2012e). For the purposes of this analysis the term “OHV” is considered synonymous with “ORV.”

4.3.4.1 Analysis Methods

4.3.4.1.1 Indicators

The quantitative analysis indicator for travel management is the number of acres of OHV travel categories under the alternatives. These categories are 1) open to unlimited cross-country travel, 2) OHV limited (travel limited to existing or designated routes), and 3) travel routes and trails that are closed to OHV use. The indicator is applicable to the BLM-administered and maintained roads, routes, and trails within the planning area, and determines the degree of travel accessibility and travel opportunities within the planning area.

4.3.4.1.2 Methods

The analysis method for travel management was to compare the changes in acreage for the closed, open, and limited OHV classes for all of the alternatives. Also, non-quantitative management actions were compared for all of the alternatives to determine if they would expand or limit travel opportunities and accessibility within the planning area.

4.3.4.1.3 Assumptions

The travel management analysis assumptions consist of the following:

- Travel routes and trails designated as OHV limited would be beneficial to travel, as these roads, primitive roads, and trails would allow access to areas within the planning area.
- Travel routes designated as closed would be adverse to travel because of the reduced opportunities for access within the planning area.
- For impacts from land use and minerals decisions, an assumption was made that accessible spur roads and access roads would be created for new ROWs, exploratory and production well pads, salable and locatable minerals sites, and hard rock mining sites. These new routes would benefit travel by providing (temporary or long-term) opportunities for travel within the planning area.

4.3.4.2 Resources Eliminated from Further Impacts Analysis

The following resources would have no impacts on travel management or travel opportunities within the planning area and are not analyzed further in this section.

4.3.4.2.1 Impacts of Backcountry Byways on Travel

Under all of the alternatives, the backcountry byway management actions would enhance the existing 55-mile-long Guadalupe Backcountry Byway, which would have no impact on travel accessibility or opportunities.

4.3.4.2.2 Impacts of Cultural Resources on Travel

Under all of the alternatives, cultural management actions would mitigate impacts to cultural sites by creating buffer zones, identifying and gathering data on cultural sites, developing cultural resources management plans, and identifying priority areas for future cultural inventory. These actions would have no impacts on travel within the planning area because they would not, at the programmatic level of resource management, inhibit or expand the opportunities for travel within the planning area.

4.3.4.2.3 Impacts of Health and Safety on Travel

Health and safety management actions for all the alternatives would identify and address mine safety concerns, ensure compliance with toxic and explosive gas protection procedures, monitor and respond to hazardous waste releases, and protect public health and safety. These actions would have no impacts on travel management because they would not close routes, delay, restrict, or otherwise interfere with travel within the planning area.

4.3.4.2.4 Impacts of Livestock Grazing on Travel

Grazing management actions for all alternatives would have no impacts on travel because grazing restrictions and exclusions, and authorized grazing use, within the planning area would not prevent or limit travel.

4.3.4.2.5 Impacts of Paleontology on Travel

Management actions for paleontological resources would have no impacts on travel opportunities because the collection of fossils for personal, commercial, and scientific use, and the protection of these resources would not restrict or expand travel within the planning area.

4.3.4.2.6 Impacts of Recreation on Travel

Management actions for recreation resources would have impacts on OHV travel opportunities and accessibility, but to reduce redundancy in the analysis the reader is referred to the Recreation section (Section 4.3.5). The impacts of management actions on SRMAs and ERMAs pertaining to travel within the planning area are discussed in detail in the Impacts of Recreation Actions on Recreation section.

4.3.4.2.7 Impacts of Soils and Water Resources on Travel

Soils and water resources management actions common to all of the alternatives would have no impacts on travel because none of the management actions that mitigate soil erosion, reclaim disturbed sites in sensitive soils areas, mitigate impacts to surface water and groundwater resources, acquire water rights, and permit water well drilling would restrict access, prohibit travel, or affect travel opportunities within the planning area.

4.3.4.2.8 Impacts of Special Status Species on Travel

Special status species management actions for all of the alternatives would have no impacts on travel because actions under this resource to protect species through designating critical habitat, applying site-specific mitigation, reclaiming habitat, and evaluating areas as potential habitat would not affect travel opportunities and accessibility.

4.3.4.2.9 Impacts of Visual Resources on Travel

There would be no impacts on travel opportunities caused by the proposed VRM actions because VRM class designations and visual resource objectives within the planning area for all the alternatives would be consistent with other land management actions, including travel. There are no specific VRM actions that would restrict or prohibit travel or access within the planning area, beyond those actions already required by law (e.g., restrictions on motorized travel within designated VRM Class I wilderness areas and WSAs).

4.3.4.2.10 Impacts from Management Common to All

As discussed above, the impacts common to all of the alternatives would designate two categories of OHV travel access for all of the BLM-administered public lands within the planning area: OHV limited and closed. The proposed acres within the planning area for each travel category for the No Action and the action alternatives are shown in Table 4-167 and in Maps 2.37 through 2.41 and discussed in Section 3.3.4. Closed areas are locations where travel by vehicle is prohibited. Limited OHV areas are locations where travel is limited to roads and routes already in existence. An existing road or route is defined as "an established road, built or maintained by equipment, which shows no evidence of ever having been closed to vehicular traffic by such means as berms, ripping, scarification, reseeding, fencing, gates, barricades or posted closures. A two-track road would be defined as void of vegetation in the tracks which shows use for other purposes, such as recreation, mining, logging, and ranching, and shows no evidence of ever having been closed to vehicular traffic by such means as berms, reseeding, gating, fencing or signing."

4.3.4.3 Direct and Indirect Impacts

4.3.4.3.1 Impacts of Travel Management Actions on Travel

Table 4-167 summarizes the acreage of travel categories for the No Action and action alternatives (Maps 2.37–2.41).

Table 4-167. Travel Management Decisions by Alternative (acres)

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
OHV limited	2,035,307	2,039,299	2,049,391	2,052,584	2,052,584
Closed	55,966 (2.7)*	52,028 (2.5)	41,936 (2.0)	38,738 (1.9)	38,738 (1.9)
Total	***2,091,273***	***2,091,326***	***2,091,327***	***2,091,320***	***2,091,321***

*Number in parentheses is the percentage of the total CFO planning area.

Impacts from Management Common to All Action Alternatives

After approval of the revised RMP, management actions under the action alternatives would continue to analyze the impacts of OHV closed and OHV limited for all vehicles within the planning area through adaptive management at the activity planning (project) level. This would be beneficial to travel management in the long-term because travel-related resource use conflicts would be identified and resolved through potential modification of these designated closed, open, and limited routes. A Travel Management Plan would also be developed and implemented after approval of the revised RMP, which would be beneficial to travel in the long-term because it would assist in identifying and resolving travel-related resource use conflicts.

Impacts from the No Action Alternative

As the popularity of travel within the planning area increases and greater numbers of on-road vehicles, OHVs, and visitors use the travel routes within the planning area, travel management issues are and would continue to be a concern (see the discussion of OHV resource use and recreation user conflicts in Chapter 3, Section 3.3.4, and the Recreation section, Section 3.3.5). Under current RMP management actions, these concerns would continue to include engine noise, air pollution from engine exhaust emissions, vehicle impacts on erodible soils, and the production of fugitive dust.

Under this alternative, travel would be managed under OHV limited and closed designations, as shown in Table 4-167 and Map 2-37. Limited access areas would include 2,035,307 acres (97% of the planning area) to protect ACECs, recreation areas, and sensitive resources (e.g., riparian areas, nesting habitat, special status species habitat); and there would be 55,966 acres (3% of the planning area) designated as closed to OHV use to protect resource values, such as critical habitat for threatened or endangered plant, animal, and fish species, cultural sites, and designated non-mechanized scenic recreational areas.

Designated OHV limited areas within 2,035,307 acres (97%) would be beneficial to travel by providing continued, controlled access to the planning area for OHV travel opportunities and access; designated closed areas 55,596 acres (3%) would continue to be adverse to travel in the long term by restricting OHV travel access and travel opportunities in these areas. This alternative would not permit cross-country game retrieval on those areas designated as closed or OHV limited within the planning area, which would be adverse to travel in the long term because accessibility would not be allowed for this type of travel.

Impacts from Alternative A

Under Alternative A, management actions would designate limited OHV use on 2,039,299 acres (97.5%), with 52,028 acres (2.5%) designated as closed to OHV travel (Map 2-38). The impacts on OHV travel would be adverse in the long term in areas designated as closed to travel because travel access and opportunities within these portions of the planning area would not be permitted. The long-term impacts to travel within OHV limited areas would be beneficial for the same reasons as discussed for the No Action Alternative: travel accessibility and opportunities. Compared to the No Action Alternative, this alternative would have more beneficial impacts in the long term on travel access because approximately 4,000 more acres would be designated as OHV limited (a 0.2% area increase from the No Action Alternative), which would provide more travel opportunities within the planning area.

Impacts from Alternative B

Under Alternative B, acreage designated as limited would be 2,049,391 acres (98% of the planning area) for Alternative B (Map 2-39). Alternative B actions would close 41,936 acres (2% of the planning area). This alternative’s actions would have the same impacts as those discussed for Alternative A because the areas and percentages of the planning area designated as OHV limited and closed would be similar. Specifically, the differences between Alternative A and Alternative B would be 0.5% more OHV limited travel area than Alternative A. Compared to the No Action Alternative, this alternative would be more beneficial to travel because 14,030 more acres within the planning area would be designated as OHV limited that could provide travel opportunities.

Under Alternative B, big game retrieval management actions and impacts to OHV travel would be the same as discussed for Alternative A.

Impacts from Alternatives C and D

Under Alternatives C and D, management actions would designate 2,052,584 acres (98.1% of the planning area) as OHV limited and 38,738 acres as closed to OHV travel (1.9% of the planning area) (Maps 2.40 and 2.41). The impacts to travel would be the same as Alternative B because the OHV limited and closed acreages are similar. Compared to the No Action Alternative, the impacts of these alternatives would be more beneficial for travel because there would be an increase in travel accessibility: approximately 17,277 more acres would be designated for OHV limited access and travel opportunities than under the No Action Alternative.

Alternatives C and D would permit OHV game retrieval within limited areas within 300 feet of a designated route, primitive road, or trail, which would be beneficial in the long term for this type of travel activity because it would increase accessibility.

4.3.4.3.2 Impacts of Air Resources Actions on Travel Management

Impacts from Management Common to All

Air quality management actions common to all of the alternatives would require compliance with federal and New Mexico air quality standards that include controlling fugitive dust production. BLM policy requires monitoring and managing exhaust emissions and dust production to prevent deterioration of visibility within Class I airsheds (see Air Quality section 4.2.11), which includes the area around Carlsbad Caverns National Park. The impacts on travel within the planning area would be adverse and short term along unpaved road and trails that require road surfacing-related dust abatement measures, because travelers could experience some travel delays or rerouting around the affected road sections during maintenance.

4.3.4.3.3 Impacts of Cave and Karst Resources Actions on Travel Management

Impacts from Management Common to All Action Alternatives

Under all of the action alternatives, the CFO would maintain existing access routes within the proposed Cave Resources ACEC (formerly the Cave Resources SMA). These routes would be maintained in order to prevent new route creation accessibility of the cave and karst resources that would otherwise adversely affect those resources and resources surrounding the cave and karst sites. There would be no impacts to travel because accessibility and travel opportunities would be maintained.

4.3.4.3.4 Impacts of Wildland Fire Management on Travel Management

Impacts from Management Common to All

Under all of the alternatives, fire management actions would have no long-term impacts on travel because prescribed fire treatments, fuels treatments, fire prevention and mitigation, and wildland fire suppression, applicable to all of the alternatives, would not prevent or impede travel within the planning area. There would be short-term adverse impacts to travel opportunities and access if prescribed burns or wildland fires crossed travel routes that required temporary closing or temporary rerouting around the fire management or suppression area for public safety reasons.

4.3.4.3.5 Impacts of Land Tenure Actions on Travel Management

Impacts from Management Common to All

Under all of the alternatives, lands would be acquired through land exchanges, purchases of private and state lands, purchase of land easements, donations, and other means of title transfer if they provide public access to public lands. The impacts would be beneficial in the long term for travel because there would be an increase in travel opportunities and accessibility within the planning area on lands formerly held in private or state ownership. All of the alternatives would be beneficial because of the increased accessibility of the planning area to on-road, OHV, and equestrian travel.

Impacts from Management Common to All Action Alternatives

Under all of the action alternatives, lands would be acquired through land exchanges, land purchases, and donations if they provide public access to public lands. The acquisitions would include, but not be limited to, river access and areas of high recreation value. The impacts would be beneficial in the long term for travel because there would be an increase in travel opportunities and accessibility within the planning area on lands formerly held in private ownership. All of the action alternatives would be beneficial because of the increased accessibility of the planning area to on-road, OHV, and equestrian travel. Compared to the No Action Alternative, the action alternatives would be more beneficial in the long term because specific management actions would be applied to increase the travel opportunities and accessibility of the planning area to on-road, OHV, and equestrian travel.

Impacts from the No Action Alternative

Management actions under the current RMP would set a priority on easement acquisitions on former county roads that have been vacated by the county government when those roads are important for public land management. This would have no impacts on travel management or on travel opportunities within the planning area because access would still be available to travelers.

4.3.4.3.6 Impacts of Land Use Authorization Actions on Travel Management

Impacts from Management Common to All

Under the No Action and action alternatives, management actions would make a reasonable effort to provide travel access to private land owners and public land users if planning area resources are not significantly impacted. This would have a long-term beneficial impact on travel because travel accessibility and opportunities would be expanded into portions of the planning area otherwise restricted to travel.

4.3.4.3.7 Impacts of Minerals Actions on Travel Management

Impacts from Management Common to All

The impacts of minerals resource management decisions on travel would be similar to those discussed above for land tenure and land use authorization actions because the actions are similar. The granting of ROWs and the construction of fluid (oil and gas) and solid leasable, salable, and locatable minerals-related exploration and development roads would be permitted under all of the alternatives. Accordingly, minerals decisions would have beneficial short- and long-term impacts on opportunities for travel and access within the planning area along well pad spur roads, at salable and locatable mineral development sites, and along oil and gas field development roads (see Travel Assumptions above). Hydraulic fracturing has opened new opportunities for oil and gas production, and associated air emissions from construction, drilling, and operations due to the ability to extract oil and gas product in areas previously considered inaccessible or too costly. This increased opportunity for oil and gas development is reflected in the number of wells predicted in the RFD. Truck traffic associated with fracturing operations and horizontal well development may be higher than conventional drilling methods due additional water needs. Potential impacts associated with traffic would be analyzed in site-specific detail at the APD stage.

A summary of the planning area acreages for leasable, salable, and locatable minerals that would allow travel access are shown below in Table 4-168.

Table 4-168. Planning Area Minerals Acreages Available for Travel Access by Alternative

Minerals Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Leasable open	1,598,870	1,142,802	1,089,481	1,750,774	1,997,681
Leasable CSU	956,410	799,649	449,759	786,381	631,634
Total open and CSU	***2,555,280 (91.8)****	***1,942,451 (69.8)***	***1,589,240 (57.1)***	***2,537,155 (91.1)***	***2,629,315 (94.4)***
Salable open	2,637,465	1,179,104	1,122,020	1,784,431	2,028,324
Salable open with moderate constraints	–	1,043,152	725,368	752,286	602,621
Total open and with moderate constraints	***2,637,465 (94.7)***	***2,222,256 (79.8)***	***1,847,388 (66.4)***	***2,536,717 (91.1)***	***2,630,945 (94.5)***
Locatable open to mineral entry	2,751,856 (98.8)	2,403,114 (86.3)	2,110,098 (75.8)	2,651,855 (95.2)	2,661,705 (95.6)

* Number in parentheses is the percentage of total BLM planning area, calculated using a total BLM planning area of 2,784,224 acres.

Impacts from Management Common to All Action Alternatives

There are no management actions common to all of the action alternatives that pertain specifically to travel management.

Impacts from the No Action Alternative

Under the No Action Alternative, 92% of the planning area would be available for leasable minerals exploration and development, 95% would be available for salable minerals use, and 99% would be open to locatable minerals development. This would be beneficial in the short term from the construction of temporary minerals-related spur roads and access roads during minerals exploration. Long-term beneficial impacts would be produced by minerals development spur roads and access roads because it would provide OHV travel access and travel opportunities in areas otherwise unavailable to travel.

Impacts from Alternative A

Management actions under Alternative A would permit leasable exploration and surface development on 70% of the planning area. Approximately 80% of the planning area would be open to salable development, and 86% would be available for locatable minerals development. The benefits to OHV travel would be the same as discussed for the No Action Alternative, but to a lesser degree, because 22% fewer leasable minerals acres, 15% fewer salable minerals acres, and 13% fewer locatable minerals acres would be available would be available for travel accessibility and opportunities than under the No Action.

Impacts from Alternative B

Alternative B management actions would allow leasable minerals related surface development on 57% of the planning area. Salable minerals open exploration and development would be allowed on 66% of the planning area, and 76% of the planning area would be open to locatable mineral development.

The benefits to OHV travel would be the same as discussed for the No Action Alternative but to a lesser degree, because 35% fewer leasable minerals acres, 28% fewer salable minerals acres, and 23% fewer locatable minerals acres would be available development that would create opportunities for travel accessibility than under the No Action.

Impacts from Alternative C

Under Alternative C, the area open to leasable minerals development would be 91% of the planning area; the total area open to salable minerals would be 91%, and locatable minerals open areas would total 95% of the planning area. These acreages are similar to those discussed under the No Action Alternative, and would have the same beneficial impacts on planning area OHV travel opportunities and accessibility.

Impacts from Alternative D

Alternative D management actions would maximize the availability of minerals resources for exploration and development. Under this alternative approximately 94% of the planning area would be open to leasable minerals development. The total area open to salable minerals development would be 95% of the planning area, and locatable minerals exploration and development would be allowed on 96% of the planning area. The impacts would be beneficial in the short and long term to OHV travel for the same reasons as discussed under the No Action Alternative: increased accessibility and opportunities for travel within the planning area; however, compared to the No Action Alternative, Alternative D would be more beneficial for OHV travel because more acreage would be available for travel within minerals exploration and development areas.

4.3.4.3.8 Impacts of Lands with Wilderness Characteristics Actions on Travel Management

Impacts from Management Common to All

For all of the alternatives, lands with wilderness characteristics would be managed under three levels of activity (see table below): the protection level would maintain wilderness characteristics; the protection/multiple use level would apply varying degrees of protection or multiple use actions to designated wilderness characteristics lands. The multiple use level would manage wilderness characteristics lands with an emphasis on a range of uses. Managing designated wilderness characteristics under the multiple use management levels would have beneficial impacts on travel because travel opportunities would become available in these areas. There are no lands designated under the No Action Alternative, so these management levels would have no effect on lands under this alternative.

Impacts from Management Common to All Action Alternatives

Management actions for all of the action alternatives would manage areas for wilderness characteristics, but some units would be protected, some managed for multiple use. The protected areas would be managed to maintain their pristine, undeveloped state under VRM Class I or II objectives. They would be closed to new road construction, and travel routes through them would either be closed or designated as OHV limited. The impacts to travel would be adverse in protected areas in the long term under all of the action alternatives because, while travel opportunities would be available within and through those areas where routes have been proposed, opportunities and access would be reduced or lost in areas where routes would be closed. The impacts to travel in multiple use areas would be beneficial to travel for the reasons mentioned above in Management Common to All Alternatives. Compared to the No Action Alternative, the action alternatives would be more adverse because of the loss of travel opportunities. Table 4-169 summarizes the management levels to travel within the proposed lands with wilderness characteristics.

Table 4-168. Acres of Lands with Wilderness Characteristics by Alternative and Management Level

Management Level	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Protects wilderness characteristics	0	66,666	47,611	5,119	1,221
Emphasizes other multiple uses while applying some protective management	0	0	18,964	30,595	0
Emphasizes other multiple uses	0	0	0	30,862	65,446
OHV Limited	66,654	66,573	66,575	66,576	66,667
OHV Closed	1	82*	82	82	82

*The acreage numbers do not add up because of variations in mapping shape-files used to determine these areas.

Impacts from the No Action Alternative

Under current management actions, none of the planning area would be managed to preserve wilderness characteristics. Planning area travel opportunities and accessibility would continue to be available along routes designated as OHV limited. There would be no impacts on travel because current accessibility along OHV routes would remain for planning area travelers.

Impacts from Alternatives A to D

Under Action Alternatives A, 82 acres would be adversely closed to OHV travel opportunities. Compared to the No Action Alternative, travel management impacts under this alternative would be adverse in the long term because OHV travel opportunities and accessibility would be more restricted to preserve wilderness characteristics.

4.3.4.3.9 Impacts of Noxious Weeds and Vegetation Actions on Travel Management

Impacts from Management Common to All

The short- and long-term impacts of noxious weeds and vegetation treatments for exotic vegetation control and for ecosystem restoration would be the same as those discussed under Section 4.2.6, Wildland Fire Management Action Impacts on Travel. Herbicide and pesticide treatments, mechanical treatments, and controlled fire treatments near or adjacent to travel routes may require temporary or short-term closures or rerouting around treatment areas for safety reasons to protect public health.

4.3.4.3.10 Impacts of Renewable Energy Actions on Travel Management

Impacts from Management Common to All

Under all of the alternatives, the programmatic policies and BMPs in the Wind Energy Development Programmatic EIS ROD (BLM 2014) and the Solar Energy Development Programmatic EIS ROD (BLM 2012a) would be adopted. To ensure public health and safety, sites developed for solar and wind energy collection and transmission would be appropriately fenced to restrict public access during construction and operations. The impacts to travel within the planning area under all of the alternatives would be adverse in the long term because travel opportunities would be restricted within these sites.

4.3.4.3.11 Impacts of Riparian Actions on Travel Management

Impacts from Management Common to All

There are no management actions common to all alternatives that pertain to travel management.

Impacts from Management Common to All Action Alternatives

There are no management actions common to all of the action alternatives that are relevant to travel management.

Impacts from the No Action Alternative, Alternative A, and Alternative B

Under current management, Alternative A, and Alternative B seeps and springs in the planning area would be closed to OHV travel. Management actions under these alternatives would have long-term adverse impacts on travel from closing these riparian areas to vehicle traffic and reducing planning area travel opportunities and accessibility.

Impacts from Alternative C

Under Alternative C, OHV travel in and adjacent to planning area seeps and springs would be OHV limited or BLM administrative use only. This action would have long-term adverse impacts on travel because travel accessibility and opportunities would not be available in these areas. The impacts would be the same as discussed for the No Action Alternative.

Impacts from Alternative D

Alternative D would not apply any specific restrictions to travel within riparian areas, except that no surface disturbances would be allowed within seep and spring areas. The impacts would be the same as the No Action Alternative for the same reasons.

4.3.4.3.12 Impacts of ACECs and Special Designations Lands Actions on Travel Management

Impacts from management actions for all of the alternatives related to OHV travel access and travel opportunities within ACECs, WSAs, and along recommended eligible WSR segments are analyzed under the Recreation Actions on Recreation section, the ACEC actions on Recreation section, in the WSA Actions on Recreation section, and in the WSR Actions on Recreation section. These recreation subsections discuss in detail the impacts to travel accessibility and opportunities for OHV use and on-road use.

4.3.4.3.13 Impacts of Wildlife and Fish Actions on Travel Management

Impacts from Management Common to All

There are no management actions common to all of the alternatives that are specifically related to travel management.

Impacts from Management Common to All Action Alternatives

There are no management actions common to all of the action alternatives that are specifically related to travel management.

Impacts from the No Action Alternative

Under this alternative, the 349,355-acre Birds of Prey Grasslands (not managed as an ACEC under the No Action Alternative) would be OHV limited throughout the area. There would be no impact to travel because travel opportunities and access would continue to be available.

Impacts from Alternatives A to D

Management actions under Alternatives A, B, C, and D would restrict travel opportunities to OHV limited within the proposed Birds of Prey Grasslands ACEC to protect wildlife species. The long term beneficial impacts to travel would be the same as discussed under the No Action Alternative because travel accessibility and travel opportunities within the 349,355-acre area would be the same. While Alternatives C and D would not designate the area as an ACEC, this land status would have no impact on travel accessibility and opportunities.

4.3.5 Recreation and Visitor Services

This section analyzes impacts to recreation resources and user experiences from management actions discussed in Chapter 2. Current activities, existing conditions, and trends for recreation are discussed in Chapter 3 (see Section 3.3.5). The analysis indicators, assumptions, and methods described below were used to analyze the level of impacts the proposed RMP management actions would have on recreation resources, opportunities, recreation expectations, and the likelihood for recreation user satisfaction. The terms “recreation resources,” “recreational opportunities,” “expectations,” and “recreational satisfaction” have precise definitions in the context of this analysis and are defined below in the Recreation User Groups subsection.

4.3.5.1 Analysis Methods

4.3.5.1.1 Indicators

The indicators for this resource issue analysis are the following:

- Acres with targeted recreation management.
- Acres of SRMAs and ERMAs that would provide opportunities for beneficial recreational experiences.
- Acres of VRM Class I and II areas within SRMAs and ERMAs that would maintain scenic quality as a part of the recreational experience.
- Changes in the number of recreation opportunities (e.g., the number of targeted recreation activities emphasized in SRMAs).
- Acres of land or linear miles of trail that provide opportunities for beneficial recreational experiences for recreation user groups in the planning area.

4.3.5.1.2 Methods

The method used to assess impacts to recreation resources was to determine whether the management actions under each of the alternatives would increase or decrease the recreational opportunities for the range of user groups typically recreating within the Carlsbad planning area. Recreational opportunities for the action alternatives were quantitatively assessed by comparing the management actions that would increase or decrease the size of SRMAs and ERMAs, increase or decrease the acres of VRM Class I or II within SRMAs and ERMAs (scenic quality being an important component of recreation), and the acres of targeted recreational experiences, opportunities, and benefits. Targeted recreation refers to the management of areas emphasizing a specific type of recreation with the purpose of reducing the likelihood for resource use conflicts. An example of a targeted use would be setting aside an area within an SRMA that emphasizes OHV use, while setting aside another area within that SRMA for hiking only so that these two user groups can have opportunities for a satisfying recreational experience independent of the other recreation use. Other quantitative measures included assessing the increase or decrease in the types of recreational opportunities (for example, managing for one type of use such as OHV riding versus managing for OHV riding, hiking, and sightseeing) and quantitatively measuring the miles or acres of trails and travel routes within an SRMA and ERMA.

The BLM's Recreation Setting Characteristic (RSC) concepts were also used in the analysis of impacts within SRMAs and ERMAs. The RSCs are a way of describing the current and desired conditions for SRMAs and ERMAs so that BLM recreation management can modify conditions in ways that recreation users within these areas will more likely have opportunities for satisfying experiences. The RSCs are divided into three main categories: physical settings, social settings, and operational settings. The physical settings describe the area's remoteness, naturalness, and the visitor facilities; the social settings describe the level of contacts between users, the group sizes, and the evidence of visitor use; the operational settings describe the access to the area by public users, visitor services and information available to users, and management controls. As mentioned above, both existing conditions and desired conditions are described. The criteria are then used in the analysis of impacts by assessing how the proposed management actions of the No Action and action alternatives would affect the existing and desired conditions within the SRMAs and ERMAs.

The recreation affected environment (see Chapter 3) briefly describes the existing SRMAs and developed recreation areas, as well as the types of recreational activities for which they are currently being managed. As mentioned, the ERMA encompasses all of those areas within the planning area that are not managed as SRMAs. The recreational activities, benefits, and opportunities in ERMAs are not as focused as for SRMAs, and no ERMAs were specifically defined in the current RMP.

4.3.5.1.3 Assumptions

A number of assumptions were used in assessing the impacts of management actions on recreational opportunities. These assumptions were based on the affected environment descriptions mentioned above, detailed CFO descriptions of the planning area SRMAs and ERMAs, and the proposed SRMAs, ERMAs, and other developed areas within the planning area:

- An assumption used in the analysis of the proposed management actions that may impact recreational resource users was, that resource users within the planning area could be classified into specific user groups, each having individualized recreation expectations, objectives, settings, opportunities, and needs to achieve satisfying recreational experiences that yield and personal, social, economic, and environmental benefits;
- Each resource user group has specific recreational conditions and criteria (RSCs) that increase the likelihood for satisfying recreational experiences;
- Resource user group criteria (i.e., wants, needs, satisfying experiences, dissatisfactions) are applicable to all areas where they tend to gather for recreation, and are not dependent upon the locality of a specific BLM Field Office;
- It was assumed that emphasizing specific user groups within SRMAs and ERMAs would enhance and increase the likelihood that recreational users would have satisfying experiences because user conflicts would be reduced; and
- Satisfying recreational experiences are related to high scenic quality, and high-quality scenery is an important recreational expectation, so it was assumed that management actions that protect or preserve scenery (under VRM Class I and II objectives) would enhance the recreational experience; management actions that allow surface disturbance and increased landscape changes (under VRM Class III and IV objectives) would degrade the recreational experience.

Recreation User Groups

Recreation user groups, their preferences, the effects that would adversely impact their recreation experiences, and other user group criteria were obtained from approved BLM RMPs (Moab RMP 2008, Monticello RMP 2008). The Moab BLM Field Office conducted personal and group surveys, interviewed national and international user group organizations, and conducted field studies to gain a sense of what recreation users within a user group want and need for satisfying experiences. The recreation user groups within the CFO planning area and assumed conditions and criteria for satisfactory recreational user experiences are as follows.

Motorized (off-highway vehicle)

This group would include users of off-road motorcycles, ATVs, and four-wheel drive vehicles.

This group prefers a range of settings from remote, natural-appearing environments, through settings that include upgraded, unpaved routes and challenging trails, to settings that could include moderate evidence of human sights, sounds, and surface disturbances. A moderate concentration of users and the presence of human-constructed structures are acceptable. Trails and facilities provided for group activities (including parking lots, trail information, trailheads, and toilet facilities) are generally positive for this group.

Overcrowding and overuse of trails, particularly by non-motorized users such as hikers or mountain bikers, would have a negative impact on their experience. Moderate numbers of hikers, bikers, or equestrians are unlikely to negatively affect their recreational experiences.

Non-motorized OHV

This group would include but is not limited to mountain bikes as a non-motorized vehicle. Mountain bike users prefer a relatively natural environment, with challenging trails ranging from beginner to advanced, where evidence of human disturbances, restrictions, and controls are present, but are subtle or do not dominate the environment. Recreation facilities would be optional and would blend with the natural environment. Recreation management would encourage user dispersal. Preferred facilities include semi-primitive camping with basic facilities (parking lots, trailheads, and toilet facilities).

Overcrowding, noise (particularly from motorized users), dust/exhaust, and poor trail etiquette from other users can have a negative impact on the recreational experience.

River and Lake Users

This group would include those recreating in boats, canoes, kayaks, and rafts.

The needs of this group are similar to those of the non-mechanized user group (see below), with a natural-appearing environment that shows little evidence of human disturbances within the river corridor or on the lake. Other than boat ramps and restroom facilities at put-in and take-out locations, as well as designated primitive campsites, facilities needs are few.

Overcrowding, noise, and impacts to visual resources would detract from the user experience.

Scenic Drivers

This would include users of passenger vehicles and recreational vehicles (RVs) driving for pleasure while enjoying scenic attractions.

This user group prefers paved access to scenic vistas, cultural sites, and interpretive stations with turnoffs and/or temporary parking.

High traffic volumes, crowded kiosk parking areas, impacts to visual resources from paved viewpoints, and crowded developed campsites would negatively affect this user group.

Non-mechanized

This group would include hikers, backpackers, and horse riders (equestrians).

This group prefers a natural-appearing environment with little evidence of disturbance, few restrictions or visitor controls, no motorized users, and few mountain bikers. Trails, signs and active management that foster dispersal of users are the typical management actions needed for this user group.

Negative recreational experiences include those listed under mountain non-motorized, but would also include the high speeds of mountain biking and motorized users. The speed and noise of motorized users is of particular concern to equestrian users (BLM 2008b).

Specialized Recreation

This diverse user group includes cavers and rock climbers.

This group prefers locations that provide the conditions for specialized recreation. Cavers prefer a range of challenging caves in sufficient numbers so that crowding is minimized. They also prefer to have a natural environment, free of development in the surrounding area, with sites for primitive camping. Developed overnight camping sites can create conditions for an unsatisfying experience (cavers prefer overnight camping with few amenities). Rock climbers prefer a range of challenging routes in sufficient numbers so that crowding and waiting is minimized. Overcrowding of a given area may detract from the user or group experience for either cavers or rock climbers.

The term "recreational resources" is used throughout this section. For analysis purposes in this document, recreational resources are defined as the natural elements (e.g., scenery, soils, vegetation, geology, land forms, weather, etc.) within the environment that provide the physical basis for recreation. Recreational "opportunities" are defined as the combination of the natural elements and human-controlled conditions (e.g., roads and trails, developed and undeveloped sites, signs, route markers, facilities, etc.) that create the potential for recreation. Recreational "expectations" are those assumptions made by the recreation resource user that, having prepared for the desired recreational experience, he or she will have that desired experience (e.g., a challenging or scenic OHV trail, on-road driving while enjoying high-quality scenery, or the natural sights and sounds of an undeveloped landscape along a hiking trail). Recreational user "satisfaction" can be defined as the mental state in which the resource user is able to successfully benefit from the available recreational opportunities and resources and recognizes that his or her recreational experiences meet or exceed those recreational expectations.

4.3.5.2 Resources Eliminated from Further Impacts Analysis

The management actions of some resources within the planning area would have no impacts on recreation resources. These are described below.

4.3.5.2.1 Impacts of Cultural Resource Actions on Recreation

Under all of the alternatives, management actions include the development of management plans to protect cultural resource complexes and sites, mitigate damage to cultural resources, and nominate eligible sites for the NRHP. Management actions would also solicit research for identification, monitoring, and data gathering of cultural resources. These actions would have no direct impact on recreation or recreationists because there are no specific actions to inhibit recreation or reduce recreational opportunities within the planning area. Likewise, there are no cultural resource management actions that would indirectly impact the recreational experience for user groups.

4.3.5.2.2 Impacts of Paleontological Resources Actions on Recreation

For all of the alternatives, there are no specific management actions that would decrease or increase the opportunities for recreational fossil collection beyond those already in place. The Paleontological Resource Preservation Act stipulates that vertebrate fossils can only be collected by qualified individuals; however, invertebrate and plant fossils can be casually collected without a permit by the public on public lands for non-commercial use. There would be no impacts of planning area actions on recreation resources and users because recreational fossil collection under current and proposed management actions would be unchanged.

4.3.5.2.3 Impacts of Water Resources Actions on Recreation

There are no management actions common to all of the alternatives or described under the No Action and action alternatives that are specifically applicable to recreation resources or opportunities. Water resources actions would evaluate flood hazards in the planning area and seek to reduce flood risks, watershed management plans would be developed, water rights would continue to be acquired as needed to continue public land management, and injection wells would not be permitted in freshwater aquifers. These actions would have no impacts on recreation because they would neither increase nor decrease opportunities for water-related recreational opportunities.

Specific actions under the No Action and action alternatives would include actions to preserve water quality, manage the disposal of produced water from oil and gas wells, and manage water used for livestock and municipalities. These actions would have no impacts on water-related recreational opportunities for the reasons discussed above.

4.3.5.3 Direct and Indirect Impacts

4.3.5.3.1 Impacts of Recreation Actions

Impacts from Management Common to All

Under all of the alternatives, RAMPs would be developed for all of the SRMAs in the planning area. These RAMPs would consider the specific recreation objectives for each of the SRMAs and include management prescriptions to address the levels of recreational activity and recreation resources so that conditions and opportunities are created for satisfying experiences by recreation user groups. The impacts of developing the RAMPs would be beneficial to recreation in the long term because the needs and recreation objectives for each SRMA would be considered and SRMA-specific actions would be taken to ensure satisfying and beneficial outcomes for all of the users.

Impacts from Management Common to All Action Alternatives

Under all of the action alternatives, the BLM's Benefits-Based Management system would be applied to the proposed SRMAs that include targeted outcomes to enhance personal, community, economic, and environmental goals. This would have beneficial impacts on all user groups, as all SRMAs would be managed with prescriptions to increase the likelihood that resource users' recreation needs are met and that they would have satisfying recreational experiences.

The management actions and the impacts of those actions for all of the action alternatives are as follows:

1. A Cave Resources SRMA would not be designated. There would be no impacts caused by this management action because this area would be designated as the Cave Resources ACEC, with prescriptions to "develop a comprehensive ACEC management plan to direct the management of cave visitor use, scientific research, and other cave related projects."
2. The Hackberry Lake OHV Area and Alkali Lake Area would be the preferred locations for recreational OHV use, including commercial and organized competitive OHV events. This would be beneficial in the long term for all recreational resource users because the area would be managed as a target area for OHV use, which would potentially reduce user conflicts between mechanized and non-mechanized users in the planning area.
3. Four SRMAs would be designated under all of the action alternatives: Black River, Hackberry Lake, Conoco Lake, and La Cueva Trails. The impacts of applying special management to these areas would be beneficial for all resource user groups. These SRMAs include opportunities for a variety of recreation experiences ranging from front country, developed motorized OHV and waterways enjoyment, to middle–backcountry wildlife viewing, equestrian and hiking, and dispersed, primitive camping.
4. Camping would be prohibited within 900 feet of all natural and human-made water sources (excluding the Pecos River). The impacts to recreation resources would be beneficial because the potential for polluting these water sources would be reduced; however, the impacts to non-mechanized campers and hikers would be adverse. Non-mechanized users often rely on these water sources for cooking, cleaning, and drinking as they cannot always carry all the water that they need. Having to hike potentially 1,800 feet (round trip) or more for water would not create conditions for beneficial outcomes and satisfying experiences for this user group.
5. Rock climbers would be prohibited from creating bolted routes, using permanent anchors, or using fixed hardware for any climbing activities without prior coordination. The impacts to recreation resources and to specialized users would be beneficial. The climbing areas and routes would be beneficially maintained by reducing damage to the rock face and by maintaining the appearance of the route. Specialized resource users would benefit from the opportunities for a challenging climb, which would otherwise be diminished by the use of pre-set hardware and other climbing aids.

As is described under the Impacts of Special Designations (ACECs) Actions on Recreation subsection below (and for the same reasons), the format for analyzing the impacts of recreation management actions on recreation is organized differently for the No Action and action alternatives than the other resource impacts. The impacts are arranged by SRMA and ERMA to allow the reader to more easily see and compare the range of alternative impacts on each designated recreation management area.

Table 4-169 can assist the reader in comparing the impacts from recreation management actions on existing and proposed SRMAs and ERMAs. A detailed discussion of impacts follows the table.

Table 4-169. Summary of SRMA and ERMA Designation and Acreages for the No Action and Proposed Action Alternatives

SRMA/ ERMA	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Alkali Lake	944-acre, no SRMA or ERMA designation	318-acre SRMA	318-acre SRMA	1,341-acre ERMA	1,341-acre, Same as No Action Alternative
Black River	1,275-acre SRMA designation	Same as No Action Alternative	Same as No Action Alternative	Same as No Action Alternative	Same as No Action Alternative
Cave Resources	8,626-acre SRMA designation	No SRMA or ERMA designation*	Same as Alternative A	Same as Alternative A	Same as Alternative A
Conoco Lake	7-acre, no SRMA designation	7-acre SRMA	Same as Alternative A	Same as Alternative A	Same as Alternative A
Hackberry Lake	53,560-acre SRMA designation	36,889-acre SRMA designation	Same as Alternative A	Same as Alternative A	Same as Alternative A
La Cueva	1,565-acre, no SRMA designation	1,565-acre SRMA	Same as Alternative A	Same as Alternative A	Same as Alternative A
Pecos River Corridor	6,008-acre SRMA	9,936-acre SRMA	9,936-acre ERMA	Same as Alternative B	9,936, No SRMA or ERMA designation
West Wells Dune	624-acre, no SRMA or ERMA designation	Same as No Action Alternative	624-acre ERMA	Same as Alternative B	Same as Alternative B
Pecos River Equestrian Trail	11,207-acre, no SRMA or ERMA designation	11,022-acre ERMA	10,052-acre ERMA	Same as Alternative C	8,832-acre ERMA
Hay Hollow Equestrian	12,913-acre, no SRMA or ERMA designation	12,913-acre ERMA	Same as A	Same as No Action Alternative	Same as No Action Alternative
Square Lake	5,285-acre, no SRMA or ERMA designation	2,975-acre ERMA	Same as Alternative A	5,285-acre ERMA	Same as Alternative C

*The Cave Resources area would be managed within the proposed Cave Resources ACEC. See ACEC alternatives impacts Subsection 4.3.5.3.15 below.

Alkali Lake

No Action Alternative

Under current management actions the 944-acre Alkali Lake area would be managed with an emphasis on OHV use that includes both organized, unstructured and undeveloped OHV recreation. Management prescriptions would include applying oil and gas stipulations to ensure that OHV trails and camping areas are protected from development, maintaining the entire area as open to livestock grazing, and managing the SRMA under VRM Class IV objectives. The area would be open to cross-country OHV recreation, and managed under VRM Class IV objectives. The impacts to motorized and non-motorized OHV use would be beneficial in the long term, as the area would be managed to provide a range of OHV recreational opportunities for these user groups, would continue to be used as an area that emphasizes these recreational activities, and would maintain opportunities for beneficially developing motor skills, reducing stress, and sharing time with friends and family. The impacts to the area's RSCs would be adverse. Without ERMA or SRMA designation, infrastructure, access, and visitor information would not likely be developed or prioritized for OHV users. A lack of formal management of the area would not likely control contacts between users, which could exceed levels of recreation satisfaction, and trails would be informally developed and maintained.

Alternatives A and B

Under these alternatives, the Alkali Lake area would be designated as a 318-acre SRMA, with a recreational focus on unstructured and unfocused OHV experiences. A RAMP would be developed for the area to ensure that opportunities for motorized and non-motorized OHV experiences are maintained. The use of OHVs within the SRMA would be OHV limited; however, the area would be effectively open to cross-country OHV travel on all of the SRMA because the limited route designation would include the entire OHV play area. The area would be managed under VRM Class III, and open to livestock grazing. These actions would be beneficial in the long term for mechanized users because they would provide a range of OHV opportunities for route recreation. The impacts to recreation resources would be less adverse than the No Action Alternative because VRM III management objectives would surface disturbances would be more limited than under VRM Class IV objectives. The impacts would be more beneficial to OHV users than the No Action Alternative because the emphasis on OHV recreational uses, benefits, and infrastructure would be specifically managed and maintained through stipulations in the area's RAMP. However, the impacts would be less beneficial than the No Action Alternative because the range of OHV recreational opportunities would not include structured (e.g., competitive) OHV use in the area's management objectives. The impacts to the area's RSC would be beneficial under these alternatives because the proposed RAMP would provide the opportunity to develop user group infrastructure (e.g., paved parking areas, paved access to sites, signs, and information kiosks) that would enhance users' recreational experiences and benefits. Existing routes and trails would be maintained and improved, and user contacts would be maintained at levels that promote OHV satisfactory experiences.

Alternative C

Alternative C management actions would designate Alkali Lake as a 1,341-acre ERMA for unstructured and undeveloped OHV use. Recreational OHV use would be OHV limited (but functionally open to cross-country travel as discussed under Alternative A), and the ERMA would be managed under VRM Class III objectives. A RAMP would not be developed for the ERMA. Facilities such as a parking lot, trash cans, signs, and toilets would be built if conditions warrant these types of infrastructure; these conditions could include increased popularity and use of the ERMA or recreational use demand. The impacts to recreation resources would be less adverse in the long term, when compared to the No Action Alternative, because surface disturbances to scenic quality would be more limited under VRM Class III objectives compared to VRM Class IV management under the No Action. The impacts to the targeted OHV recreation users would be beneficial in the long term because opportunities for OHV recreation would be maintained, though not as formally as under SRMA management; however, there would be adverse impacts because user contacts would not be managed to promote satisfactory experiences. The impacts to the recreational setting would be beneficial because desired infrastructure would be developed (as needed) to enhance the recreational experience and benefits. Compared to the No Action Alternative, this alternative would be more beneficial to OHV recreation users in the long term because OHV opportunities within the designated ERMA OHV target area would be improved with as-needed infrastructure, and scenic quality would be maintained at a moderate level of disturbance through VRM Class III objectives.

Alternative D

Under Alternative D, the 1,342-acre Alkali Lake area would not be managed as an SRMA or as an ERMA, but would be managed according to the planning area's Travel Management Plan. The area would be managed with prescriptions similar to the No Action Alternative: travel designated as OHV limited, but effectively open to OHV cross-country travel (as discussed under Alternative A), open to livestock grazing, and managed under VRM Class IV objectives. The impacts to recreational OHV users would be beneficial in the long term, but to a lesser degree than the No Action Alternative because the recreation resource would not be directly managed to maintain its current use as an OHV play area. There would be long-term, adverse degradation of the area's RSCs from a lack of management prescriptions to prevent overcrowding and overuse of trails, and a lack of facilities for users and OHV groups that would likely reduce the opportunities for satisfying experiences and beneficial outcomes. This alternative would have the least beneficial impacts on recreation.

Black River SRMA (Including the Cottonwood Day Use Area)

No Action Alternative

Current management would designate the 1,275-acre area as an SRMA with an emphasis on non-mechanized and water-related recreational activities, such as swimming, shoreline fishing, wildlife viewing, and hiking. Under this alternative, the area would be managed under VRM Class III objectives, and the area would be closed to OHV use, equestrian use, and livestock grazing. The impacts on the targeted non-mechanized and water users would be directly beneficial in the long term because the area's RAMP would promote wildlife viewing. Recreational enhancements within the SRMA would create a greater range of opportunities for recreational experiences and beneficial outcomes for all visitors that include enjoying the scenic and natural landscape, reducing stress, escaping from crowds, and interacting with family and friends. Management under VRM Class III objectives for moderate surface disturbances would have indirect, long-term, adverse impacts on the recreation resource and long-term indirect and adverse impacts on all users because scenic quality would be degraded under VRM Class III objectives. The impacts to the area's RSCs would be beneficial because infrastructure would continue to be added as need under the RAMP, and the natural landscape (creating a sense of naturalness) would be maintained by controlling surface disturbances.

Alternatives A through C

Under these action alternatives, the 1,275-acre area would be designated as an SRMA with the same management objectives and emphases as the No Action Alternative. The SRMA would be closed to OHV travel and closed to livestock grazing. Long-term beneficial scenic quality protection would be prescribed by managing the undeveloped portion of the SRMA (outside Cottonwood Day Use Area) under VRM Class II objectives to preserve scenic quality. Compared to the No Action Alternative, these alternatives would have more beneficial impacts on recreation resources and on users because the long-term preservation of scenic quality would enhance visitor experience with an increased likelihood for satisfying experiences and beneficial outcomes on non-mechanized user groups. The impacts to RSCs would be the same as discussed for the No Action Alternative for the same reasons.

Alternative D

This alternative would have similar impacts as discussed for action Alternatives A, B and C, except that the area would be adversely open to NSO mineral leasing (with major constraints to comply with VRM Class II scenic quality objectives). Compared to the No Action Alternative, this alternative would be more beneficial because management under VRM Class II objectives would preserve scenic quality within the SRMA. The impacts to RSCs would be the same as discussed for the No Action Alternative for the same reasons.

Cave Resources SRMA

No Action Alternative

Current management actions under the No Action Alternative would continue to manage the 8,626-acre Cave Resources areas as an SRMA. Actions under this alternative would close the SRMA to all minerals activities, and 5,627 acres (65% of the SRMA) would be managed under VRM Class I and Class II objectives to protect scenic quality, 2,889 acres (33%) would be managed under VRM Class III, and the remaining area would be managed under VRM Class IV (160 acres). Within the SRMA, 7,739 acres (98% of the area) would be managed for OHV limited travel. The SRMA would be open to livestock grazing. The impacts to recreation resources would be beneficial in the long term because OHV surface disturbances would be limited, and most of the SRMA would be protected at high and very high levels of scenery preservation. Livestock grazing would have an adverse impact on primitive camping areas. The impacts to the SRMA's emphasized specialized recreation users (cavers) would be beneficial because their needs for a natural, undisturbed landscape would be maintained, which would increase the likelihood for satisfying recreational experiences. These experiences would include spending time with friends and family, enjoying risk-taking adventure, and improving skills and abilities with beneficial outcomes of reduced stress, improved mental health, and a closer relationship with the natural world. The impacts to the area's RSCs would be beneficial because surface disturbances around cave sites (maintaining a sense of naturalness) would be minimized. User group contacts, managed under the RAMP, would be maintained at levels that ensure opportunities for satisfactory experiences.

Alternatives A through D

Under all of the action alternatives, the Cave Resources SRMA would not be designated. The 8,626-acre acre and additional cave resource areas would be designated for management within the 18,832-acre Cave Resources ACEC. See Subsection 4.3.5.3.15 below for a description of impacts to the area from management under the ACEC action alternatives. Under the management actions of the proposed Cave Resources ACEC, the RSCs would be beneficially impacted. The emphasis on managing the ACEC recreation resources for specialized caving users would have the same impacts as discussed above for the No Action Alternative: naturalness would be maintained, user group contacts would be managed for satisfactory experiences, and infrastructure would be developed, as needed, to meet the targeted user group's needs.

Conoco Lake SRMA

No Action Alternative

The 7-acre Conoco Lake area is not currently managed as an SRMA, but the area is managed with an emphasis on picnicking, fishing, hiking, and wildlife viewing. The area's targeted recreational activity is fishing. The area would be managed under VRM Class IV objectives, and the area would be OHV limited. The area would be open to livestock grazing. The impacts to the area's recreation resources from these management actions would be adverse in the long term: VRM Class IV objectives would permit major surface disturbances and modifications to the recreation area's landscape, which would cause long-term scenic quality degradation. The impacts to recreation users would be adverse in the long term as a result. Permitted limited route OHV use would be beneficial for mechanized OHV users, but would create long-term adverse user conflicts with non-motorized users of the area (picnickers, hikers, non-motorized boaters, wildlife viewers), who are the recreation users for which the area would be primarily managed. Resource user conflicts would diminish the opportunities for non-motorized users to have satisfactory recreational experiences and would diminish the likelihood for expected beneficial outcomes such as reduced stress and improved well-being. While OHV users would gain these beneficial outcomes, other recreation user groups would not likely gain expected beneficial outcomes because of OHV-produced dust and noise, and the loss of a sense of naturalness. The loss of a sense of naturalness for the targeted activity, OHV noise, loss of solitude, and user conflicts would have adverse impacts on the area's RSCs.

Alternatives A through C

Under all of the action alternatives, the Conoco Lake area would be designated as a 7-acre SRMA. Under these action alternatives, the management actions would be the same: scenic quality management under VRM Class II objectives to preserve scenic quality, closed to livestock grazing, and closed to OHV travel. The impacts to recreation resources would be beneficial in the long term because surface disturbances would be reduced and through the reduction of surface disturbances under VRM Class II objectives. The impacts to the targeted non-mechanized recreation user groups would be beneficial because user group conflicts would be reduced in the short term by restrictions on additional surface disturbances. OHV users would also experience an adverse loss of opportunities because this activity would be prohibited within the SRMA. Compared to the No Action Alternative, these alternatives would have similar impacts in the long term because the conditions for resource use conflicts, overcrowding, and degradation of the landscape would be present. The impacts on the area's RSCs would be beneficial because the SRMA would preserve the desired sense of remoteness and solitude. The desired preservation of naturalness and development of infrastructure within the SRMA would also be beneficial for the targeted users.

Alternative D

The impacts to recreation resources would be the same as discussed above for Alternatives A through C because management prescriptions would be the same, except that non-motorized boating would be allowed, which would have long-term beneficial impacts on the users of the area by increasing the range of water-related opportunities. The impacts to RSCs would be the same as discussed for the other action alternatives (A–C) because the management actions would be the same.

Hackberry Lake SRMA

No Action Alternative

The management actions under the No Action Alternative would continue to manage the 53,560-acre Hackberry Lake area as an SRMA, but subdividing the area into two RMZs, or recreational activity target areas. An RMZ is an area within an SRMA that is managed for specific types of recreational uses. The Hackberry Lake SRMA would be composed of two RMZs: the Dunes RMZ and the Trails RMZ. The Dunes RMZ would be managed with a recreational emphasis on camping, OHV use, sand sledding, photography, hiking, and picnicking. The Trails RMZ would be managed with an emphasis on camping, OHV trail riding, picnicking, and OHV racing.

Under this alternative, travel throughout both of the RMZs within the SRMA would be OHV limited. The SRMA would be managed under VRM Class IV objectives, and open to livestock grazing. The impacts to recreation resources would be adverse in the long term because of permitted major modifications to the landscape (and increased scenic quality degradation) under the VRM Class IV objectives and from livestock grazing. The impacts to recreation user groups would vary: motorized and non-motorized OHV users (motorcyclists, four-wheelers, and mountain bikers) would benefit in the long term from OHV recreational opportunities along existing routes within the SRMA; non-mechanized users would be adversely impacted by dust, noise, reduced opportunities for naturalness and isolation. However, both of the RMZs would be managed primarily for OHV non-competitive and competitive recreational opportunities that would include picnicking, photography, hiking, and camping. Under this alternative, there would be long-term adverse resource user conflicts between mechanized OHV users and non-mechanized users: noise, dust, and OHV intrusions would adversely diminish non-mechanized users' expected experiences and reduce the likelihood for satisfying recreational experiences. OHV users would be adversely affected by slower and/or hidden picnickers, hikers, campers, and photographers; and safety concerns and adverse user conflicts would exist between sand sledders and OHV users in the Dunes RMZ. However, the range of OHV recreational opportunities and related activities would likely create satisfying experiences that would benefit mechanized user groups in the long term and produce outcomes that include improved well-being, enhanced OHV motor skills, and greater self-reliance. In the long term, non-mechanized users would experience diminishing opportunities for satisfying experiences. The impacts on RSCs for the SRMA would be beneficial as recreation-related infrastructure would continue to be developed for the targeted user groups, and improvements to trails, access roads, and parking areas for the targeted OHV users would be beneficial also.

Alternatives A through D

These action alternatives would apply similar management actions to the designated 36,889-acre SRMA: the entire area would be available for OHV limited recreational opportunities. The SRMA would be managed under VRM Class III objectives, and open to livestock grazing. The adverse impacts to recreation resources within the SRMA would be the same as discussed for the No Action Alternative, but to a lesser adverse degree, because surface disturbances would be reduced under VRM Class III objectives. The impacts to non-mechanized user groups would be the same as discussed for the No Action Alternative because the SRMA would be managed primarily for OHV users and managed to ensure that OHV users have opportunities for a range of satisfactory experiences and beneficial outcomes. However, resource user conflicts and safety concerns would be reduced in both of the RMZs because OHV use would be limited to routes. Compared to the No Action Alternative, these alternatives would have a reduced adverse impact on recreation resources in the long term because of the limitations on surface disturbances imposed by VRM Class III objectives. The impacts on resource users would be the same as discussed under the No

Action Alternative because the actions are similar to that alternative. The impacts to RSCs would be the same as the No Action Alternative because management actions would continue to develop infrastructure and area improvements that benefit the targeted OHV users.

La Cueva SRMA

No Action Alternative

Under current RMP management, the 1,565-acre La Cueva area would not be managed as an SRMA. The area would be open to livestock grazing and would be OHV limited throughout the area. The area would be managed under VRM Class IV objectives on 1,024 acres (65% of the area) with 482 acres managed under VRM Class III objectives (31% of the area) for permitted moderate to major changes to the landscape, and the remainder (60 acres) managed under VRM Class II objectives. In the long term, under current management actions, impacts to recreation resources and recreation users in the area would be adverse. As discussed in Recreation Affected Environment Chapter, the area is a popular and informal mountain biking and equestrian riding locale with approximately 33 miles of hiking trails but is currently and continues to be degraded by its use as a public dumping ground. The impacts to recreation resources would be adverse in the long term because management under current VRM objectives and permitted livestock grazing, and uncontrolled public dumping would continue to create surface disturbances and degrade scenic quality. The impacts to all recreation user groups (mechanized and non-mechanized) would be adverse in the long term because the area would not be managed to maintain opportunities for satisfying non-motorized recreational experiences and not formally managed to reduce, eliminate, or discourage public dumping. The impacts to RSCs would be adverse because the physical characteristics would continue to be degraded, the trails would be formally managed to improve the area's social characteristics, and infrastructure would not be improved.

Alternatives A through D

Under these action alternatives, the 1,565-acre La Cueva area would be managed as an SRMA, with an emphasis on non-motorized recreation that includes mountain biking, hiking, equestrian travel, and dispersed camping. Management actions would designate the entire SRMA as VRM Class III, permitting livestock grazing within the entire SRMA, and as OHV limited. The impacts to the SRMA's recreation resources would be adverse in the long term because, as discussed above for the Black River SRMA, cattle cause surface disturbances that degrade the scenic landscape, and VRM Class III objectives permit moderate surface disturbances to the landscape. As discussed throughout this section, a natural or naturally appearing landscape is an important component of the expected recreational experience, particularly for non-motorized and non-mechanized users. The permitted surface disturbances to the scenic landscape would have long-term, adverse impacts on the non-motorized user groups for which this SRMA would be primarily managed. The SRMA objectives of creating recreational opportunities for experiences that allow users to escape enjoy scenery and natural landscapes and interact with the environment would not likely be met. The SRMA beneficial goals of reducing stress and gaining closer relationships with the natural world would not likely be met. However, the beneficial goals of escaping from crowds, fostering family interaction, testing and improving rider skills, and gaining an understanding of recreation in the community would likely be met. There would be no impacts to motorized OHV users because the area is not used for this type of recreation and would not be managed for those users under these alternatives. Under the action alternatives, the impacts to RSCs would be beneficial because the current level of physical remoteness and naturalness would be maintained and improved under SRMA stipulations. The SRMA trails would be more beneficially maintained, and infrastructure improvements (repaving access roads, widening roads and trails, building information kiosks, toilets, picnicking areas, etc.).

Compared to the No Action Alternative, these alternatives would be more beneficial because managing this area as an SRMA would eliminate public dumping and improve recreational infrastructure for users of the area. Maintaining hiking, equestrian, and mountain biking trails would increase the likelihood for satisfying recreational experiences in the short-term, and beneficial outcomes for these user groups that include reduced stress, improved mental health, improved riding skills, and a finer appreciation of the natural world.

Pecos River Corridor SRMA

No Action Alternative

Under the No Action Alternative, the 6,008-acre Pecos River Corridor would continue to be managed as an SRMA, with an emphasis within the Pecos River RMZ on recreational boating, hunting, fishing, and wildlife viewing. Defined as a 0.5-mile-wide corridor on public lands along the Pecos River, management actions would maintain the SRMA as open to livestock grazing (91% of the SRMA would be open) and manage the SRMA as VRM Class II. The SRMA would manage 5,497 acres (91% of the SRMA) as limited OHV, with the remaining area closed to OHV use. The SRMA would prohibit mineral surface occupancy on 5,619 acres (94% of the SRMA). The impacts of the current SRMA management actions on recreation resources would be beneficial in the long term because minerals stipulations and VRM Class II objectives would limit adverse surface disturbances within the SRMA and maintain the SRMA's scenic quality, and limiting OHV use would limit surface disturbances to previously impacted areas. Livestock grazing within the SRMA would have long-term, adverse impacts on recreation resources (as discussed in the Livestock Grazing actions on Recreation subsection, see below) by consuming wildlife forage, creating conditions for soil erosion, and creating conditions for the spread of non-native, invasive weed species.

The impacts on recreation users would be beneficial in the long term for mechanized and non-mechanized user groups because OHV route limitations would reduce resource use conflicts by segregating these user groups by maintaining an RMZ focus area. Scenic quality preservation under VRM Class II objectives would create conditions and opportunities for all users to experience expected outcomes that include high scenic quality. Beneficial outcomes for all users in the SRMA from managed conditions that maintain scenic quality and limit surface disturbances would include diminished stress, improved mental health, and a closer relationship with the natural environment. Wildlife viewing users would be adversely affected in the long term by livestock grazing within the SRMA for the reasons discussed in the livestock grazing subsection: loss of wildlife forage to cattle would reduce opportunities for wildlife viewing; establishment and spread of noxious invasive weeds from conditions produced by cattle would reduce wildlife forage. However, current SRMA management stipulations that include weed control and treatments would continue to offset these adverse conditions. The impacts to the SRMA's RSCs would be beneficial for the same reasons as discussed above: the natural landscape would be maintained and disturbed areas reclaimed where feasible; infrastructure would be maintained and additional infrastructure would be developed as needed.

Alternative A

Under Alternative A, management actions would be similar for the SRMA and RMZ to those discussed under the No Action Alternative, except that the entire (and expanded) 9,936-acre SRMA would be managed with more restrictions on leasable minerals than the No Action with 818 acres closed to leasable minerals development (the rest limited to [NSO] no surface occupancy). The targeted activity within the SRMA would be non-motorized boating. Off-highway travel would be limited, and livestock grazing would be prohibited (closed) to 92% of the SRMA. The impacts on recreation resources and recreation users would be similar to those discussed for the No Action Alternative, but scenic quality would be maintained and enhanced to a greater degree because of greater restrictions on surface disturbances under VRM Class II objectives, and the reduction of livestock grazing impacts. Compared to the No Action Alternative, Alternative A would be more beneficial for recreation resources and all user groups because scenic quality, a major component of expected recreational experiences, would be enhanced in the long term. Recreation user groups that seek wildlife viewing opportunities would benefit in the long term from improved habitat from livestock grazing closure. The impacts to RSCs would be the same as discussed for the No Action Alternative for the same reasons.

Alternatives B and C

Under these alternatives, the 9,936-acre river corridor would be managed as an ERMA, but management prescriptions would be similar to those discussed under Alternative A. The area would be managed under VRM Class II objectives to preserve scenic quality; minerals leasing would be open, but with major (NSO) constraints; and travel use would be OHV limited. However, livestock grazing would be permitted within the ERMA (52% open under Alternative B, and 87% open under Alternative C). The impacts to recreation resources would be beneficial in the long term because the management prescriptions are similar to

Alternative A: surface disturbances would be reduced and scenic quality protected by limiting minerals activities, by limiting OHV use, and by maintaining visual quality at VRM Class II objective levels. Livestock grazing would cause surface disturbances that affect recreational scenic quality and all user groups, but VRM Class II objectives would ensure that this type of disturbance is maintained at a minor level of impact. The impacts to RSCs would be adverse because a RAMP would not be developed to provide for infrastructure needs as rigorously as under a SRMA.

Compared to the No Action Alternative, these alternatives would be less beneficial to resource users because designation of the river corridor as an ERMA under these alternatives would reduce the levels of recreation resource management, a RAMP would not be developed, and recreation-related infrastructure would not be provided except as needs demand. The ERMA would not be specifically managed for boating, hunting, fishing, and wildlife viewing, as designation of the river corridor as an SRMA under the No Action Alternative would ensure that the area was managed specifically for emphasized user groups. There would be the likelihood for adverse resource use conflicts between mechanized and non-mechanized user groups within the narrow corridor from reduced recreational management, which would adversely reduce the likelihood for satisfying recreational experiences. The impacts to recreation resources would be more beneficial under these alternatives than under the No Action Alternative because scenic quality protection would be maintained under VRM Class II objectives.

Alternative D

Under Alternative D, management actions would not designate the 9,936-acre Pecos River corridor as either an SRMA or ERMA, but would manage the area for dispersed use, allowing for recreational use in accordance with other resource management objectives. The area would be managed under VRM Class II objectives, OHV use would be limited, and 8,838 acres of the area (89%) would be open to livestock grazing. The impacts to recreation resources would be the same as discussed for Alternatives B and C because the management actions are similar: surface disturbances would be limited and visual quality would be maintained under VRM Class II objectives and restricting OHV use to limited routes, but a lack of recreational management would create conditions for resource use conflicts within the narrow corridor and reduce the likelihood for recreational infrastructure to meet user needs. Compared to the No Action Alternative, this alternative would have long term impacts as discussed for Alternatives B and C for the same reasons. The impacts to RSCs would be similar to those discussed for Alternatives B and C because the management actions are similar.

West Wells Dune ERMA

No Action Alternative

Under the No Action Alternative, the 624-acre West Wells Dunes area would not be managed as an ERMA, but continued to be managed for unstructured and undeveloped OHV play. The 624-acre area is currently managed under VRM Class IV objectives, travel is OHV limited, and livestock grazing is permitted throughout the area. The entire area would be open to leasable and saleable minerals development. The impacts to recreation resources from limiting OHV would reduce surface disturbances in the area, but this would be offset by surface disturbances from grazing and permitted major landscape changes under VRM Class IV objectives. The impacts to OHV users would be variable: impacts would be beneficial in the long term for OHV users because the area would be managed for this user group, so resource use conflicts would be low; however, there would be long term adverse impacts to OHV users from overcrowding as the area became more popular and use intensified, and the informal management of the area for OHV use would adversely maintain the area at a low priority level for recreation-related infrastructure needed by this user group. There would be adverse impacts to recreation setting social characteristics from informally managed OHV users that could crowd each other; however, there would be no physical characteristics impacts because the dunes are constantly shifting and covering up tracks and other surface disturbances.

Alternative A

Under this action alternative, the 624-acre West Wells Dunes area would not be managed as an ERMA. The area would be managed under VRM Class III objectives, recreational travel would be OHV limited, and the area would be open to livestock grazing. The entire area would be open to leasable and saleable minerals development. There would be no impacts caused by grazing in this area because the landscape is sparsely vegetated, the dunes are shifting and windblown sand covers grazing areas, and the physical and visual intrusion of humans and vehicles would discourage the presence of livestock. As discussed for Hackberry Lake and Alkali Lake SRMAs, while OHV use would be limited, the dune play areas would be totally included within the limited designation, so there would be effectively open OHV use within the play areas. The impacts to recreation resources from unlimited OHV use on dune slopes would be adverse in the long term because OHV use would contribute to dune erosion. Managing the area as VRM Class III would be beneficial in the long term because VRM Class III objectives would ensure that scenic quality would be managed for moderate surface disturbances to the landscape. The impacts to recreation users from effectively open OHV use would be varied. Unlimited OHV use would be adverse in the long term to all users of the dunes area because of the likelihood of resource user conflicts and increased safety concerns between mechanized OHV users and non-mechanized users (picnickers, photographers, sightseers, and hikers). This would decrease opportunities for satisfying experiences for all users of the area and decrease the likelihood for beneficial outcomes that include enhanced self-reliance, improved mental well-being, and improved OHV motor skills. However, the impacts to OHV users from unrestricted trail and dune use would also beneficially increase the range of OHV recreational opportunities for this user group. The impacts to RSCs would be the same as discussed for the No Action because the level of management and dune dynamics would be the same.

Compared to the No Action Alternative, the impacts of Alternative A would be more beneficial to recreation resources in the long term because management actions would provide greater resource protection under VRM Class III objectives. The impacts to non-mechanized users would be less beneficial in the long term because of increased user conflicts with OHV users. The impacts to OHV users would be more beneficial in the long term because there would be an increase in the range of OHV recreational opportunities when compared to the No Action Alternative.

Alternatives B through D

Under action Alternatives B, C, and D, the 624-acre West Wells Dunes recreation area would be managed as an ERMA, with management actions to protect the area for recreation. The management actions would be the same as discussed for Alternative A, with additional ERMA prescriptions to provide recreation-related infrastructure as needed. The beneficial and adverse impacts to recreation users of the area would be the same as those discussed under Alternative A, with additional beneficial impacts from infrastructure provided as determined by need under ERMA management. The impacts to recreation resources in the dunes ERMA under these action alternatives would be the same as those discussed under Alternative A because the ERMA management prescriptions would be similar: management as VRM Class III and designated OHV limited travel within the ERMA, but effectively open for OHV use. RSC impacts under these alternatives would be the same as discussed for the No Action Alternative for the same reasons as discussed under that alternative.

Pecos River Equestrian Trail ERMA

No Action Alternative

Under this alternative, current management actions would not manage the 11,207-acre Pecos River area as an ERMA. The area would continue to be managed for dispersed use, for undeveloped and unstructured boating and hunting, and as an unstructured and undeveloped system of trails within the Pecos River corridor. Scenic quality would be managed under VRM Class II on 1,940 acres (17%) and VRM Class IV objectives on 9,268 acres (83% of the area). The area would be 92% designated as OHV limited (10,124 acres) and closed on the remaining 897 acres. Livestock grazing would be permitted throughout the area.

The impacts of these management actions on recreation resources would be adverse in the long term because VRM Class IV objectives that permit major modifications to the landscape would degrade scenic quality. Livestock grazing would adversely contribute to scenic degradation by trampling vegetation, compacting soils and creating conditions for soil erosion and vegetation loss. The impacts on mechanized OHV user groups and on non-mechanized users would be adverse in the long term because unstructured use of the area would create resource use conflicts between these groups that would reduce the likelihood for satisfying recreational experiences. Opportunities for non-mechanized solitude, quiet, and a sense of naturalness would be diminished by OHV noise, dust, and visual intrusions. However, OHV users would benefit from opportunities for trail riding. As discussed in Chapter 3, Section 3.3.5, long-term trends in recreation include an increasing demand for equestrian recreation areas, the increasing interest in water-related areas, and the popularity of the Pecos River corridor. In the long term, the trend of increasing resource use demands and intensifying resource use conflicts in the area would substantially reduce recreational opportunities from management actions under this alternative. The impacts to RSCs would be adverse because user access and other infrastructure would not be developed, trails would not be developed, and group contacts would not be managed for beneficial outcomes.

Alternative A

Management actions under Alternative A would designate the 11,022-acre Pecos River area as an ERMA with the primary recreational target that emphasizes equestrian use and a secondary target that emphasizes non-motorized recreational uses. Actions would allow limited OHV recreation throughout the ERMA, manage visual resources under VRM Class II on 3,954 acres (35%) and under VRM Class IV objectives (7,253 acres or 65%). The area would be open to livestock grazing on 9,512 acres (86%). Management actions under this alternative would beneficially increase scenic quality protection in the area under VRM Class II and limited OHV use, and recreational management of the area would have long term beneficial impacts on resources and users. Compared to the No Action Alternative, this alternative would, in the long term, have more beneficial impacts on recreation user groups and on recreation resources because 1) there would be a reduction in surface disturbances and an increase in scenic quality protection that exceeds the No Action Alternative and 2) the area would be managed as an ERMA. The impacts on RSCs would be both beneficial and adverse under this alternative. Beneficial impacts would be produced by managing a portion of the area to preserve naturalness under VRM Class II objectives. Adverse impacts would result from a lack of infrastructure development and access for both mechanized and non-mechanized users, and no formal management of contact between user groups.

Alternatives B and C

Under Alternatives B and C, the 10,052-acre Pecos River Equestrian Trail would be managed as an ERMA. Livestock grazing would be permitted; however, all of the ERMA would be managed to preserve scenic quality under VRM Class II objectives, a RAMP would be prepared to address infrastructure needs and trail locations. The long-term impacts on recreation resources would be beneficial because scenic quality would be preserved at a high level and surface disturbances minimized under the area's VRM Class II objectives. Non-motorized OHV and non-mechanized user users would benefit in the long term from these management prescriptions because a management plan would be developed to ensure that the needs of these ERMA-target groups were met, which would result in beneficially reduced user conflicts, increased opportunities for satisfying experiences, and beneficial outcomes. The beneficial outcomes would include enjoying scenery and natural landscapes, interacting with the natural environment, diminished stress, improved mental health, and improving equestrian skills. Compared to the No Action Alternative, these alternatives would be more beneficial for recreation resources and for user groups because resource use conflicts would be reduced through active management of the ERMA, and recreation resources would be protected under VRM Class II. The impacts to RSCs would be beneficial because the area's naturalness would be maintained and enhanced under VRM Class II objectives, user group contacts would be managed for beneficial outcomes, and visitor facility infrastructure and access would be provided, as needed.

Alternative D

Alternative D management actions would manage the 8,832-acre Pecos River Equestrian Trail as an ERMA for dispersed recreational use. Under this alternative, OHV recreation throughout the ERMA would be OHV limited, livestock grazing would be permitted. The ERMA would be managed to preserve scenic quality under VRM Class II objectives on 981 acres (11% of the area), 7807 acres (88%) under VRM Class III, and Class IV objectives on the remaining 230 acres. Management actions under this alternative would designate or construct new trails, with no motorized or mechanized use on single track trails. The impacts to recreation resources would be the same as discussed for Alternatives B and C because the management actions are similar. The impacts to recreation users would be the same as discussed for those alternatives. Compared to the No Action Alternative, this alternative would have the same beneficial impacts as discussed for Alternatives B and C, for the same reasons: recreational management of the ERMA would ensure that resource use conflicts were addressed, and that recreation resources were maintained at a high level of preservation. The impacts to RSCs would be the same as discussed for Alternatives B and C because the management actions are the same.

Hay Hollow Equestrian ERMA

No Action Alternative

Under the No Action Alternative, the 12,913-acre Hay Hollow Equestrian area would not be managed as an ERMA, but would be managed for dispersed recreational use and there would be no trail development. The Hay Hollow area would be managed under VRM Class III objectives on 7,310 acres (57%) for moderate landscape modification and VRM Class IV objectives on 5,603 acres (43%) that allow major modifications of the landscape. The area would be designated as OHV limited, and livestock grazing would be permitted throughout the area. The impacts to recreation resources and recreation users would be the same as discussed above for the Pecos River Equestrian area under the No Action Alternative for the same reasons. The long-term trend of increasing use of the area would create intensifying recreation user conflicts between mechanized and non-mechanized users; scenic quality would become increasingly degraded from OHV use and VRM objectives that allow moderate to major surface disturbances. The impacts to RSCs under this alternative would be adverse because, as discussed above for the Pecos River Equestrian Trail area, user access, parking access and other necessary infrastructure would not be developed, trails would not be developed or maintained, and recreation user group contacts would not be managed for beneficial outcomes.

Alternative A

Management actions under Alternative A would designate Hay Hollow as a 12,913-acre ERMA, and manage the area for dispersed recreational use and no trail development (the same as the No Action Alternative). Management actions would designate OHV limited travel within the 12,913-acre area and the ERMA would be closed to livestock grazing. Scenic quality would be managed under VRM Class III objectives on 9,696 acres (75%) that would allow moderate surface impacts and Class IV objectives on 3,217 acres (25%) that would allow major surface disturbances. The impacts to recreation resources would be adverse in the long term because the VRM objectives would permit moderate to major disturbances to scenic quality throughout the area. The impacts to all recreation users would be adverse in the long term from resource use conflicts between mechanized and non-mechanized users, particularly OHV and equestrian users on trails. The area includes wildlife corridors, so long term increased use of the area by mechanized and non-mechanized users of the area would likely reduce opportunities for recreational wildlife viewing. Compared to the No Action Alternative, this alternative would have the same adverse impacts on recreation resources and users for the same reasons: intensifying use by mechanized and non-mechanized users would create use conflicts; and resources would continue to be degraded over time from permitted surface disturbances. The impacts to RSCs would be the same as discussed for the No Action Alternative for the same reasons.

Alternative B

Under Alternative B, the 12,913-acre Hay Hollow Equestrian area would be managed as an ERMA with a primary targeted emphasis on equestrian trail use and a secondary target on non-motorized recreational use. The ERMA would be closed to grazing, OHV (non-motorized) recreation would be OHV limited, and the area would be managed under VRM Class II objectives on 5,276 acres (41%) and VRM Class III objectives on 7,628 acres (59%). The impacts to recreation resources would be beneficial in the long term because scenic quality would be protected for a substantial portion of the ERMA under VRM Class II objectives, and the elimination of livestock grazing would reduce soil compaction and erosion. The impacts to recreation users would be varied: motorized OHV users would be adversely impacted because opportunities for recreation within the ERMA would be reduced; non-motorized OHV users and non-mechanized users would be beneficially impacted because the focus of the ERMA would be on maintaining the area for these activities. Management prescriptions under the ERMA would beneficially provide recreation infrastructure as needed. So, recreational opportunities would be enhanced for the targeted user groups to likely have satisfying recreational experiences that include biking, horseback riding, wildlife viewing, solitude, a sense of naturalness, and quiet. The impacts to RSCs would be beneficial because, as discussed above, user infrastructure, access, information kiosks, toilets, and parking areas would be developed as needed, User contacts would be controlled by managing trails for mechanized and non-mechanized users, and the sense of naturalness, quiet, and isolation for the targeted users would be promoted. When compared to the No Action Alternative, this alternative would be more beneficial for recreation resources and non-motorized users from greater protection of scenic quality, increased management as an ERMA, and targeted use for non-OHV users. It would be more adverse for OHV users because the management focus would be for other recreation users.

Alternatives C and D

Under these alternatives, the impacts to recreation resources and user groups would be the same as discussed under Alternative A because the management actions would be similar. The 12,913-acre Hay Hollow area would not be designated as an ERMA, OHV limited throughout the area, and scenic quality management would be either totally (Alternative C) or substantially managed (75% for Alternative D) under VRM Class III objectives that allow moderate surface disturbances to the landscape. Under these alternatives, livestock grazing would be allowed throughout the area. All user groups would be adversely impacted by intensifying resource use conflicts on the existing trails from unstructured management of the area. When compared to the No Action Alternative, the impacts would be the same as discussed for Alternative A for the same reasons: surface disturbances to scenic quality and resource user conflicts. The impacts to RSCs would be the same as discussed for the No Action Alternative, for the same reasons.

Square Lake ERMA

No Action Alternative

Under the No Action Alternative, the 5,285-acre Square Lake recreation area would not be managed as an ERMA. The area would be designated as OHV limited on 2,982 acres (56% of the area) and closed to OHV use on the remaining 2,304 acres (44%), managed under VRM Class IV objectives that permit major surface modifications of the landscape, and open to livestock grazing.

The impacts to recreation resources would be adverse in the long term because livestock grazing, and permitted VRM Class IV management for surface disturbances would continue to degrade scenic quality and create conditions that would reduce the likelihood for satisfying recreational experiences for non-motorized OHV and non-mechanized user groups. The unstructured use of the area for recreation would limit opportunities for satisfying recreational experiences in the long term because increasing OHV use would create user conflicts for all users, and infrastructure would not be provided as needed to meet the increasing demands by OHV and non-OHV users. However, motorized OHV users would continue to benefit from a range of recreational opportunities. The impacts to the RSCs would be adverse because infrastructure development would be limited, and group contacts would likely create use conflicts.

Alternatives A and B

Under these alternatives, the 2,975-acre Square Lake recreation area would be managed as an ERMA with an emphasis on maintaining it as a target area for open OHV play. The area would be managed as OHV limited, but OHV play areas would be effectively open (as discussed above for Hackberry Lake and Alkali Lake SRMAs). The ERMA would be managed under VRM Class III objectives for moderate surface disturbances.

The impacts to recreation resources would be beneficial in the long term because surface disturbances would be reduced under the ERMA management prescriptions. The impacts to recreation users would be beneficial because the ERMA would be managed specifically for OHV use, creating a range of opportunities for satisfying OHV experiences. There would be a beneficial reduction in resource use conflicts because the ERMA would emphasize OHV use. The OHV opportunities would create beneficial conditions for improving riding and motor skills, spending time with family and friends, reducing stress, and escaping crowds. Compared to the No Action Alternative, the action alternatives would be more beneficial for recreation users because maintaining the ERMA as a target area for OHV use would reduce user conflicts. The impacts to recreation resources would be the same as the No Action because the area would continue to experience moderate surface disturbances. The impacts to RSCs for all of the action alternatives would be beneficial because the ERMA designation would raise the priority of the area for as-needed infrastructure development.

Alternative C

Alternative C would have the same management actions as Alternative A, except the ERMA would be increased in size to 5,285 acres, so the impacts would be same as discussed for that alternative.

Alternative D

Under Alternative D, the ERMA would be the same as Alternative A, but increased in size to 5,285 acres and the area would be managed under VRM Class IV objectives for major surface disturbances. The impacts to resources and users would be the same as discussed under Alternative A because the area would be managed specifically for OHV use, travel would be limited, and resource user conflicts would be reduced.

4.3.5.3.2 Impacts of Air Quality Actions on Recreation

Impacts from Management Common to All

As mentioned in the recreation resources introductory subsection above, an assumption for the assessment of impacts to recreation is scenic quality as a component for most recreational activities. Management actions that degrade air quality would have potential short- or long-term adverse impacts on long-distance views of scenery caused by obscuring smoke, haze, dust, and industrial pollutants. All of the alternatives would require projects within the planning area to meet air quality standards, which would directly and indirectly and beneficially impact recreation resources by maintaining long distance views of scenic landscapes within the SRMAs and ERMAs.

Impacts from Management Common to All Action Alternatives

Under all of the action alternatives, management actions would require that drill rig, completion rig, work-over rig, and fracturing pump engines would be required to meet EPA Tier 4 Nonroad Diesel Emission Standards within 1 year of the ROD. Also, vent socks would be required on bulk cement transfers to silos and back into bulk trucks. These actions would have direct and indirect, beneficial impacts on recreation resources in the long term because they would further mitigate the release of potential pollutants into the air and reduce fugitive dust production.

Impacts from the No Action Alternative

Management actions under the current RMP would require that proposed projects meet air quality standards. This would continue to be directly beneficial for all resource users in the long term because required levels of air quality would maintain long distance scenic quality views.

Impacts from Alternative A

Under Alternative A, management actions would require that potential light pollution be mitigated by shading or directing project night lights downward to reduce skyglow. Watering and other approved dust abatement applications would be required to reduce fugitive dust production, and industrial vapor recovery units would be required at drilling sites.

The actions would have direct and indirect, long-term and short-term beneficial impacts on recreation resources by maintaining and improving long distance viewing conditions within the planning area during the day and at night. Compared to the No Action Alternative, Alternative A would provide more beneficial impacts on recreation resources because more stipulations would be required by projects to prevent the production and release of scenery-obscuring atmospheric pollutants.

Impacts from Alternative B

Alternative B would have the same management actions as Alternative A, except light pollution mitigation would only apply within the Guadalupe Escarpment Scenic Area. The impacts to recreation resources from mitigation of industrial emissions on daytime atmospheric clarity would be the same as discussed for Alternative A. Compared to the No Action Alternative, there would be long-term, direct beneficial impacts to recreational night-time sky viewing from reduced skyglow.

Impacts from Alternative C

Management actions under this alternative would not require fugitive dust mitigation, industrial vapor recovery would be determined case-by-case, and light pollution would be mitigated in VRM Class II and III areas only where sensitive receptors (e.g., communities, neighborhoods, scenic vistas) were identified. The impacts to recreation resources would be direct and beneficial because air quality standards would be required within the planning area. Compared to the No Action Alternative, this alternative would have more long-term, direct, beneficial impacts because more mitigation would be applied to protect long distance scenic viewing.

Impacts from Alternative D

Under Alternative D, there would be no required mitigation of light pollution caused by projects, no fugitive dust mitigation, and the same industrial vapor recovery actions as discussed under Alternative C. The impacts, compared to the No Action Alternative, would be more beneficial for the same reasons as discussed for Alternative C.

4.3.5.3.3 Impacts of Backcountry Byways Actions on Recreation

Impacts from Management Common to All

Under all of the alternatives, the 55-mile Guadalupe Backcountry Byway would continue to be managed for sightseeing, which would be directly beneficial in the long-term to those seeking on-highway, motorized sightseeing opportunities.

Impacts from the No Action Alternative

Under current management actions the byway corridor would be managed under VRM Class II objectives to preserve scenic quality. Scenic driving users would benefit in the long term because recreational opportunities that meet their expectations would be preserved, and the likelihood for satisfying experiences would be maintained.

Impacts from Alternatives A through C

Under Alternatives A, B, and C, the byway would be managed under VRM Class II objectives to beneficially preserve the route’s scenic quality. Recreational scenic driving users would benefit in the long term from management action under these alternatives to protect and maintain scenic quality along the byway. Compared to the No Action Alternative, Alternatives A, B, and C would provide similar opportunities for recreational sightseeing as the No Action Alternative because scenic quality would be protected at the same level as under the No Action Alternative.

Impacts from Alternative D

Alternative D actions would manage under VRM Class III objectives, which would permit moderate surface disturbances and contrasts within the byway’s viewscape, which would have adverse impacts on sightseeing opportunities along the route and reduce the opportunities for satisfying experiences for scenic motorized recreation. Compared to the No Action Alternative, Alternative D would provide a lesser degree of opportunity because scenic quality would have less protection from potential impacts to the viewscape.

4.3.5.3.4 Impacts of Cave and Karst Actions on Recreation

Impacts from Management Common to All

The No Action Alternative and each of the proposed action alternatives have varying management actions for cave and karst resources, but the impacts to these resources would be the same for recreation resources and resource users: under all of the alternatives, cave and karst resources would be beneficially protected and intensively managed to preserve the resource. This would have long-term, direct, beneficial impacts on the caving specialized user group because opportunities for recreation would be maintained.

4.3.5.3.5 Impacts of Wildland Fire Management Actions on Recreation

Impacts from Management Common to All

Under all of the alternatives, prescribed fires would be conducted within the planning area to maintain and to reduce fuel loads, and wildland fires would be controlled and suppressed as needed to protect resources and people. The impacts of prescribed burning would be directly and indirectly adverse to all recreation user groups and to recreational opportunities in the short term because access could be limited in areas where controlled burns were being conducted, which would temporarily reduce recreational opportunities for backcountry and front country sightseeing, hiking, camping, biking, caving, and OHV use. The impacts would be indirectly adverse because areas could be closed during vegetation regrowth and because scenic quality could be degraded until vegetation regrowth and visible signs of firefighting operations became less noticeable. In the long term, the impacts to recreation resources and to resource user groups would be directly beneficial because of the reduced risk of wildland fire, and the reduced risk of loss of backcountry and front country facilities. There would also be long-term benefits from improved wildlife habitat and vegetation that would increase the opportunities for wildlife viewing and sightseeing.

4.3.5.3.6 Impacts of Health and Safety Actions on Recreation

Health and safety management actions within the planning area focus on buried and unburied pipelines, subsidence, increased traffic, and on protecting the public from toxic releases of hydrogen sulfide gas and explosive gases generated by oil and gas exploration and development (see Air Resources, Section 0).

Impacts from Management Common to All

Management actions common to all of the alternatives would maintain current strategies for floodplains, hazardous materials, and air quality to ensure public health and safety. Under all of the alternatives, visual and audible alarms would be required for hydrogen sulfide releases. Actions would also continue to comply with BLM procedures to protect public health and safety from toxic and explosive gases. There would be no impacts to recreation resources and user groups as these actions are currently being enforced and would continue to be enforced within the planning area.

4.3.5.3.7 Impacts of Land Tenure Actions on Recreation

Impacts from Management Common to All Action Alternatives

Under all of the action alternatives, the CFO would acquire easements across non-federal lands to provide access for recreation resource needs, including but not limited to river access and areas of high recreation value. This would have long-term, direct, beneficial impacts on all recreation user groups because recreational opportunities would be established in areas not otherwise available or accessible for use.

4.3.5.3.8 Impacts of Land Use Authorizations Actions on Recreation

Impacts from Management Common to All

There are no management actions common to all of the alternatives that would specifically affect recreation. The management of land use authorizations under the proposed alternatives specifically addresses the designation of ROW utility corridors, land use authorizations for future projects within the CFO, and exclusion and avoidance areas for utility and CFO infrastructure. The CFO has proposed minor ROW corridors within the Hay Hollow area (Map 2-31), but the impacts on recreation resources and users cannot be determined at this programmatic level of analysis.

4.3.5.3.9 Impacts of Minerals Actions on Recreation

It can be generally stated that minerals-related management actions would potentially have the greatest impacts on recreation resources and on all user groups. As discussed in Chapter 3, Section 3.3.5, the trend of increased mining activities within the CFO are expected to decrease the quality of recreational opportunities within the planning area that are currently popular for developed and dispersed recreation (e.g., the Hackberry Lake OHV area) because of the large areas that may become available for mining and other minerals development. A brief summary of the existing and proposed acreages and actions being considered are shown below in Table 4-170.

Table 4-170. Minerals Management Actions on Recreation

Minerals Management Actions (acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Oil and Gas Leasing					
Open	1,598,870	1,142,802	1,089,481	1,750,774	1,997,681
CSU (open with moderate constraints)	956,410	799,649	449,759	786,381	631,634
NSO (open with major constraints)	54,602	80,394	162,013	158,401	70,142
Closed	174,391	761,404	1,082,972	88,502	84,687
Total Closed and NSO	228,993 (8.2)*	841,798 (30.23)	1,244,985 (44.72)	246,903 (8.87)	154,829 (5.56)
Total	***2,784,273***	***2,784,248***	***2,784,224***	***2,784,058***	***2,784,145***
RFD (# of wells on lands open to surface disturbance)	5,874	4,465	3,538	5,832	6,044
RFD total acres of surface disturbance from well drilling	11,778	8,547	8,262	11,175	12,129
RFD total acres of surface disturbance after reclamation	8,636	6,565	5,202	8,575	8,887
Recreation buffer areas	No specific management action	No surface disturbance within 0.5 mile of developed recreation sites	Same as Alternative A	No surface disturbance within 0.25 mile of developed recreation sites	Surface disturbance buffer consistent with county/municipal guidelines
Minerals Non-Energy Solid Leasable					
Minerals Locatable					
	No Action Alternative	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Acres open to mineral entry	2,751,856	2,403,114	2,110,098	2,651,855	2,661,705
Acres recommended (or previously recommended for withdrawal)	32,374 (1.16)	380,990 (13.68)	673,996 (24.21)	132,249 (4.75)	122,444 (4.40)
Total	***2,784,229***	***2,784,105***	***2,784,094***	***2,784,104***	***2,784,149***
Minerals Salable					
	No Action	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Open	2,637,465	1,179,104	1,122,020	1,784,431	2,028,324
Avoid (open with moderate constraints)	–	1,043,152	725,368	752,286	602,621
Closed	146,568 (5.3)	561,995 (20.18)	936,799 (33.64)	247,323 (8.88)	153,174 (5.50)
Total	***2,784,033***	***2,784,251***	***2,784,186***	***2,784,041***	***2,784,119***

*The numbers within parentheses are percentages.

Impacts from Management Common to All

Mineral leasing actions common to all alternatives would apply drilling mitigation and design features to the Dark Canyon area north of Carlsbad National Monument to protect the area from the effects of oil and gas drilling. These actions would have direct long-term beneficial impacts on recreation resources and users because high quality scenery would be preserved for all users in the Dark Canyon area.

Impacts from Management Common to All Action Alternatives

There are no minerals-related actions that are common to all of the action alternatives.

Impacts from the No Action Alternative

Under current RMP management actions, oil and gas leasing would be closed or have surface disturbance constraints on 228,993 acres (8.2% of the BLM-administered planning area available for leasing). The remaining 2,555,280 acres (91.8%) would be designated as open and open with moderate surface disturbance constraints (CSU). Approximately 32,374 acres (1.2% of the planning area) would be recommended for withdrawal from locatable mineral use, and 146,568 acres (5.3%) would be closed to salable mineral use. There would be RFD of approximately 5,874 wells within the BLM-administered planning area with a total surface disturbance of 8,636 acres after reclamation. These closures and constraints would reduce surface disturbances and preserve recreation resources by maintaining vegetation, soils, topography, and scenic quality. However, a substantial portion of the planning area would be available for fluid and solid minerals exploration and development, which would have long term adverse impacts on recreation resources and on all resource user groups that have expectations of high scenic quality and naturalness. OHV users would benefit from additional recreational opportunities along drilling and mining access and spur roads. On-road sightseers, water-related users, wildlife viewers, campers, hikers, equestrians, and other non-motorized user groups would be adversely impacted by visually intrusive minerals infrastructure, noise, dust, mining and drilling vehicles from a loss of solitude, quiet, naturalness, and scenic quality.

Impacts from Alternative A

Under Alternative A, oil and gas leasing would be closed or have surface disturbance constraints (NSO leasing) on 841,798 acres (30.23% the BLM-administered planning area), with the remaining 1,942,450 acres designated as open and CSU. Approximately 380,990 acres (13.68%) would be recommended for withdrawal from locatable mineral use, and 561,995 (20.18%) acres would be closed to salable mineral use. There would be RFD of approximately 4,465 wells within the BLM-administered planning area with a total surface disturbance of 6,565 acres after reclamation. Table 4-170 above provides a concise summary of acreages and leasing designations for the proposed action alternatives and the No Action Alternative. This table will allow the reader to compare quantitative and qualitative information between these alternatives. The table is applicable to this alternative and to the other alternatives. The impacts to recreation users and recreation resources would be similar to those discussed under the No Action Alternative because the types of surface disturbances would be the same.

Compared to the No Action Alternative, this alternative would be more beneficial for recreation resources and users because more acreage (612,805 acres of leasable landscape) within the planning area would be protected from leasable minerals-related surface disturbances and visual infrastructure intrusions, with preservation of scenic quality in these areas. Also, 384,616 more acres of locatable minerals landscape and 415,427 more acres of salable minerals landscape would be protected from minerals-related disturbances, with scenic quality protection. Recreational opportunities for all users seeking naturalness, quiet, and a sense of remoteness would be increased by the protection of these landscapes, with the increased likelihood for satisfying experiences.

Impacts from Alternative B

Alternative B management actions would close or have major surface disturbance constraints (NSO) on 1,244,985 acres (44.72% the planning area), with the remaining 1,539,240 acres designated as open and CSU. Approximately 673,996 acres would be recommended for withdrawal from locatable mineral use, and

936,799 acres would be closed to salable mineral use. There would be RFD of approximately 3,538 wells within the BLM-administered planning area with a total surface disturbance of 5,202 acres after reclamation. The impacts to recreation resources and user groups would be similar to those discussed above for the No Action Alternative because the surface impacts would be the same.

Compared to the No Action Alternative, the impacts to recreation would be more beneficial than those discussed for Alternative A because a larger area would be protected from minerals-related surface disturbances with direct, long-term beneficial impacts on recreation resources and users. Approximately 1,015,992 more leasable acres than under the No Action Alternative would be closed or NSO; 641,622 more acres than under the No Action would be closed to locatable minerals use, and 790,231 more acres would be closed to salable minerals use.

Impacts from Alternative C

Management actions under Alternative C would designate approximately 246,903 acres as NSO or closed to minerals leasing (8.87% of the planning area), with the remaining 2,537,155 acres designated as open and CSU. Approximately 132,249 acres would be recommended for withdrawal from locatable mineral use and 247,323 acres would be closed to salable mineral use. There would be RFD of approximately 5,832 wells within the BLM-administered planning area with a total surface disturbance of 8,575 acres after reclamation. The impacts to recreation resources and users would be the same as discussed under the No Action Alternative.

Compared to the No Action Alternative, the impacts to recreation would be more directly beneficial in the long term because more acreage within the planning area would be protected from minerals-related surface disturbances: 17,910 more acres would be closed or NSO than under the No Action Alternative, 99,875 more acres would be closed to locatable mineral use, and 100,755 more acres would be closed to salable mineral use. The impacts from these management actions would be the same as those discussed for Alternative A for the same reasons.

Impacts from Alternative D

Under Alternative D, management actions would designate approximately 154,829 acres as NSO or closed to minerals leasing (5.56% of the planning area), with the remaining 2,629,315 acres designated as open and CSU. Approximately 122,444 acres would be recommended for withdrawal from locatable mineral use, and 153,174 acres would be closed to salable mineral use. There would be an RFD of approximately 6,044 wells within the planning area with a total surface disturbance of 8,887 acres after reclamation. The impacts to recreation resources and users would be the same as discussed under the No Action Alternative.

Compared to the No Action Alternative, this alternative would have fewer beneficial long-term impacts on recreation resources and users and more long-term adverse impacts because there would be less scenic quality protection and more surface disturbance. There would be 74,164 fewer acres protected from minerals-related surface disturbances under leasable NSO and closed designations than under the No Action Alternative. There would be 90,070 more acres protected from locatable minerals use than under the No Action Alternative, but 6,606 fewer acres protected from salable minerals use than under the No Action Alternative.

4.3.5.3.10 Impacts of Livestock Grazing Actions on Recreation

Impacts from Management Common to All

Under all of the alternatives, acreage would be managed as either open or closed to livestock grazing. Closed areas would have long-term, beneficial impacts on all recreation user groups because surface disturbances would be reduced, scenic quality would be preserved, and a higher degree of naturalness would be maintained. Cattle tend to degrade the backcountry recreational experience for hikers, backpackers, primitive backcountry campers, and cavers by the presence of manure on trails and in camping areas, by compacting soil and creating conditions for soil erosion, creating conditions for exotic weeds establishment from surface disturbances, and consuming wildlife forage (that reduces opportunities for wildlife viewing) (see BLM 2008b).

Table 4-171 depicts the acreage designated as open and closed to livestock grazing within the BLM-administered area.

Table 4-171. BLM Grazing Acres

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Open	2,089,394	1,598,198	1,937,725	2,083,232	2,087,759
Closed	1,939	493,120	153,583	8,115	3,594
Total	***2,091,333***	***2,091,318***	***2,091,308***	***2,091,347***	***2,091,353***

Impacts from the No Action Alternative

Management actions for the current RMP would exclude livestock within 1,939 acres or 0.01% of the BLM-administered planning area, with directly beneficial long-term impacts as discussed above.

Impacts from Alternative A

Under Alternative A, 493,120 acres would be closed to grazing (23.57% of the total area available for grazing), with impacts as discussed above. Compared to the No Action Alternative, this alternative would be more beneficial to recreation because more area would be excluded from long-term grazing impacts.

Impacts from Alternative B

Under Alternative B, management actions would close 153,583 acres (7.34% of the planning area) to grazing, with impacts to recreation as discussed above. Compared to the No Action Alternative, this would be more beneficial to recreation resources and all user groups because more acreage would be closed to grazing.

Impacts from Alternative C

The management actions under Alternative C would close 8,115 acres to livestock grazing or 0.39% of the planning area. There would be long-term benefits from this action (as discussed above), but there would be practically no impacts on recreation resources and recreational opportunities because the impacted area would be very small when compared to the total planning area. Compared to the No Action Alternative, this alternative would have more beneficial impacts because more acres would be protected from scenic quality degradation and surface disturbances.

Impacts from Alternative D

Alternative D management actions would close 3,594 acres to grazing (0.17% of the planning area). The impacts would be similar to those discussed for Alternative C because the livestock grazing closed acreages would be similar small when compared to the total planning area.

4.3.5.3.11 Impacts of Lands with Wilderness Characteristics Actions on Recreation

Impacts from Management Common to All

For all of the alternatives, lands with wilderness characteristics would be managed under three levels of activity (see table below): the protection level would maintain wilderness characteristics; the protection/multiple use level would apply varying degrees of protection and multiple use actions to designated wilderness characteristics lands. The multiple use level would manage wilderness characteristics lands with an emphasis on multiple use. Managing designated wilderness characteristics under the multiple use management levels would have beneficial and adverse impacts on resource users because the levels would create recreational opportunities for a range of users, but would also create surface disturbances that would degrade recreational scenic quality. There are no wilderness characteristics lands designated under the No Action Alternative, so these management levels would have no effect on lands under this alternative.

Impacts from Management Common to All Action Alternatives

Lands with wilderness characteristics would be designated and managed under all of the action alternatives. Recreation resources would receive direct, long-term beneficial protection from management actions that restrict surface disturbances to preserve the wilderness values within these areas. These protective actions would include closure of OHV cross-country use (though travel along existing primitive routes within and through these areas would still be allowed), management under VRM Class I and II objectives to preserve high scenic quality, and closure to mineral leasing and mineral materials disposal. The impacts on recreation users would be beneficial in the long term because 1) scenic quality would be preserved within these areas, 2) opportunities for dispersed camping would be available for non-mechanized user groups, and 3) scenic driver, motorized OHV, and mechanized user groups would retain opportunities for travel along limited OHV primitive routes through these areas. As mentioned above, managing these areas for protection and multiple use would be beneficial because it would create opportunities for a range of recreation user groups; however, there would be adverse impacts to recreation if the multiple use levels of management caused degradation of recreational scenic quality. Table 4-172 shown below summarizes the wilderness characteristics management actions. A more detailed impacts analysis follows the table.

Table 4-172. Acres of Lands with Wilderness Characteristics by Alternative and Management Level

Management Level	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Protects wilderness characteristics	0	66,666	47,611	5,119	1,221
Emphasizes other multiple uses while applying some protective management	0	0	18,964	30,595	0
Emphasizes other multiple uses	0	0	0	30,862	65,446

Impacts from the No Action Alternative

Under the No Action Alternative, there would be no lands within the planning area that would be managed to protect lands with wilderness characteristics. There would be no protection for lands with wilderness characteristics within the planning area, and these lands would be managed for other, unspecified resource uses. The impacts to recreation resources and users of that resource would be adverse in the long term as existing trends and conditions within the planning area would likely permit surface disturbances that degrade the scenic quality of these areas and reduce the opportunities for a diverse range of satisfying recreational experiences.

Impacts from Alternative A

Under Alternative A, there would be 66,666 acres managed for protection of wilderness characteristics, with impacts as discussed under Impacts from Management Common to All Action Alternatives. Compared to the No Action Alternative, this alternative would have more beneficial impacts on recreation resources and users because it would manage the most acres within the planning area for the protection of wilderness characteristics and preserve scenic quality for recreational uses.

Impacts from Alternative B

Alternative B actions would manage 47,611 acres for protection of wilderness characteristics and 18,964 acres for protection and multiple use, with impacts as discussed under Impacts from Management Common to All Action Alternatives. Compared to the No Action Alternative, the impacts would be more beneficial to recreation because wilderness characteristics would be preserved in some areas while also creating recreational opportunities.

Impacts from Alternative C

Management actions under Alternative C would provide protection for 5,119 acres of wilderness characteristics areas and 61,457 acres under protection and multiple use management levels, with impacts as discussed under Impacts from Management Common to All Action Alternatives. The impacts, when compared to the No Action Alternative, would be the same as Alternative B.

Impacts from Alternative D

There would be 1,221 acres managed for protection of wilderness characteristics and 65,446 acres managed under protection and multiple use levels. The impacts to recreation would be similar to those discussed under the No Action Alternative because a very small area would be managed to preserve wilderness characteristics.

4.3.5.3.12 Impacts of Noxious Weeds Actions on Recreation

Impacts from Management Common to All

Actions common to all of the alternatives would follow BLM management prescriptions for treating noxious and invasive weed species with herbicides, and mechanical methods. These actions would have no impacts on recreation resources and recreation opportunities for user groups because they would not restrict or limit recreation opportunities in SRMAs or ERMAs.

Impacts from Management Common to All Action Alternatives

Noxious weed management actions under the action alternatives pertain to herbicide use limitations and prohibitions, and herbicide priority use areas (see Appendix L). None of the actions would impact recreation resources or the opportunities of user groups to benefit from those resources.

4.3.5.3.13 Impacts of Renewable Energy Actions on Recreation

Impacts from Management Common to All

Management actions common to all would adopt the BMPs and programmatic policies in the Wind and Solar Energy EIS Records of Decision (BLM 2012a; NREL 2012). These actions would, at the programmatic level of analysis, have no impact on recreation resources, recreation users, and recreation opportunities.

Impacts from Management Common to All Action Alternatives

The encouragement of wind energy development in existing or planned areas of surface disturbance, such as transmission corridors, would be beneficial in the long term for recreation resources and all recreation user groups because scenic quality would be maintained by the concentration of wind energy projects in areas where VRM class objectives allow major changes to the landscape.

Impacts from the No Action Alternative

Under current RMP actions, wind energy projects would be restricted in ACECs, the Carlsbad National Park viewshed, the Guadalupe Scenic Byway, the Guadalupe Escarpment, the face of the Guadalupe Mountains, and in known cave and karst areas. The impacts would be directly beneficial in the long term for recreation resources and users for the same reasons as discussed under Management Common to All Action Alternatives: scenic quality would be preserved, which would maintain recreational opportunities with conditions for satisfying experiences.

Impacts from Alternative A

Under Alternative A, areas within the planning area would be excluded from wind and solar energy development and closed to geothermal development. These areas would include SRMAs, ERMAs, the viewshed of Carlsbad National Park, and known karst areas. The beneficial impacts to recreation would be the same as discussed under Impacts from Management Common to All, but with additional direct, long-term beneficial impacts from preservation of recreational opportunities for all user groups caused by exclusion of these projects from recreation areas. Compared to the No Action Alternative, this alternative would be more beneficial to recreation because more recreational opportunities would be preserved in the long term, with the greater likelihood for satisfying recreational experiences.

Impacts from Alternative B

The management actions would be the same as Alternative A, except wind energy projects would be avoided (not excluded) from ERMAs. The potential development of wind farms in the planning area ERMAs would have direct, long-term, adverse impacts recreation users that seek backcountry, dispersed, primitive camping, hiking, equestrian, and OHV opportunities. Wind development in the ERMAs would degrade the expectation of these users for naturalness and a sense of solitude. Also, wind energy development would create surface disturbances and degrade scenic quality that is part of the recreation experience. The likelihood for satisfying recreational experiences within ERMAs would be diminished. Compared to the No Action Alternative, this alternative would be more beneficial for the same reasons as discussed under Alternative A.

Impacts from Alternatives C and D

The management actions, as they pertain to recreation, would be the same as discussed under Alternative B, with the same impacts to the resource and to users of that resource.

4.3.5.3.14 Impacts of Riparian Actions on Recreation

Impacts from the No Action Alternative

Current management under the No Action Alternative would prohibit surface disturbances in riparian areas and designate all seeps and springs within the planning area as closed to OHV use and would restrict camping within these areas to ensure the recovery of riparian habitat. These actions would have direct, long-term, adverse impacts on recreation user groups that would potentially recreate in these areas, including OHV users, and primitive and undeveloped backcountry campers. Recreational opportunities would be adversely reduced for these users; however, there would be direct long-term, beneficial impacts on daytime wildlife sightseers because improving seep and spring riparian habitat would increase the opportunities for wildlife viewing.

Impacts from Alternatives A, B, and C

The management actions that affect recreation resources and opportunities would be the same for these alternatives as discussed under the No Action Alternative, with the same adverse and beneficial impacts.

Impacts from Alternative D

Alternative D actions would prohibit surface disturbances within riparian areas, but does not specify OHV use or OHV restrictions or camping restrictions in these areas, except no surface disturbances within seep and spring areas. Compared to the No Action Alternative, these actions would potentially be beneficial in the long term for mechanized OHV users and primitive campers because more opportunities would be available to these user groups. The actions would potentially be adverse in the long term for recreation resources, wildlife viewers and other sightseers because of surface disturbances, and noise and human presence and movement would likely reduce the opportunities for wildlife viewing. Also, Alternative D actions would likely create an adverse, long-term increase in resource user conflicts between non-mechanized sightseers and primitive campers and mechanized OHV users. In the long term, there would be a long-term, adverse reduction in opportunities for non-mechanized users because the conditions for satisfying experiences (that include solitude, quiet, and naturalness) would be reduced.

4.3.5.3.15 Impacts of Special Designations (ACECs) Actions on Recreation

Impacts from Management Common to All

There are no management actions that are common to all alternatives. Table 4-172 briefly summarizes the acreages and designations of the existing and proposed ACECs in the planning area. Note in the analysis below that when a statement includes "limited to designated routes" or "limited to existing routes" that the statement applies to all motorized and mechanized vehicle use.

Table 4-172. Summary of ACEC Designations and Acreages

ACECs	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Blue Springs Riparian Habitat	444-acre ACEC designation on private lands	444-acre, no ACEC designation on private lands	Same as Alternative A	Same as Alternative A	Same as Alternative A
Birds of Prey Grasslands	349,355-acre, no designation as ACEC	349,355-acre designation as ACEC	Same as Alternative A	349,253-acre, same as No Action	349,282, same as No Action
Boot Hill	1,065-acre designation as a CRMA	1,065-acre, no ACEC designation	1,065-acre designation as an ACEC	Same as Alternative A	Same as Alternative A
Cave Resources	19,625-acre SMA designation	19,625-acre designation as an ACEC	Same as Alternative A	Same as Alternative A	Same as Alternative A
Chihuahuan Desert Rivers	108,483-acre, no designation as an ACEC	108,483-acre designation as an ACEC	108,483-acre, no ACEC designation	Same as Alternative B	Same as Alternative B
Chosa Draw	2,797-acre designation as an ACEC	Managed as part of the Cave Resources ACEC	Same as Alternative A	Same as Alternative A	Same as Alternative A
Dark Canyon Scenic Area	1,525-acre designation as an ACEC	Managed as part of the Cave Resources ACEC	Same as Alternative A	Same as Alternative A	Same as Alternative A
Desert Heronries	48,711-acre, no designation as an ACEC	48,711-acre, no designation as an ACEC	48,711-acre designation as an ACEC	Same as Alternative A	Same as Alternative A
Gypsum Soils	65,564-acre, no ACEC designation	625,564-acre, No ACEC designation	65,564-acre designation as an ACEC	Same as Alternative B	Same as No Action
Laguna Plata	4,496-acre, no ACEC designation	4,496-acre designation as an ACEC	Same as Alternative A	Same as No Action	Same as No Action
Lonesome Ridge	2,981-acre designation as an ACEC	3021-acre designation as ACEC	Same Alternative A	Same as Alternative A	Same as Alternative A
Maroon Cliffs	8,659-acre, no ACEC designation	Same as No Action	8,659-acres designated as an ACEC	Same as No Action	Same as No Action
Pecos Bluntnose Shiner Habitat	201-acre designation as an ACEC	Same as No Action	Same as No Action	Same as No Action	Same as No Action
Pecos River/ Canyons Complex	5,688-acre designation as an ACEC	4,115-acre designation as an ACEC	Same as Alternative A	Same as Alternative A	4,115-acre, no designation as an ACEC.

ACECs	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Pope's Well	81-acre, no designation as an ACEC	Same as No Action	81-acre designation as an ACEC	Same as Alternative B	Same as No Action
Salt Playas	49,772-acre, no ACEC designation	Same as No Action	49,772-acre designation as an ACEC	Same as No Action	Same as No Action
Serpentine Bends	5,019-acre, no designation as an ACEC	5,019-acre designation as an ACEC	Same as Alternative A	Same as Alternative A	Same as Alternative A
Seven Rivers Hills	1,027-acre, no designation as an ACEC	Same as No Action	1,027-acre designation as an ACEC	Same as Alternative B	Same as Alternative B
Six Shooter	735-acre, no designation as an ACEC	735-acre designation as an ACEC	Same as Alternative A	Same as No Action	Same as No Action

Impacts from Management Common to All Action Alternatives

Management actions common to all action alternatives would designate four ACECs: Cave Resources, Pecos Bluntnose Shiner Habitat, Lonesome Ridge, and Serpentine Bends ACECs. The impacts would range from no impacts for the Bluntnose Shiner Habitat ACEC (because the area is not managed for recreation) to beneficial for recreation from resource preservation and/or preservation of recreational opportunities (Cave, Lonesome Ridge, and Serpentine Bends ACECs). The specific effects of the proposed action alternatives on these ACECs are discussed below. It should be noted that the format for this subsection has been modified from the other subsections for ease of comparison of effects on the proposed ACECs. The alternatives for each ACEC are compared separately, and not by alternative, so that the reader can more easily see the range of effects on each ACEC.

Blue Springs Riparian Habitat ACEC

No Action Alternative

The 444-acre ACEC is currently under private ownership and surrounded by private lands and is managed to protect the habitat of an endangered fish species. OHV use is currently limited to designated routes, and camping and plant collection are restricted. There would be no impacts to recreation resources and opportunities because the area is not managed for recreation.

Alternatives A through D

Under all of the action alternatives, the ACEC would continue to be managed under the same prescriptions as described under the No Action Alternative. There would be no impacts to recreation resources and users as the area is not managed for recreation and would continue to be managed for habitat protection and very limited surface disturbances.

Birds of Prey Grasslands ACEC

No Action Alternative

Current management actions within the 349,355-acre Birds of Prey grasslands would not be designated as an ACEC, but would include prescriptions that allow limited OHV use, moderate to major surface disturbances under VRM Class III and IV objectives, and open to livestock grazing.

Current management would continue to be beneficial in the long term to motorized OHV users, as this user group would have OHV limited access and recreational opportunities throughout the area. The impacts to non-mechanized hikers, campers, equestrian, wildlife viewers, and sightseers would be adverse because of resource use conflicts between non-mechanized and mechanized user groups. Non-mechanized users would continue to have reduced opportunities for quiet and solitude, and surface disturbances caused by livestock and OHVs would continue to reduce or degrade the opportunities to experience a natural, undisturbed setting. Also, scenic quality would continue to be adversely degraded for all recreation users from continued, allowed surface disturbances under VRM Class III and IV objectives.

Alternative A

Under this alternative, the area would be designated as an ACEC would be managed with the same area as the No Action Alternative (349,355 acres). The ACEC would be managed with 59,512 acres (17%) under VRM Class I and Class II objectives to protect scenic quality within the ACEC, and 289,829 acres (83%) managed under VRM Classes III and IV. Travel would be OHV limited. The entire area would be closed to livestock grazing.

The impacts on recreation resources would be beneficial in the long term because scenic quality would be protected within the VRM Class I and Class II areas, and there would be no impacts from livestock grazing. There would be long term resource use conflicts between mechanized and non-mechanized user, as discussed under the No Action Alternative. Compared to the No Action Alternative, this alternative would be more beneficial to recreation resources, but the impacts to users would be similar.

Alternative B

The actions under Alternative B would be the same as Alternative A, except that livestock grazing would be open on 99% of the ACEC. The impacts to recreation resources and users would be beneficial from scenic quality protection under VRM Class I and Class II (the same acreages as under Alternative A). The impacts to recreation users would be the same as discussed under Alternative A for the same reasons. Livestock grazing would adversely impact all users for the same reasons as discussed under 4.3.5.3.10 above: degrading scenic quality, reducing wildlife habitat, and creating conditions for invasive species growth. Compared to the No Action Alternative this alternative would be more beneficial because more scenic quality would be protected under VRM I and II objectives.

Alternative C

Under this alternative, the Birds of Prey ACEC would not be designated for the protection of habitat. The impacts to the recreation user groups within the 349,253-acre area would be adverse in the long term from loss of wildlife-viewing opportunities, loss of scenic quality from management under VRM Class III and Class IV objectives, and permitted minerals development within the area. There would be opportunities for satisfying experiences by OHV users on limited routes; however, there would be long-term scenic quality degradation within the ACEC from permitted moderate to major surface disturbances under the VRM objectives that would adversely reduce the quality of the recreational experience for all users. Compared to the No Action Alternative, this alternative would have the same impacts because of the lack of protection as an ACEC.

Alternative D

This alternative would have the similar management actions as discussed for the No Action Alternative, with the similar impacts on recreation resources and users: OHV limited throughout the 349,282-acre area (and no ACEC designation), management under VRM Class III and Class IV objectives, and open to livestock grazing.

Boot Hill District ACEC

No Action Alternative

This 1,065-acre ACEC is currently managed to protect important and sensitive cultural resources for research. Current management includes managing the area under VRM Class IV objectives, livestock grazing is permitted over the entire ACEC, no surface disturbances are allowed until culturally cleared, and OHV travel is limited throughout the ACEC.

There would be no impacts to recreation because the area is not managed for recreation. Recreational opportunities would exist for OHV travel along existing routes.

Alternative A

Under this alternative, the ACEC would not be designated, but managed with the same prescriptions as the surrounding area. These prescriptions would be the same as discussed for the No Action Alternative: open to livestock grazing, OHV limited to existing routes, and scenic quality managed under VRM Class IV objectives.

The impacts to recreation would be the same as the No Action Alternative because the area is not currently managed for recreation and would not be under the revised RMP. There are opportunities for OHV use within the area, but management actions under this alternative would neither enhance nor degrade any existing opportunities or recreation resources.

Alternative B

Under this alternative, the 1,065-acre ACEC would be designated; however, the impacts for recreation would be same as discussed for the No Action because the area is not currently managed for recreation and would not be in the future.

Alternatives C and D

These action alternatives would not designate the Boot Hill ACEC, but the management actions would be the same as the No Action Alternative, and the impacts to recreation resources and recreation users would be the same as discussed for Alternative A.

Cave Resources ACEC

No Action Alternative

Current management prescriptions protect the 19,625-acre area with its 19 caves within nine cave management units. Current management objectives include protection of cave resources scenic quality and other cave natural values while accommodating recreational use. The area is open to livestock grazing. Limited OHV travel is permitted on 18,237 acres (93% of the ACEC). Scenic quality VRM Class I and Class II objectives protect 6,837 acres (35%), and the remaining acreage is managed under VRM Class III and IV objectives for moderate to major surface disturbances.

The impacts to recreation resources would be directly beneficial in the long term for specialized caving opportunities because the ACEC area is managed for this resource. Motorized OHV users would also directly benefit from these management prescriptions because the majority of the area allows limited OHV recreational opportunities. Other non-mechanized resource users (hikers, campers, equestrians, sightseers) would be adversely affected in the long term because of resource use conflicts between mechanized and non-mechanized users, and because the majority of the area is managed to permit substantial surface disturbances and degradation of surface scenic quality. Non-mechanized opportunities for scenic quality, quiet, naturalness, and a sense of isolation and remoteness would be adversely degraded in the long term by livestock grazing surface disturbances and OHV noise.

Alternative A

Under this alternative, the 19,625-acre ACEC would manage 14,630 acres under scenic quality protecting VRM Class I and II objectives (75% of the ACEC). Approximately 4,516 acres would be closed to livestock grazing, and OHV limited access would be the same as the No Action (96% of the area).

The actions would have long-term beneficial impacts on recreation resources and users from scenic quality protection under VRM Class I and Class II objectives. Specialized caving users would be beneficially impacted and OHV users in the long term by prescriptions that protect cave and karst features and the areas surrounding these features and OHV limited use throughout the ACEC; however, there would be adverse user conflicts between mechanized OHV and non-mechanized users as discussed under the No Action Alternative. Compared to the No Action Alternative, this alternative would be more beneficial in the long term for all users because more opportunities would be available for more recreation users, more areas would be protected for scenic quality, and resource conflicts would be reduced.

Alternatives B through D

Under these action alternatives, management actions would be the same as those discussed under Alternative A, with the same impacts as discussed for that alternative.

The impacts would be beneficial to all users who seek recreational opportunities within the ACEC because scenic quality would be enhanced in the long term. Compared to the No Action Alternative, these alternatives would have the same impacts on recreation resources and user groups as discussed under Alternative A for the same reasons.

Carlsbad Chihuahuan Desert Rivers ACEC

No Action Alternative

The 108,483-acre area would not be managed as an ACEC for scenic quality protection associated with the Guadalupe Escarpment. Management actions include OHV limited travel on 101,820 acres (94% of the area), livestock grazing on 102,056 acres (94% of the ACEC), and managing 106,007 acres (98% of the area) under VRM Class III and IV for moderate to major surface disturbances to the scenic landscape (2% managed under VRM Class II).

The impacts of these actions would be adverse in the long term for recreation resources and for all users because scenic quality degradation would be permitted on a substantial portion of the area from livestock grazing and other surface disturbances. Non-mechanized recreation user groups would be adversely affected by resource use conflicts with OHV users that would degrade their opportunities for satisfying experiences. The OHV-related adverse effects would include noise and visual and physical intrusions that would reduce the likelihood for solitude, quiet, naturalness, and a sense of isolation.

Alternative A

The ACEC would be designated under this alternative. Management prescriptions would exclude livestock grazing within the 108,483-acre ACEC, and limit OHV recreation to 101,880 acres (94% of the ACEC). The area would continue to be managed under VRM Class III and IV objectives on 96,242 acres (89% of the ACEC) for moderate to major surface disturbances to the landscape, and VRM Class II objectives for scenic preservation on the remaining 11%. Management prescriptions would limit camping or close some areas to camping and use minerals BMPs to protect scenic values.

The impacts to recreation resources would be adverse in the long term because scenic quality in most of the ACEC would continue to degrade from permitted surface disturbances, and the impacts to resource users would be the same as discussed for the No Action Alternative for the same reasons. Compared to the No Action Alternative, this alternative would be more beneficial to recreation resources because more area would be protected under VRM Class II objectives and there would be greatly reduced surface disturbance-related impacts from livestock grazing.

Alternative B

The ACEC would not be designated under this alternative, but the 108,483-acre area would be managed similar to the surrounding area. Approximately 28,138 acres (26%) of the area would be managed under VRM Class II objectives to preserve scenic quality, and 80,333 acres (82%) managed for surface disturbances under VRM Class III and Class IV objectives. Livestock grazing would be excluded on 63,371 acres (58% of the area), and OHV travel would be limited on 101,880 acres (94% of the area).

The impacts to recreation resources would be beneficial in the long term because a substantial portion of the area would be protected under VRM Class II to maintain and improve scenic quality. The impacts to mechanized and non-mechanized users would be the same as discussed under Alternative A for the same reasons. Compared to the No Action Alternative, this alternative would be more beneficial for the same reasons as discussed under Alternative A.

Alternatives C and D

These alternatives would allow grazing on 95% and 99% of the area, respectively (the ACEC would not be designated under these alternatives), OHV travel would be limited (the same as discussed under Alternative B), and the landscape would be predominantly managed under VRM Class III and IV objectives (91,547 acres or 88% of the area). Scenic quality protection under VRM Class II would apply to the remaining 12% of the area.

The impacts to recreation resources would be similar to those discussed under Alternative A because the acreage managed under VRM Class III and IV would be similar and the acreage managed for limited OHV use would be similar, with similar levels of permitted surface disturbances. The impacts to recreation users would be similar to Alternative A for the same reasons. Permitting livestock grazing on the area would be adverse in the long term for non-mechanized users because (as discussed in the Livestock Grazing and Recreation subsections) cattle tend to degrade the backcountry recreational experience for hikers, backpackers, primitive backcountry campers, and cavers by the presence of manure and by compacting soil and creating conditions for soil erosion, creating conditions for exotic weeds establishment from surface disturbances, and consuming wildlife forage (that reduces opportunities for wildlife viewing). Compared to the No Action Alternative, these alternatives would be more beneficial for recreation resources and users because more area would be protected for scenic quality preservation under VRM Class II objectives.

Chosa Draw ACEC

No Action Alternative

The 2,797-acre Chosa Draw ACEC is currently being managed to protect sensitive karst resources that include significant caves, sinking streams, springs, and sink holes. The area is also managed for cave-recreation, scientific research, and education. Management actions for the No Action Alternative are discussed under the Cave Resources ACEC No Action Alternative because this area lies within that proposed ACEC boundary.

Alternatives A through D

For all of the action alternatives, the Chosa Draw ACEC area would be managed as part of the proposed Caves Resources ACEC. The impacts to the Chosa Draw area and comparisons with the No Action Alternative are discussed under that ACEC subsection.

Dark Canyon Scenic Area ACEC

No Action

The 1,525-acre Dark Canyon Scenic ACEC is currently being managed to protect the area’s highly sensitive visual values, natural values, fragile caves, and threatened and endangered plant species. As mentioned above for Chosa Draw ACEC, management actions for the No Action Alternative include those prescriptions that are discussed under the Cave Resources ACEC No Action Alternative because this area lies within that proposed ACEC boundary.

Alternatives A through D

For all of the action alternatives, the Dark Canyon Scenic ACEC area would be managed as part of the proposed Caves Resources ACEC. The impacts to the Dark Canyon Scenic area and comparisons with the No Action Alternative are discussed under that ACEC subsection.

Desert Heronries ACEC

No Action Alternative

This area is currently being managed with the objectives of preserving and protecting important and sensitive cultural resources for research and protecting active heronries. Current management of this 48,711-acre area would allow livestock grazing, allow OHV limited travel on 48,393 acres (99% of the area), and manage scenic quality under VRM Class III (720 acres or 2%) and 47,991 acres under VRM Class IV objectives (98% of the area). The impacts to recreation resources would be adverse because the area would not be managed to protect scenic qualities or prevent surface disturbances. Recreation OHV users would continue to benefit from travel opportunities, but there would be no beneficial impacts for other recreational resource users because the area is not specifically managed for recreational opportunities, the focus of management is resource preservation, and recreation opportunities would be neither enhanced nor diminished by the area's management prescriptions.

Alternatives A, C, and D

The 48,711-acre area would not be designated as an ACEC under Alternatives A, C and D, but would be designated under Alternative B (see below). Management prescriptions would maintain the area as open to livestock grazing on 74% to 99% of the area, but limit OHV travel. Approximately 98% of the area would be managed under VRM Class IV objectives (the same as the No Action Alternative) for major surface disturbances, with the remainder under VRM Class III objectives. The impacts would be the same as discussed for the No Action Alternative because surface disturbances and the opportunities for recreation would be similar. Compared to the No Action Alternative, these alternatives would have similar impacts to recreation resources and users in the long term because the area would be managed with similar prescriptions.

Alternative B

Under this alternative, the 48,472-acre Desert Heronries ACEC would be designated for the protection of great blue heron nest colonies. The impacts to recreation users would be the same as discussed for the above action alternatives because the area is not currently managed for recreational opportunities, but for habitat preservation.

Gypsum Soils ACEC

No Action Alternative

The 65,564-acre Gypsum Soils area would not be managed to protect visual resource values associated with the Guadalupe Escarpment while accommodating other resource uses. Current prescriptions include limited OHV travel on 60,009 acres (92% of the area), scenic quality management under VRM Class III and Class IV on 59,146 acres (90% of the area), and the remaining acres managed under VRM Class II. Livestock grazing would be permitted on 92% of the area (60,445 acres). The impacts on recreation resources and user groups would be similar to those discussed for Serpentine Bends below: OHV limited users would benefit from travel opportunities throughout the area, but non-mechanized user groups (hikers, campers, equestrians, sightseers, wildlife viewers) would be adversely affected in the long term because of resource use conflicts between OHV mechanized and non-mechanized users, and because the majority of the area is managed to permit substantial surface disturbances and degradation of surface scenic quality under VRM Class III and Class IV and livestock grazing. Non-mechanized opportunities for scenic quality, quiet, naturalness, and a sense of isolation and remoteness would be adversely degraded in the long term by livestock grazing surface disturbances and OHV noise and visual intrusions. The likelihood for non-mechanized groups to have satisfying experiences would continue to be diminished.

Alternative A

Under Alternative A, the ACEC would not be designated, but OHV travel would be limited on 60,072 acres (or 92% of the area) within the 65,562-acre area. Livestock grazing would be closed in 92% of the area (60,534 acres). Approximately 50,679 acres (77% of the area) would continue to be managed under VRM Class III and IV objectives (with the remainder [11,995 acres] managed under VRM Class II objectives) that permit moderate to major changes to the visual landscape. The impacts to recreation resources would be adverse in the long term because moderate to major surface disturbances would continue to be allowed on a substantial portion of the area (an area whose resource objective is scenic quality protection). The impacts to OHV resource users of the area would be beneficial in the long term because opportunities for OHV travel would be available. The impacts to non-mechanized and specialized user groups would be adverse for the same reasons as discussed under the No Action Alternative for the same reasons. The reduction in livestock grazing would reduce surface disturbances and benefit all user groups. Compared to the No Action Alternative, this alternative would be more beneficial for recreation resources because more area would be protected to preserve scenic quality under VRM II than under the No Action Alternative.

Alternative B

Under this alternative, the 65,564-acre Gypsum Soils ACEC would be designated. Management prescriptions would include closing all of the ACEC to grazing, and provide limited OHV use on 92% of the landscape (the same as Alternative A). Under this alternative, 25,993 acres (40% of the ACEC) would be managed under VRM Class II objectives to preserve scenic quality, with the remaining 60% managed under VRM Class III and Class IV objectives. Compared to the No Action Alternative, this alternative would be more beneficial to recreation resources in the long term because, in addition to the benefits discussed above under Alternative A, a substantial portion of the ACEC's scenic quality would be maintained in the long term under VRM Class II, which would enhance the recreational experience for all recreation resource users of the ACEC.

Alternative C

Under this alternative, the 65,564-acre ACEC would be designated and management prescriptions would be similar to those discussed under Alternative A: similar acreage managed under VRM Class III and IV (53,530 acres or 82%) and similar acreage managed for limited OHV use (61,028 acres). However, this alternative would permit livestock grazing on approximately 57,405 acres of the ACEC (88%). The impacts to recreation resources and users would be adverse in the long term because surface disturbances caused by livestock and permitted moderate to major alterations of the landscape under VRM objectives would diminish and degrade scenic quality. Compared to the No Action Alternative, these action alternatives would be less adverse because more acres under VRM Class II objectives would protect scenic quality within the ACEC.

Alternative D

Under Alternative D, the 65,564-acre area would not be designated as an ACEC (same as Alternative A). The acreage of the area managed under VRM Class III and IV objectives would be similar to Alternative A, 50,638 acres or 77%. Similar acreage would be managed for limited OHV use, 60,967 acres (93%). Livestock grazing would be permitted on 60,905 acres (93% of the area). The impacts to recreation resources and users would be similar to those described under Alternative C for the same reasons: long term adverse impacts caused by surface disturbances permitted under VRM Class III and Class IV, and livestock grazing. Compared to the No Action Alternative, the impacts would be the same as discussed under Alternative C for the same reasons.

Laguna Plata ACEC

No Action Alternative

Under current management, the 4,496-acre Laguna Plata area would not be designated as an ACEC, but managed to protect important and sensitive cultural resources. Under this alternative, the area would be closed to OHV travel on 3,010 acres (67%) with the remainder as OHV limited. Surface disturbances are restricted, and there are no prescriptions that pertain to recreational use. The area would be managed under VRM Class III and Class IV objectives that allow moderate to major surface disturbances and scenic quality impacts. There would be no impacts to recreation resources and users because the area is not managed for that resource use.

Alternatives A and B

Management actions under these alternatives would designate and manage the 4,496-acre ACEC to preserve sensitive and important cultural resources. The management prescriptions would be the same as the No Action Alternative, except that the entire area would permit OHV limited travel. Alternative B would close the ACEC to livestock grazing. Compared to the No Action Alternative, there would be more beneficial to OHV users because OHV opportunities would be available. There would be no impacts to other users because recreational activities would still be very limited.

Alternatives C and D

Under this alternative, the management actions would be the same as the No Action Alternative. The impacts to OHV recreation would be the same as discussed for the other action alternatives because the opportunities for recreation would be the same.

Lonesome Ridge ACEC

No Action Alternative

Under current management prescriptions, the 2,981-acre Lonesome Ridge ACEC is managed to preserve the geologic feature's scenic quality and other natural values. The area would be closed to OHV use except for OHV limited recreation on 41 acres, VRM Class I objectives would be applied to 2,940 acres (99% of the ACEC) with the remainder managed under VRM Class II, and surface disturbances within the ACEC would be restricted. The area would be open to livestock grazing. These actions would be adverse in the long term for mechanized OHV users because opportunities would be limited, but beneficial to non-mechanized backcountry users that seek opportunities for primitive backcountry hiking, sightseeing, and wildlife viewing. The impacts to recreation resources would be beneficial because the area's scenic quality would be preserved.

Alternatives A, C, and D

Management actions under these alternatives would designate the 3021-acre ACEC with management actions similar to the No Action Alternative: the entire ACEC would be managed under VRM Class I objectives to preserve scenic quality, OHV recreation would to be closed in the ACEC, and livestock grazing would be permitted on the ACEC. The impacts to recreation resources would be beneficial in the long term because scenic quality would be preserved, though there would be adverse surface-disturbance impacts caused by livestock grazing. The impacts to recreation users would be the same as discussed under the No Action Alternative for the same reasons: adverse impacts to OHV users from limited opportunities, but beneficial impacts to other users. Compared to the No Action Alternative, the impacts under this alternative would be more adverse for OHV users because opportunities for OHV recreation would be eliminated.

Alternative B

Management of the 3021-acre ACEC would be the same as the other action alternatives, except that 41 acres would be managed as VRM Class II. The impacts to recreation would be the same as discussed for Alternative A. When compared to the No Action Alternative the impacts would be the same as discussed under Alternative A because the management actions are the same.

Maroon Cliffs ACEC

No Action Alternative

The 8,659-acre Maroon Cliffs area is currently managed to protect and preserve important cultural resources for research. Livestock grazing is permitted, and the area allows OHV limited travel throughout. Surface disturbances are restricted to prevent impacts to cultural resources, and the site is managed entirely under VRM Class III objectives (with the exception of four acres under VRM Class IV). The impacts to recreation under this alternative would continue to be beneficial in the long term for OHV recreation because opportunities for limited OHV travel throughout the site would not be impaired. There would be no impacts to other, non-mechanized users or recreation resources because the area is currently managed for cultural resource preservation and protection and that management objective would continue, so these other opportunities would neither be impaired nor enhanced.

Alternative A

Management actions for this alternative would not designate the Maroon Cliffs ACEC (the same as the No Action Alternative), but would continue management prescriptions similar to the No Action Alternative: OHV limited travel would be allowed throughout the area, and the area would be open to livestock grazing. Actions under this alternative would manage the site under VRM Class III and Class IV objectives (the same as the No Action). The impacts to recreation would be the same as the No Action Alternative, as OHV use would be available throughout the site on routes, and non-mechanized opportunities would be restricted to prevent surface disturbances.

Alternative B

Management actions under this alternative would designate the 8,659-acre area as an ACEC and manage the ACEC area under VRM Class II objectives. The ACEC would be closed to livestock grazing. The long-term impacts to recreational opportunities would be the same as those discussed under the No Action Alternative, but recreation resources would be enhanced by long-term improvements in scenic quality under VRM Class II. Compared to the No Action Alternative, this alternative would be more beneficial because there would be more scenic quality preservation and less surface disturbance.

Alternatives C and D

These alternatives would have the same management actions as Alternative A, with the same impacts to recreation resources and users.

Pecos Bluntnose Shiner Habitat ACEC

No Action Alternative

Currently, this 201-acre ACEC is managed to protect and enhance the habitat for an endangered fish species. Camping and plant collection is restricted, and OHV use is limited throughout the ACEC. The area is open to livestock grazing, and managed under VRM Class IV objectives. There would be no impacts to recreation because the area is managed for species protection, not recreational use.

Alternatives A through D

Under all of the action alternatives, the 201-acre habitat would be designated as an ACEC for the protection of a fish species. The management actions for all of the action alternatives are the same: management under VRM Class II objectives, OHV travel is limited, and closed to livestock grazing. There would be no impacts to recreation resources and users because the area is not currently managed for recreational use under the No Action Alternative and would not be managed for recreation under the action alternatives. There would potentially continue to be opportunities for OHV travel within the area, but the opportunities would be neither enhanced nor reduced from current conditions.

Pecos River/Canyons Complex ACEC

No Action Alternative

This 5,688-acre designated ACEC would be managed to protect sensitive cultural, natural, and scenic values. Management actions include designation as VRM Class II for scenic quality protection and preservation. Within the ACEC 4,730 would be OHV limited (83% of the ACEC)and the remaining 942 acres as closed to OHV use. Livestock grazing would be permitted on all of the ACEC. Long-term beneficial opportunities would continue for OHV travel. Non-mechanized recreation users would be adversely affected in the long term by resource use conflicts with mechanized users from OHV noise and physical intrusion, and with a loss of opportunities for solitude and quiet. There would be long-term, beneficial impacts to recreation resources and users from scenic quality preservation under VRM II and maintenance of a sense of naturalness.

Alternatives A and B

Under these alternatives, the 4,115-acre area would continue to be managed as an ACEC. The ACEC would be managed under VRM Class II objectives, which would be beneficial in the long term for recreation resources and all users because of scenic quality protection. Livestock grazing would be permitted on 83% and 84% of the ACEC and OHV limited travel would be allowed throughout the ACEC, which would have long-term, beneficial impacts on OHV users by maintaining OHV recreational opportunities. However, non-mechanized and specialized user groups would be adversely affected in the long term from resource use conflicts with mechanized OHV users (same as the No Action Alternative) and livestock grazing surface-disturbance impacts. Compared to the No Action Alternative, this alternative would be more beneficial to recreation resources in the long term because applying VRM II management objectives throughout the ACEC would preserve scenic quality to a greater degree.

Alternative C

Under this alternative, the 4,115-acre area would be managed as an ACEC. Management actions would be the same as under Alternative A, except that less area would be managed under VRM Class II (2,276 acres or 55%) and Class III objectives (1,839 acres). The area would be open to livestock grazing, and the area would permit OHV limited travel throughout the ACEC. There would be long-term, adverse impacts to recreation resources from degradation of scenic quality within Class III areas and from grazing that would affect all non-mechanized recreation users who consider high quality scenery to be a component for satisfying recreational experiences. There would be beneficial impacts to OHV users from maintained opportunities for recreation experiences. Compared to the No Action Alternative, this alternative would have the same impacts on resource users for the same reasons: beneficial impacts for OHV users and adverse impacts for non-mechanized users. Recreation resource scenic quality would be more adversely impacted because visual quality preservation would be reduced.

Alternative D

Under this alternative, the area would not be managed as an ACEC, but would have management actions that are the same as Alternative C: management under VRM II Class objectives (2,276 acres) and Class III objectives (1,839 acres), open to grazing, and limited OHV travel. The impacts to recreation resources and users would be the same as discussed under Alternative C because the actions are the same.

Pope's Well ACEC

No Action Alternative

The 81-acre ACEC is currently managed as a historic site. The area is closed to OHV travel and closed to livestock grazing. The area is managed under VRM Class IV objectives. The impacts to recreation would continue to be beneficial in the long term for on-road motorized sightseers and scenic drivers who seek opportunities to visit developed, cultural interpretive and historic sites. There would be no impacts to other resource users because the area is not managed for other recreational users.

Alternatives A, B, C, and D

These alternatives would have management actions similar to those for the No Action Alternative, with the same long-term impacts on recreation resources and user groups. The impacts to recreational opportunities would be the same as those discussed for the No Action Alternative because the same restrictions on travel, livestock grazing, and recreation would apply. Alternatives B and C would designate the area as an ACEC, but management actions under all of the action alternatives would have the same impacts on recreation resources and users because the actions are the same.

Salt Playas ACEC

No Action Alternative

The 49,772-acre Salt Playas area would be managed to preserve and protect important and sensitive cultural resources. Under this alternative, the site is designated as OHV limited on 46,189 acres (93% of the area) and closed to OHV use on the remaining 7% of the area. Approximately 91% of the area (45,258 acres) is managed for major scenic quality modifications under VRM Class IV objectives, and the remaining 9% is managed under VRM Class III objectives for moderate surface modifications. The site is open to livestock grazing. Opportunities for a range of OHV travel recreation would continue to be beneficial for this resource group in the long term, but opportunities for non-mechanized recreation users would be adversely limited. The impacts to recreation resources and to all users would be adverse because VRM Class III and Class IV objectives would permit moderate to major surface disturbances which would degrade scenic quality.

Alternative A

Under Alternative A the Salt Playas would not be designated as an ACEC. Management actions under this alternative would be similar to those under the No Action Alternative because management prescriptions would be similar, with similar impacts to recreation resources and user groups.

Alternative B

Under this alternative, the Salt Playas ACEC would be designated within a 49,772-acre area. Scenic quality management would be approximately the same as Alternative A, as well as livestock grazing and restrictions on OHV use. The impacts on recreation would be the same as discussed under Alternative A.

Alternatives C and D

These alternatives would have the same management prescriptions as Alternative A (as they pertain to recreation), including not designating the area as an ACEC. The impacts to recreation would be the same as discussed under Alternative A.

Serpentine Bends ACEC

No Action Alternative

Current management actions for the 5,019-acre Serpentine Bends area include protecting scenic quality on 3,892 acres (78% of the area) under VRM Class II objectives and 638 acres (13%) under VRM Class I objectives, managing the area as OHV limited on 3,578 acres (71% of the area), and permitting livestock grazing throughout the area. The impacts to recreation resources would be beneficial from managing the area to protect and maintain scenic quality under the VRM objectives. The impacts to recreation users under these management prescriptions would be variable: motorized OHV users would continue to directly benefit from these management prescriptions in the long term because OHV recreational opportunities would be available. Other non-mechanized and specialized resource users (rock climbers, hikers, campers, equestrians, sightseers, wildlife viewers) would be adversely affected in the long term because of resource use conflicts between mechanized and non-mechanized users. Non-mechanized opportunities for scenic quality, quiet, naturalness, and a sense of isolation and remoteness would be adversely degraded in the long term by livestock grazing surface disturbances, and OHV noise and visual intrusions. The likelihood for these non-mechanized and specialized groups to have satisfying experiences would continue to be diminished.

Alternatives A through D

Under all of the action alternatives, the 5,019-acre area would be designated as the Serpentine Bends ACEC. Under all of these alternatives, OHV travel would be limited on 3,578 acres (71% of the designated ACEC) with the remainder of the area closed to OHV use (the same as the No Action Alternative). High levels of scenic quality protection would be maintained under VRM Class I and II objectives. The management prescriptions under all of the action alternatives are similar to those described for the No Action Alternative. Compared to the No Action Alternative these alternatives would have more beneficial impacts on recreation resources and users because more area would be protected under VRM Class I and Class II objectives than under the No Action Alternative (which would manage 492 acres under VRM Class III).

Seven Rivers Hills ACEC

No Action Alternative

Under current planning actions, this 1,027-acre area is managed to protect and enhance habitat for a threatened plant species. The area’s scenic quality is protected under VRM Class II objectives on 644 acres (63% of the ACEC) and the remaining 310 acres (37%) are designated as VRM Class III and Class IV, and open to livestock grazing. The area is designated as OHV limited, and camping and surface disturbances are restricted. There would be no impacts to recreation resources and non-OHV resource users under this alternative because the area is not managed for recreational use. Recreational opportunities for OHV limited travel exist within the area and would benefit mechanized user groups, but other recreational opportunities are restricted Managing the area under VRM Class II would beneficially preserve scenic quality within two-thirds of the area, but scenic quality would be adversely degraded within the designated VRM Class III and Class IV areas.

Alternative A

Management actions under Alternative A would not designate the 1,027-acre area as an ACEC. Management prescriptions would include managing the area under the same VRM objectives as the No Action Alternative, permit livestock grazing on the entire area, and limit travel to existing OHV routes. The impacts to recreation resources and users would be the same as discussed under the No Action Alternative because the area would not be managed for recreation.

Alternatives B and C

Under these alternatives, management actions would designate the 1,027-acre ACEC for plant species protection. Under these alternatives, the ACEC would be managed entirely under VRM Class II objectives that would preserve scenic quality. OHV use would be allowed on existing routes throughout the ACEC. The area would be open to livestock grazing. Compared to the No Action Alternative, these alternatives would have the same impact on recreation users because recreational opportunities would be available for mechanized use (motorized OHV use and non-motorized bicycles). The impacts on recreation resources would be more beneficial than the No Action Alternative because the entire ACEC would be managed to preserve scenic quality under VRM Class II objectives.

Alternative D

Management actions under Alternative D would be the same as Alternatives B and C, except the ACEC would be managed entirely under VRM Class III objectives, which would permit moderate surface disturbances. The impacts would be adverse in the long term for recreation resources and users because scenic quality would be degraded for those recreation users who seek OHV opportunities in the ACEC. Compared to the No Action Alternative, the impacts to users would be the same in the long term because a similar range of recreational opportunities would be available users, but less beneficial for recreation resources because the entire ACEC would be managed under VRM Class III.

Six Shooter

No Action Alternative

This area is managed for protection of its high scenic quality. Under current management action, the Six Shooter area is not managed as an ACEC. However, current management actions for the area permit livestock grazing on the 735-acre area. The area is designated for limited OHV use, and the entire area is managed for scenic quality protection under VRM Class II objectives. The impacts to recreation resources would be adverse in the long term because, though VRM objectives would prohibit obvious surface disturbances, grazing would degrade scenic quality from soil compaction, vegetation loss, and soil erosion. The impacts to recreation users would be similar to the discussion for the Pecos River/Canyons Complex ACEC: long-term beneficial opportunities would continue for mechanized OHV travel by permitting recreational OHV opportunities. Non-mechanized recreation users would be adversely affected in the long term by resource use conflicts with mechanized users from OHV noise and physical intrusion, with a loss of opportunities for solitude and quiet. All resource users would continue to be adversely impacted by livestock grazing throughout the relatively small area with long-term, adverse degradation of scenic quality and loss of a sense of naturalness.

Alternative A and B

Under these alternatives, the 735-acre area would be designated as an ACEC. The ACEC would be managed under VRM Class II objectives that would allow only minor disturbances to the landscape, recreational OHV use would be limited, and livestock grazing would continue to be permitted throughout the ACEC. The impacts would be the same as those discussed for the No Action Alternative because the management prescriptions are the same.

Alternatives C and D

Under these alternatives, the 735-acre area would not be designated as an ACEC. However, these alternatives would have management prescriptions similar to the No Action Alternative: the site would be open to grazing, managed under VRM Class II, and would limit OHV use. The impacts to recreation resources and users would be the same as discussed for that alternative.

4.3.5.3.16 Impacts of Special Designations (RNAs) Actions on Recreation

Impacts from Management Common to All

There are no actions common to all of the alternatives.

Impacts from Management Common to All Action Alternatives

The management actions common to all of the action alternatives would be that the currently designated RNAs would not be designated in the revised RMP. There would be no impacts to recreation for the same reasons as discussed under the No Action Alternative: the areas are not currently used for recreation and under the revised RMP would be used for other resource purposes. Those RNAs managed under the 1988 RMP and carried forward in this revised plan would be managed under existing and proposed ACECs (see Special Designations section for a detailed discussion of these areas). For example, the 493-acre Dry Cave RNA would be managed under the Cave Resources ACEC.

4.3.5.3.17 Impacts of Special Designations (SMAs) Actions on Recreation

Impacts from Management Common to All

There are no actions common to all of the alternatives.

Impacts from Management Common to All Action Alternatives

Similar to the impacts discussed above for RNAs, the management actions common to all of the action alternatives would be that the currently designated SMAs would not be designated in the revised RMP.

There would be no impacts to recreation for the same reasons as discussed under the No Action Alternative: Dark Canyon, Potash Bull Wheel, and Bear Grass Draw are currently used for a variety of resource uses, including recreation, and under the revised RMP these areas would continue to be managed to protect recreation resources and uses, but without the SMA designation (see ACECs and Recreation subsections). As mentioned above for the RNAs, those SMAs managed under the 1988 RMP and carried forward in this revised plan would be managed under existing and proposed ACECs (see Special Designations section) for a detailed discussion of these areas). For example, the 27,254-acre Phantom Banks Heronries SMA would be managed under the Desert Heronries ACEC.

4.3.5.3.18 Impacts of Special Designations (WSRs) Actions on Recreation

Impacts from Management Common to All

Under all of the alternatives, if Congress legislates that a river segment is designated as part of the NWSRS, then protection is removed for that river segment and management of the river segment would be according to other management actions within the RMP.

Impacts from the No Action Alternative

Current management under the No Action Alternative would not manage rivers segments along the Delaware and Black Rivers under the NWSRS; however, the Delaware and Black Rivers would be managed as eligible under the NWSRS until suitability determinations are made during the RMP process. The impacts to recreation resources and users would be directly and indirectly beneficial because these waterways would be protected and maintained for their scenic or wild characteristics. The recreational opportunities for satisfying river-related experiences would be maintained over time from river protection under current management actions. Recreational groups most likely affected would be hikers, wildlife viewers, campers, river users, and OHV users.

Impacts from Alternative A

Under Alternative A, 8.22 miles of the Delaware River would be recommended for inclusion in the NWSRS with a tentative classification as Scenic. Additionally, sections of the Black River (3.67 miles within the planning area) would be recommended for inclusion in the NWSRS with a tentative classification as Scenic.

The impacts would be directly beneficial in the long term for recreation resources and user groups mentioned above in the No Action Alternative because scenic quality would be maintained, recreational opportunities would be preserved, and there would be the likelihood for satisfying river-related experiences along the protected Delaware and Black River segments. Compared to the No Action Alternative, this alternative would be more beneficial to recreation because of the long-term increased recreational opportunities that would be available.

Impacts from Alternatives B, C, and D

Management actions under these alternatives would be the same. The 3.67 miles of the Black River would be recommended for inclusion in the NWSRS, but the Delaware River would not be recommended for inclusion in the NWSRS. The impacts on recreation from the Black River NWSRS recommendation would be same as Alternative A for the same reasons, but there would be a potential loss of and long-term adverse impacts on river-related recreational opportunities along the Delaware River from a lack of protection of river scenery. Compared to the No Action Alternative, these alternatives would be more adverse because some scenic protection would be applied to the Black River, but river resources protection along the Delaware River would be reduced.

4.3.5.3.19 Impacts of Special Designations (WSAs) Actions on Recreation

Impacts from Management Common to All

Under all of the alternatives, the four WSAs within the planning area would continue to be managed under BLM Manual 6330, Management of Wilderness Study Areas (BLM 2012c). Management would continue until Congress releases these areas from wilderness review. Maintaining these special designation areas in an unimpaired condition would continue to be directly beneficial to non-mechanized recreation user groups (hikers, wildlife sightseers, primitive backcountry and dispersed campers, and cavers) in the long term because the pristine, natural condition of the WSAs would be maintained for these types of recreational opportunities. Continued management would be directly adverse in the long term for mechanized and route-oriented user groups (on-road sightseers and scenic drivers, OHV users, and rock climbers) because mechanized use in the WSAs would be prohibited, visible surface disturbances would be prohibited, and travel through the areas would be limited to primitive routes so that wilderness suitability would not be impaired.

4.3.5.3.20 Impacts of Special Status Species Actions on Recreation

Impacts from Management Common to All

Management actions common to all of the alternatives would stipulate that New Mexico and federal agencies be consulted prior to any projects that may affect special status species in the planning area. Also, state-listed species would be protected through cooperative agreements with New Mexico state agencies. These actions would have no impacts on recreation resources and user groups. There would be no impacts because the management actions are regulated by the Endangered Species Act, and the provisions in that act do not have obvious impacts on recreational resources, recreational opportunities, and resource users. The protection of habitat, the implementation of species recovery plans and conservation agreements, HMP development, Section 7 consultations, project-level habitat protection and mitigation, and the prohibition of surface-disturbing activities around established buffers for protected plant, fish, and wildlife species would not, at this programmatic level of analysis, enhance, impair or restrict recreational opportunities within the planning area.

4.3.5.3.21 Impacts of Travel Management Actions on Recreation

Impacts from Management Common to All

Management common to all of the alternatives would seasonally limit OHV travel within active heronries to protect nesting sites. Cross-country motorized OHV travel for lessees and permittees would be limited to accessing a leased or permitted site.

The impacts from these actions would be adverse to OHV users because seasonal restrictions would limit or reduce recreational opportunities during heron nesting. There would be no impacts from restricting lessee and permittee cross-country OHV use to site inspection on OHV recreational opportunities because the intent and purpose of the cross-country allowance would be site inspection, not recreation.

Impacts from Management Common to All Action Alternatives

Travel routes would be designated as either OHV limited or closed. It should be noted, as discussed above under Recreation Impacts on Recreation (Section 4.3.5.3.1), that for Hackberry Lake and Alkali Lake SRMAs, all OHV activity would be OHV limited; however, this designation would apply to the entire OHV play areas within the SRMAs so that OHV use would be effectively open and cross-country within the play areas.

Table 4-173. OHV Travel Designations and Acreages

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Limited to designated routes	–	–	–	–	–
Limited to existing routes	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966 (2.7)	52,028 (2.5)	41,936 (2.0)	38,738 (1.9)	38,737 (1.9)
Total	***2,091,273***	***2,091,326***	***2,091,327***	***2,091,320***	***2,091,321***

Impacts from the No Action Alternative

Under the current RMP, the impacts of OHV limited routes would continue to provide beneficial, long-term travel-related recreational opportunities for motorized OHV and mountain biking user groups, with no impacts on recreation resources, as these routes would not increase surface disturbance impacts to recreation resources.

Impacts from Alternative A

Management actions under Alternative A would designate 2,039,299 acres as OHV limited and 52,028 acres (2.5% of the planning area) as closed to OHV use.

There would be no impacts on scenic drivers and specialized recreation users as these user groups are not likely to have resource-use conflicts with OHV users; the impacts on river users and non-mechanized users would be beneficial in the long term if non-motorized or closed areas were designated along river corridors and in backcountry hiking and camping areas, otherwise noise-related impacts from motorized OHV use would have potentially adverse impacts on the recreational expectations of solitude, quiet, and remoteness for these groups. The potential impacts of this alternative’s management actions on non-mechanized users would be a direct, long-term, adverse reduction in recreation opportunities for solitude and a sense of backcountry remoteness caused by noise-related OHV use if OHV limited routes were to lie near hiking and equestrian trails, primitive and undeveloped camping areas, and river segments where solitude, quiet, and a sense of remoteness are recreation expectations.

Compared to the No Action Alternative, this alternative would be more beneficial to mechanized users because there would be a 3,938-acre reduction in OHV closed areas, which would create a minor increase in opportunities for OHV recreational travel.

Impacts from Alternative B

Under this alternative 2,049,391 acres would be designated as limited OHV use, and 41,936 acres (2% of the planning area) designated as closed to OHV use. The impacts on recreational opportunities would be the same as discussed under Alternative A because the acres of designated limited and closed OHV areas would be similar. Fewer acres (14,030 acres) would be designated as closed, when compared to the No Action Alternative, so there would be a beneficial increase in opportunities for OHV users, but a reduction in beneficial impacts for non-mechanized user groups.

Impacts from Alternatives C and D

Under Alternatives C and D, management actions would designate 2,052,582 acres as OHV limited and 38,738 acres (1.9% of the planning area) as closed to OHV travel. The impacts to recreation would be the same as discussed under Alternative A because the designated acreages would be similar. There would be 17,229 fewer acres designated as closed, when compared to the No Action Alternative, so there would be a reduction in beneficial impacts for non-mechanized user groups, but a minor, beneficial increase for OHV users from increased travel opportunities.

4.3.5.3.22 Impacts of Vegetation Actions on Recreation

Impacts from Management Common to All

Common management actions for all of the alternatives would include protecting trees within migratory and threatened and endangered bird habitat, rangeland restoration would continue in order to maintain and improved habitat for wildlife, and vegetation treatments would include chemical, mechanical, and fire. The impacts to recreation resources from these actions would be both adverse and beneficial.

Short-term, directly adverse impacts would be cause by vegetation treatments that temporarily alter the visual landscape visually and temporarily alter existing wildlife habitat. As discussed in Fire Management, prescribed burning (and chemical and mechanical treatments) would temporarily degrade scenic quality, with adverse effects for all recreation user groups, until vegetation regrowth; short-term loss of wildlife habitat (until vegetation regrowth) would adversely affect wildlife viewers because opportunities for sightseeing would be reduced, and all recreation users would be adversely affected in the short-term by potential exclusion from treated areas until vegetation regrowth.

Long-term, beneficial impacts recreation resources and to all recreation users would be caused by protectively maintaining wildlife habitat and by treatment-improved wildlife habitat that would increase the opportunities for recreational wildlife viewing.

Impacts from Management Common to All Action Alternatives

There are no common management actions that are common to all of the action alternatives, and no specific actions that pertain to recreation other than those discussed above.

4.3.5.3.23 Impacts of Visual Resources Actions on Recreation

Impacts from Management Common to All

Management common to all of the alternatives would manage leased areas to accommodate transmission infrastructure (power lines, pipelines, access) along utility corridors to concentrate surface disturbances and preserve scenic quality. These actions would have no impacts on recreation resources. Also, management actions would designate VRM class objectives for all BLM-administered lands within the planning area. The designation of VRM Class I and II would have direct, long-term beneficial impacts on recreation resources and on all users of the resource because these classes would preserve landscape scenic quality. The designation of VRM Class III and IV would have potentially long-term, adverse impacts on the resource and resource users because these VRM classes would permit moderate to major surface disturbances on the landscape that would degrade scenic quality.

The proposed VRM class designations for the planning area are shown in Table 4-174.

Table 4-174. VRM Class Acreage for BLM-administered Lands within the Planning Area

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class I	7,058	37,764	42,102	7,171	7,171
Class II	43,613	235,946	315,700	60,791	41,092
Class III	402,725	367,205	294,177	549,329	546,205

VRM Class	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Class IV	2,330,462	2,142,600	2,131,501	2,166,266	2,189,116
Subtotal I and II	50,671 (1.8)	273,710 (9.8)	357,802 (12.8)	67,962 (2.4)	48,263 (1.7)
Subtotal III and IV	2,733,187 (98.2)	2,509,805 (90.2)	2,425,678 (87.2)	2,715,595 (97.6)	2,735,321 (98.3)
Total*	2,783,858	2,783,514	2,783,481	2,783,558	2,783,585

*The acreage totals are not consistent for all of the alternatives because of GIS shapefile mapping overlaps.

Impacts from Management Common to All Action Alternatives

There are no management actions common to all of the action alternatives.

Impacts from the No Action Alternative

Under the current RMP management actions, 50,671 acres would be managed as VRM Class I and II to preserve and protect scenic quality within the planning area, with the remaining 2,733,187 acres (98.18% of the planning area) managed under VRM Class III and IV for moderate to major landscape surface disturbances. The VRM Class I and II resource objectives would have long-term, protection-related, beneficial impacts on recreation resources and all recreation resource users because recreation-related scenic quality would be preserved; the areas managed under VRM Class III and Class IV objectives would have long-term, adverse impacts on recreation resources and all resource users from management for low scenic quality.

Impacts from Alternative A

Under Alternative A, 273,710 acres (9.8% of the planning area) would be managed as VRM Class I and Class II. Approximately 1,854,747 acres (90.2%) would be managed under the visual resource objectives of VRM Class III and Class IV. The VRM Classes I and II would have beneficial impacts on recreation resources and all users from preservation of scenic quality; VRM Classes III and IV would have adverse impacts on recreation resources and users from management for loss or maintenance of low scenic quality. Compared to the No Action Alternative, this alternative would manage 223,039 more acres under higher levels of VRM Class I and II scenic quality protection. This would have long-term beneficial impacts on recreation resources and users because more acres would be managed to prevent or mitigate surface disturbances to visual/scenic quality under VRM Class I and II, with associated long-term, beneficial impacts on recreation-related scenic quality. Compared to the No Action Alternative, this alternative would be more beneficial because more acres would be protected from potential scenic quality degradation.

Impacts from Alternative B

Management actions under Alternative B would designate 357,802 acres as VRM Class I and II, and the remaining 2,425,678 acres (87.15% of the planning area) would be designated as VRM Class III and IV, with the same impacts to recreation resources and users as discussed under Alternative A. This alternative would manage 307,131 more acres for protection under VRM Class I and II than the No Action Alternative, with more beneficial impacts to recreation because more acreage would be managed for the long-term protection and preservation of scenic quality. This alternative would have the most beneficial impacts of the action alternatives.

Impacts from Alternative C

Management actions under Alternative C would manage 67,962 acres for long-term beneficial scenic quality protection under VRM Class I and II, an increase of 17,291 acres when compared to the No Action Alternative. The remainder of the planning area (2,715,595 acres or 97.55%) would be managed under VRM Class III and IV objectives. The impacts on recreation resources and users are the same as discussed under Alternative A for the same reasons. This alternative would have more beneficial impacts on recreation-related scenic quality than the No Action Alternative because more acres within the planning area would be protected and preserved.

Impacts from Alternative D

Under Alternative D management actions would designate 48,263 acres within the planning area as VRM Class I and Class II; the remaining 2,735,321 acreage (98.27%) would be designated as VRM Class III and Class IV. The long-term impacts on recreation-related visual resources and users would be the same as discussed under Alternative A for the same reasons. Compared to the No Action Alternative, this alternative would adversely designate 2,408 fewer acres for recreation-related scenic quality protection and maintenance under VRM Classes I and II than the No Action Alternative. This alternative would be the least beneficial for recreation-related scenic quality preservation.

4.3.5.3.24 Impacts of Wildlife and Fish Actions on Recreation

Impacts from the No Action Alternative and Action Alternatives

Under the No Action and Action alternatives, the Birds of Prey grasslands and the Bluntnose Shiner habitat would be managed for protection of wildlife and fish species. The impacts of these actions on recreation resources and user groups are discussed above under 4.3.5.3.15 Impacts of Special Designations (ACECs) on Recreation.

4.3.6 Land Use Authorizations

Land use authorizations are administrative actions made in support of other programs rather than a program unto itself. The authorization process addresses requests from other programs for authorizations of such things as ROWs. ROWs are issued for such developments as pipelines, roads, communication facilities, and renewable energy facilities, among other types of developments.

4.3.6.1 Analysis Methods

4.3.6.1.1 Indicators

For the purpose of this analysis, the acres of land allocated by other program decisions to exclusion areas, avoidance areas, and withdrawals for land use authorizations, as well as lands allocated by other programs to designated ROW corridors are used as the indicator for comparing the impacts of the alternatives. In exclusion, avoidance, and withdrawal areas ROW authorizations would not be permitted. The acres in which land use authorizations would be restricted in some fashion are compared between alternatives where such data are applicable.

4.3.6.1.2 Methods and Assumptions

Methods

The degree to which land use authorizations can be issued is affected by management decisions from other programs and whether those programs allow or restrict such authorizations in support of that program’s resource. As such, the analysis presented below simply calculates the total acreage of program decisions by alternative that would affect the issuance of land use authorizations.

Assumptions

This analysis assumes, that unless otherwise indicated, land use authorizations would be managed in accordance with standard BLM lands policies as related to the Mineral Leasing Act, FLPMA permits and ROWs, access, easements, transportation and utility corridors, trespass resolutions, etc. The analysis also assumes that the CFO’s existing policy of reviewing all existing withdrawals on a regular basis would still occur under all alternatives, and adjustments to withdrawals may be made with due cause.

4.3.6.1.3 Direct and Indirect Impacts

Land use authorizations are not subject to direct impacts. Rather, they are subject to indirect impacts from other program management decisions. That is, if another program designates an area as a ROW avoidance area to protect a given land use or resource, a land use authorization for such a ROW cannot be granted. The issuance of ROW authorizations can be restricted in the short-term or the long-term depending on the duration of other program decisions that implement avoidance, withdrawal, and exclusion areas.

The decisions by most resource programs would have at most a negligible effect on land use authorizations because they do not determine whether land use authorizations would be issued. Those programs that *would* influence land use authorizations are discussed further in the analysis below and include the following:

- Cave and Karst Resources
- Land Use Authorizations
- Lands with Wilderness Characteristics
- Recreation
- Renewable Energy
- Riparian Resources
- Special Designations
- Special Status Species
- Visual Resource Management

Note that in some cases, only authorizations for ROWs would be affected by program decisions, while in others a broader array of land use authorizations beyond ROWs would be affected. The distinctions between these two situations are identified in the analysis that follows.

Those programs that *would not* influence land use authorizations are not discussed further and include the following:

- Air Quality
- Back Country Byways
- Cultural Resources
- Wildland Fire and Fuels Management
- Land Tenure
- Livestock Grazing
- Minerals and Leasing
- Noxious Weeds
- Riparian Resources
- Paleontological Resources
- Soils
- Travel Management
- Water Resources
- Wildlife and Fish

4.3.6.1.4 Impacts Common to All Alternatives

Certain program decisions affect the ability to issue land use authorizations in the CFO or influence how those authorizations are issued regardless of which alternative is considered. These decisions and their resulting affects to land use authorizations are summarized in Table 4-175.

Table 4-175. Effects of Management Common to All Alternatives on Land Use Authorizations

Resource Program	Impact to Land Use Authorizations
Land Use Authorizations	Issuances of land use authorizations would be subject to site-specific environmental review, and special conditions may be placed on authorizations in cases of environmental conflict. A total of approximately 479 miles (184,201 acres) of specific ROW corridors would be designated under all alternatives. Because of the need for temporary surface water lines and hydraulic fracturing ponds, hydraulic fracturing operations may require more temporary ROWs than conventional drilling operations.
Recreation	The Trails RMZ portion of the Dunes RMZ would be managed as a combination of excluded to ROWs (in dunes) and avoidance of ROWs (on trails). This designation would limit the ability to issue land use authorizations in this area.
Riparian	Approximately 7,278 acres of riparian areas would be identified as avoidance or exclusion areas for ROWs. This would limit the ability to issue land use authorizations in these areas.

Resource Program	Impact to Land Use Authorizations
Special Designations	Approximately 7,086 acres of WSAs would be managed as exclusion areas for future ROWs. This would limit the ability to issue land use authorizations in these areas.
Visual Resource Management	Areas designated VRM Class I would be managed as ROW exclusion areas. No ROW authorizations could be made in these areas. The actual acreage of VRM Class I management varies by alternative and is summarized in Table 4-176 below.
Minerals Allocations on Split Estate Lands	Surface development on split estate lands designated as open to leasable, salable, and locatable minerals development under varying levels of terms and conditions would be subject approval by the surface estate owner and could limit the nature of land use authorizations issued by the BLM in those areas.

4.3.6.1.5 Impacts Common to All Action Alternatives

A small number of program management decisions specific to only the action alternatives affect whether the CFO would issue land use authorizations for ROWs or communications sites or otherwise influence conditions that would be applied to any such authorizations. These decisions and their interaction with land use authorizations are summarized in Table 4-176.

Table 4-176. Effects of Management Common to All Action Alternatives on Land Use Authorizations

Resource Program	Impact to Land Use Authorizations
Cave and Karst Resources	See Special Designations.
Land Use Authorizations	All lands in the planning area except those specifically designated as exclusion, avoidance, or withdrawal areas would be open to consideration for land use authorizations, including ROWs, pending site-specific and project-specific analysis. This would provide flexibility to the land use program in issuing land use authorizations.
Lands with Wilderness Characteristics	All lands managed to maintain or protect wilderness characteristics would be designated as ROW exclusion areas, thereby limiting the issuance of land use authorizations in these areas. The actual acreage of designated lands with wilderness characteristics varies by alternative and is summarized in Table 4-177 below.
Recreation	The Black River SRMA (1,275 acres) would be managed as a ROW exclusion area. The Hackberry Lake SRMA (38,942 acres) would be managed as an avoidance area for ROWs. These decisions would limit the ability to issue land use authorizations in these two SRMAs.
Special Designations	Blue Springs Riparian Habitat ACEC (160 acres) and Bluntnose Shiner Habitat ACEC (201 acres) would be managed as avoidance areas for future ROWs, while the Lonesome Ridge ACEC (3,021 acres), the Laguna Plata ACEC (4,496 acres), the Cave Resources ACEC (18,832 acres), the Maroon Cliffs ACEC (8,659 acres), the Pope’s Well ACEC (81 acres), and the Serpentine Bends ACEC (4,216 acres) would be managed to exclude future ROWs. Additionally, the Black River WSR would be managed as an exclusion area for ROWs and the Delaware River WSR would be managed as either an avoidance or exclusion area for ROWs depending on the action alternative in question. These decisions would limit the ability of the BLM to issue land use authorizations in these areas.

4.3.6.1.6 Impacts of Program Decisions on Land Use Authorizations

Impacts from Program Decisions by Alternative

As noted above, the ability of the CFO to issue land use authorizations (i.e., ROWs) for actions in the planning area are affected by decisions in other management programs. Programs that impose exclusion areas, avoidance areas, or withdrawals for ROWs or communications sites to accomplish program goals and objectives prohibit the issuance of land use authorizations for the affected area(s). Table 4-177 provides a summary of the different management programs for which ROW or communication site restrictions would be placed under different alternatives and offers a comparison by alternative of the total acres for which such authorizations would be prohibited. Note that there may be some overlap between the program decisions summarized below. That is, ROW restrictions under one program may occur on the same lands where similar restrictions would be instituted under another program. However, the acreages provided in Table 4-177 offer a relative comparison of alternatives.

Table 4-177. Acres of Right-of-way Exclusions, Avoidance, and Withdrawal for Each Alternative

Program	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Lands with Wilderness Characteristics managed to protect wilderness characteristics	2,904 (avoid)	66,661 (exclude)	47,607 (exclude)	5,118 (exclude)	1,220 (exclude)
Recreation (SRMAs and ERMAs)	6,546 (avoid), 148 (exclude)	39,851 (avoid), 11,582 (exclude)	47,805 (avoid), 23,118 (exclude)	47,797 (avoid), 17,622 (exclude)	36,883 (avoid), 12,690 (exclude)
Renewable Energy – Solar (exclude)	1,778,338	767,685	832,368	734,276	629,955
Renewable Energy – Wind	947,940 (avoid) 7,061 (exclude)	623,320 (avoid), 666,783 (exclude)	417,997 (avoid), 912,251 (exclude)	881,634 (avoid), 206,184 (exclude)	925,282 (avoid), 73,142 (exclude)
Renewable Energy – Geothermal (close)	0	0	0	35	0
Special Designations – ACECs	5,533 (avoid), 1,158 (exclude)	411,275 (exclude)	2,178 (avoid), 481,248 (exclude)	19,355 (avoid), 41,810 (exclude)	2,979 (avoid), 24,246 (exclude)
Special Status Species	15,664 (avoid), 2,985 (exclude)	1,008,999 (avoid), 407,939 (exclude)	365,722 (avoid), 1,051,207 (exclude)	195,419 (avoid), 165.911 (exclude)	313,825 (avoid), 20,010 (exclude)
Visual Resources	7,058	37,764	42,102	7,171	7,171

As Table 4-177 above illustrates, Alternative D would have by far the least total amount of land designated for ROW exclusion, avoidance, or withdrawal. As such, the Alternative D would have the fewest restrictions (i.e., least impact) on the issuance of land use authorizations. By contrast, Alternative B would have the most acreage designated as ROW exclusion, avoidance, or withdrawal, thereby having the greatest impact on the ability to issue land use authorizations. Alternatives A and C would be the next most restrictive. Alternative C would be somewhat less restrictive than Alternatives A and B but far more restrictive than the Alternative D and the No Action Alternative in terms of the ability to issue land use authorizations.

4.3.7 Land Tenure

The land tenure program is a support program for other resource programs as well as general BLM land management objectives and responsibilities. The program responds to requests for land tenure adjustments from other programs or outside entities and initiates proactive land tenure adjustments to facilitate specific BLM resource management objectives. Broadly, the land tenure program is affected by decisions to retain, acquire, or dispose of land for management purposes. In some cases, land tenure decisions are influenced by regulatory requirements, such as those set forth in the Recreation and Public

Purposes Act (R&PP) (68 Statute 173; 43 USC 869 et. seq.). As discussed in Chapter 3, land tenure adjustments are made through either sale, purchases, donations to the BLM, acts of Congress and other federal legislation, and exchange.

4.3.7.1 Analysis Methods

4.3.7.1.1 Indicators

For the purpose of this analysis, the acres of land allocated to retention, disposal, withdrawal to other agencies, acquisition, and other land tenure adjustments are used as the indicator for comparing alternatives.

4.3.7.1.2 Methods and Assumptions

Methods

The analysis below uses calculations of acres identified by the CFO for land tenure adjustments in the planning area, including areas specifically identified for retention by resource programs. Land tenure adjustments that have occurred prior to this analysis are not included in the calculations; only future adjustments identified under one or more of the alternatives, including the No Action Alternative, are evaluated.

Assumptions

This analysis assumes that unless otherwise indicated, land tenure adjustments would be made in accordance with standard BLM lands policies as related to the R&PP, FLPMA, withdrawals, disposals, acquisitions, etc. The analysis also assumes that existing withdrawals to other federal agencies would continue and would not be returned to the BLM and that resource programs (e.g., cultural resources, wildlife, and recreation) establish the priority or the urgency associated with any acquisition of lands.

4.3.7.1.3 Direct and Indirect Impacts

Land tenure is not subject to direct impacts per se. Rather it is subject to indirect impacts from other program management decisions or requests from outside parties. That is, if another program identifies an area for retention or acquisition, a land tenure adjustment would be initiated. Similarly, if an outside party applies for an exchange, withdrawal, or other acquisition of land, a land tenure adjustment would be considered.

Most resource programs do not specifically identify land tenure adjustments under any of the alternatives and would, therefore, have no effect on the land tenure program. Those programs that *would* influence land use authorizations are discussed further in the analysis below and include the following:

- Cultural Resources
- Land Tenure
- Lands with Wilderness Characteristics
- Paleontological Resources
- Recreation
- Special Designations

Those programs that *would not* influence land tenure adjustments are not discussed further and include the following:

- Air Quality
- Back Country Byways
- Cave and Karst Resources
- Wildland Fire and Fuels Management
- Land Use Authorizations
- Livestock Grazing
- Minerals and Leasing
- Noxious Weeds
- Paleontological Resources
- Renewable Energy
- Riparian Resources
- Soils
- Special Status Species
- Travel Management
- Visual Resource Management
- Water Resources
- Wildlife and Fish

4.3.7.1.4 Impacts Common to All Alternatives

Certain program decisions would direct or influence the same land tenure adjustments in the CFO planning area regardless of which alternative is considered. These decisions and their resulting affects to land tenure adjustments are summarized in Table 4-178.

Table 4-178. Effects of Management Common to All Alternatives on Land Tenure

Resource Program	Impact to Land Tenure
Cultural Resources	Inventories or assessments for cultural resources would be required prior to approval of land disposals. Areas of cultural resource concern would not be prioritized for disposal. Protection of cultural resources would be prioritized in considerations of land acquisition and land exchange. This would limit the ability to enact land exchanges, particularly in areas of high cultural resource sensitivity.
Land Tenure	Public lands not specifically identified for disposal would be retained in BLM ownership and managed for multiple use. All lands considered for disposal would meet criteria in Sections 203, 206, or 209 of FLPMA. This means that the vast majority of land in the planning area would be identified for retention pending future requests from outside parties. BLM-administered lands within the Carlsbad Caverns National Park would be made available for exchange to accommodate the NPS objective to acquire a private inholding within the National Park amidst lands administered by the NPS; parties involved in the exchange would include the BLM, the NPS, and the private inholder. This decision would authorize consideration of a land tenure adjustment. Land disposal would avoid springs and seeps by 328 feet unless the water source has been closed. The BLM would prioritize lands for sale, exchange, or title transfer based on whether said lands are needed for a federal project or resource management activity; are important to the national interest; or are not cost efficient for the BLM to manage. Existing R&PP authorizations would be terminated and converted to other land tenure adjustment methods (e.g., sale) if the criteria for disposal are met.
Paleontological Resources	Inventories or assessments for paleontological resources would be required prior to approval of land disposals. Areas of paleontological resource concern would not be prioritized for disposal. Protection of paleontological resources would be prioritized in considerations of land acquisition and land exchange. This would limit the ability to enact land exchanges, particularly in areas of high paleontological resource sensitivity.
Special Designations	All WSAs (7,086 acres) would be specifically retained in federal ownership, making these lands unavailable for disposal or exchange.

4.3.7.1.5 Impacts Common to All Action Alternatives

A small number of program management decisions specific to only the action alternatives affect whether the CFO would authorize land tenure adjustments. These decisions and their interaction with land use authorizations are summarized in Table 4-179.

Table 4-179. Effects of Management Common to All Action Alternatives on Land Tenure

Resource Program	Impact to Land Tenure
Land Tenure	All springs and seeps would be closed or withdrawn from mineral disposal and locatable minerals use allocations. Land tenure adjustments would not be made for disposal of these lands for the purposes of mineral resource uses. If the Federal Land Transaction Facilitation Act is reauthorized, lands available for disposal would have to meet the Federal Land Transaction Facilitation Act criteria for disposal. Acquisition priorities (not in priority order) would include: • Endangered, threatened, proposed, or candidate species habitat; • BLM Type 2 sensitive species habitat; • lands within special designations; • riparian areas; • lands containing known archaeological, paleontological, or historical values determined to be unique or of traditional or scientific importance; • lands that would provide public access to public lands, including but not limited to river access and areas of high recreation value; • lands that would help consolidate public land; and • lands that would help improve livestock grazing management. Variances for disposal of land in areas identified for retention could be authorized to facilitate state exchanges if doing so would consolidate blocks of public land, consistent with multiple use objectives, and there is a compelling need.
Lands with Wilderness Characteristics	All lands with wilderness characteristics would be specifically designated for retention in federal ownership. The actual acreage of designated lands with wilderness characteristics varies by alternative and is summarized in Table 4-180 below.

4.3.7.1.6 Impacts of Program Decisions on Land Tenure

Impacts from Program Decisions by Alternative

As noted above, land tenure adjustments are affected by decisions in other resource programs or by requests from outside parties. Programs that specifically identify lands for disposal or retention establish priorities for land tenure adjustments. The amount of land identified for retention or disposal by the resource programs varies by alternative, save for those areas listed in the sections above that would be designated across all alternatives or all action alternatives. Table 4-180 provides a summary of acres identified for retention and disposal under the different alternatives. Map 3-32 displays the No Action Alternative disposal areas and Maps 2.63 through 2.66 display the proposed disposals for Alternatives A through D, respectively. All remaining lands administered by the CFO would be identified for retention pending future requests for land tenure adjustments.

Table 4-180. Acres of Land Tenure Adjustments by Alternative

Action	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Disposal	218,318	18,703	26,125	31,536	51,579
Retention	1,872,747	2,070,580	2,063,155	2,057,744	2,037,362

As Table 4-180 above illustrates, the No Action Alternative would designate more than four times as much land to disposal than any other alternative. It would also designate less land to retention than any alternative. Alternative A would designate the least land to disposal and the most to retention. Alternatives B, C, and D would be roughly comparable to each other in terms of land tenure adjustments, but of these three alternatives, Alternative D would designate the most land to disposal, and Alternative B would designate the most land for retention.

4.4 SPECIAL DESIGNATIONS

There are four types of special designations relevant to the impacts analysis in this chapter: ACECs, WSAs, WSRs, and the Dark Canyon and Guadalupe Backcountry Byways (Table 4-181).

Table 4-181. Special Designations in the Planning Area

Special Designations	No Action Alternative*	Alternative A	Alternative B	Alternative C	Alternative D
ACECs	6 ACECs 13,435 acres	9 ACECs 495,042 acres	15 ACECs 561,441 acres	8 ACECs 98,563 acres	5 ACECs 28,894 acres
WSAs	4 WSAs 7,086 acres	4 WSAs 7,086 acres	4 WSAs 7,086 acres	4 WSAs 7,086 acres	4 WSAs 7,086 acres
WSRs	None	2 WSR segments suitable	1 WSR segment suitable	1 WSR segment suitable	1 WSR segment suitable
Backcountry byways	Dark Canyon and Guadalupe	Guadalupe	Guadalupe	Dark Canyon and Guadalupe	Dark Canyon and Guadalupe

* The No Action Alternative includes other existing special designations, including RNAs, ONAs, and SMAs. Information on existing special designations is found in Section 3.4, Special Designations, of this RMP/EIS.

As described in the footnote above, current specially designated areas would be retained under the No Action Alternative. Under the action alternatives (Alternatives A through D), some of the existing ACECs would be retained. However, most of these special designations (including all RNAs, ONAs, and SMAs are replaced and redesignated as ACECs and the action alternatives replace the existing management activities in these areas with other management activities, as identified in the analysis below.

Management of specially designated areas focuses on allowing uses or activities that are compatible with the specific special resources of concern, while restricting any uses or activities that would impact those identified value(s). In the case of ACECs, under FLPMA, the BLM is required to manage an ACEC to protect its specific identified relevant and important values. For WSAs, the FLPMA requires the BLM to maintain wilderness characteristics. For river segments that are eligible for congressional designation into the NWSRS, the Wild and Scenic Rivers Act focuses management on protecting the specific, identified, outstandingly remarkable values, free-flowing nature, and tentative classifications for eligible river segments. For Backcountry Byways, BLM Handbook, 8357-1 mandates the BLM to focus management on providing opportunities for scenic driving and educational interpretation of unique features found along a designated road. This impact analysis will determine how each alternative impacts the relevant and important values for ACECs, the wilderness characteristics in WSAs, the outstandingly remarkable values for WSRs, and scenic driving and educational interpretation opportunities for Backcountry Byways.

4.4.1 Areas of Critical Environmental Concern

ACECs are areas where special management attention is needed to protect and prevent irreparable damage to important historical, cultural, and scenic values, fish, or wildlife resources, or other natural systems or processes, or to protect human life and safety from natural hazards (BLM Manual 1613 – Areas of Critical Environmental Concern). To qualify as an ACEC, an area must meet one or more of the following criteria (43 CFR 1610.7-2 and BLM Manual 1613 – Areas of Critical Environmental Concern):

- A significant historical, cultural, or scenic value (including but not limited to rare or sensitive archeological resources and religious or cultural resources important to Native Americans).
- A fish and wildlife resource (including but not limited to habitat for endangered, threatened, or sensitive species, habitat for pollinators, or habitat essential for maintaining species diversity).
- A natural process or system (including but not limited to endangered, sensitive, or threatened plant species; rare, endemic, or relic plants or plant communities that are terrestrial, aquatic, or riparian; or rare geological features).
- Natural hazards (including but not limited to areas of avalanche, dangerous flooding, landslides, unstable soils, seismic activity, or dangerous cliffs). A hazard caused by human action may meet the relevance criteria if it is determined through the RMP process that it has become part of a natural process.

4.4.1.1 Analysis Methods

4.4.1.1.1 Indicators

In this analysis, potential impacts to proposed ACECs are assessed quantitatively using acres of land where potential development or management actions would degrade or improve the relevant and important values for which the proposed ACEC is managed. For example, if an ACEC is designated to protect fragile soils and threatened and endangered species, then any acres of development or management actions within this ACEC that disturb fragile soils or affect habitat for threatened and endangered species would be degraded.

4.4.1.1.2 Methods and Assumptions

For an area to be designated as an ACEC, it must meet the criteria of "relevance" and "importance" and require special management to protect the relevant and important values as described in 43 CFR 1610.7-2 and BLM Manual 1613. This analysis focuses on impacts to these values. These impacts are described in detail under the No Action Alternative. The subsequent impacts analysis for the action alternatives (A, B, C, and D) discloses their level of impact in comparison to the No Action Alternative.

ACECs are areas that are subject to special management to protect relevant and important values. While standard management includes compliance with policy, laws, and mandates, special management typically includes restrictive prescriptions such as closures to mineral development, closures or limits on OHV use, and stipulations to protect resource values.

Adverse effects to the relevant and important values for each ACEC under all action alternatives primarily occur as a result of surface disturbance. To assess effects to the relevant and important values for each ACEC, the analysis assumes that any areas open to activities that cause surface disturbance within an ACEC, that surface disturbance would occur in that area sometime during the life of the RMP. The analysis also assumes that the more surface disturbance that occurs within an ACEC, the more the relevant and important values are adversely affected under a particular alternative.

4.4.1.2 Proposed Areas of Critical Environmental Concern

Under the action alternatives, the BLM proposes new ACECs and continued management of some existing ACECs. Table 4-182 summarizes the proposed ACECs by alternative. This section only discusses the proposed new ACECs and their resources and values. Any ACECs unchanged from the 1988 RMP are described in Chapter 3. Table 4-183 identifies the acres and percentage of the proposed ACEC that encompass the 1988 special designations. This table helps identify which special designations would continue to apply to the area under the No Action Alternative.

Table 4-182. Existing and Proposed Areas of Critical Environmental Concern by Alternative (acres)

ACEC	No Action	Alternative A	Alternative B	Alternative C	Alternative D
Birds of Prey	–	349,355	349,355	–	–
Blue Springs Riparian	444	–	–	–	–
Boot Hill	–	–	1,065	–	–
Carlsbad Chihuahuan Desert Rivers	–	108,474	–	–	–
Cave Resources	*	19,625	19,625	19,625	19,625
Chosa Draw	2,797	–	–	–	–
Dark Canyon	1,525	–	–	–	–
Desert Heronries	–	–	48,708	–	–
Gypsum Soils	–	–	65,562	65,554	–

ACEC	No Action	Alternative A	Alternative B	Alternative C	Alternative D
Laguna Plata	*	4,496	4,496	–	–
Lonesome Ridge	2,981	3,021	3,021	3,021	3,021
Maroon Cliffs	*	–	8,659	–	–
Pecos Bluntnose Shiner	*	201	201	201	201
Pecos River Canyons Complex	5,688	4,115	4,115	4,115	–
Pope's Well	81	–	81	81	–
Salt Playas	–	–	49,772	–	–
Seven Rivers Hills	*	–	1,027	1,027	1,027
Serpentine Bends	–	5,019	5,019	5,019	5,019
Six Shooter Canyon	–	735	735	–	–

"–" denotes no ACEC designated under that alternative.
* Under the No Action Alternatives, these areas are not managed as ACECs but through other existing special designations (RNAs, ONAs, SMAs, or WSAs). See Chapter 3, Section 3.4, for more information these other designations.

Table 4-183. Existing Special Designations within Proposed Areas of Critical Environmental Concern

Proposed ACEC	BLM Surface Ownership Acreage of Proposed ACEC	Acres of 1988 RMP Special Designations within Proposed ACEC	Percentage of Proposed ACEC with 1988 RMP Special Designations
Birds of Prey	349,355	No special designations	–
Boot Hill	1,065	387 acres Paco Site SMA	36.3%
Carlsbad Chihuahuan Desert Rivers	108,483	2,835 acres Chosa Draw ACEC 553 acres Yeso Hills RNA 2,835 acres Cave Resources SMA 23,760 acres Guadalupe Escarpment Scenic Area 2,470 acres Pecos River Corridor SMA 290 acres Springs Riparian HMA	2.6% 0.5% 2.6% 22.0% 2.7% 0.3%
Cave Resources	19,625	2,835 acres Chosa Draw ACEC 629 acres Dark Canyon ACEC 493 acres Dry Cave RNA 8,141 acres Cave Resources SMA 7,156 acres Guadalupe Escarpment Scenic Area	14.4% 3.2% 2.5% 41.4% 36.4%
Desert Heronries	48,711	80 acres Pope's Well SMA 760 acres Maroon Cliffs CRMA 27,254 Phantom Banks Heronries SMA	0.16% 1.56% 56.0%
Gypsum Soils	65,564	2,835 acres Chosa Draw ACEC 553 acres Yeso Hills RNA 2,835 acres Cave Resources SMA 20,524 acres Guadalupe Escarpment Scenic Area 2,466 acres Pecos River Corridor SMA 290 acres Springs Riparian HMA	4.3% 0.8% 4.3% 31.3% 3.7% 0.4%
Laguna Plata	4,496	4,455 acres Laguna Plata SMA	99.0%
Lonesome Ridge	3,021	2,981 acres Lonesome Ridge ACEC, ONA, and SMA 86 acres Guadalupe Escarpment Scenic Area	98.6% 2.8%

Proposed ACEC	BLM Surface Ownership Acreage of Proposed ACEC	Acres of 1988 RMP Special Designations within Proposed ACEC	Percentage of Proposed ACEC with 1988 RMP Special Designations
Maroon Cliffs	8,659	8,727 acres Maroon Cliffs CRMA	100.0%
Pecos Bluntnose Shiner	201	201 acres Bluntnose Shiner HMA	100.0%
Pecos River Canyons Complex	5,688	4,101 acres Pecos River Canyons Complex ACEC 641 acres Pecos River Canyons Complex RNA 1,780 acres Bear Grass Draw SMA	99.7% 15.6% 43.0%
Pope's Well	81	81 acres Pope's Well SMA	100%
Salt Playas	49,772	4,455 acres Laguna Plata SMA	9.0%
Serpentine Bends	5,019	708 acres Dark Canyon ACEC 49 acres Cave Resources SMA 3,502 acres Dark Canyon Scenic Area	14.1% 0.97% 70.0%
Seven Rivers Hills	1,027	522 acres Seven Rivers Hills SMA	51.0%
Six Shooter Canyon	735	No special designations	–

Note: HMA = Habitat Management Area.

4.4.1.2.1 Direct and Indirect Impacts

Impacts of Actions on Areas of Critical Environmental Concern

With the No Action Alternative six currently designated ACECs would be designated and continue to be managed as ACECs, and their relevant and important values, including historic, cultural, scenic, and fish and wildlife resources, would continue to be protected, subject to valid existing rights. Alternative A would designate nine areas as ACECs, Alternative B would designate 15 areas as ACECs, Alternative C would designate eight areas as ACECs, and Alternative D would designate five areas as ACECs. See Table 4-183 above for acreages under the No Action Alternative and each action alternative.

Surface disturbance would increase soil erosion, which can negatively impact cultural and paleontological resource sites and increase sedimentation in streams. Increased sedimentation in streams would modify riparian habitat for fish and wildlife, and degrade karst resources. Surface disturbance can also modify vegetation, which changes habitat for sensitive, threatened, or endangered fish and wildlife. Vegetation modification can also change scenery values and reduce scenic quality. Finally, surface disturbance caused by the installation of oil and gas, renewable energy, or transmission line infrastructure would modify the scenic quality by introducing human objects into the natural environment.

For mineral and renewable energy development, the more acres where mineral and renewable energy development is open within existing and potential ACECs, the fewer acres within the ACEC that retain relevant and important values. In areas where mineral or renewable energy development would be allowed, the likelihood of surface disturbance affecting relevant and important values would be greater in areas where mineral or renewable leasing is open than in areas where leasing is open with moderate or major constraints. Areas that are closed to mineral or renewable leasing or withdrawn from leasing would have little or no adverse effect to the relevant and important values within an ACEC.

Areas that are designated as OHV limited travel, either to existing or designated routes, would provide some protection to relevant and important values by minimizing surface disturbance, but adverse effects to relevant and important values may occur within existing or designated routes. Areas closed to OHV use would have no adverse effect to relevant and important values. Areas open to grazing within an ACEC under various action alternatives would increase the likelihood of adverse effects through trampling of any relevant and important values that are sensitive to soil compaction and erosion, such as cultural resource sites.

With the proposed RMP and all alternatives, relevant and important values of existing and potential ACECs would benefit from the special management attention they would receive if designated, including development of comprehensive, integrated activity plans in some cases. The plans would address the maintenance and development of OHV or non-motorized trails to avoid areas where relevant and important values occur. Activity plans would also identify facilities necessary to maintaining relevant and important values, and siting of other surface-disturbing activities that would be complementary to the relevant and important values of each ACEC.

In the proposed RMP and alternatives where some potential ACECs would not be designated or where surface disturbance would occur, the relevance and importance of these areas may be at some risk of irreparable damage during the life of the RMP, depending on the specific resource use or other actions proposed by the proposed RMP or alternative.

Decisions that would generally have a positive impact on existing and potential ACECs, regardless of whether the proposed RMP or other alternative is chosen, include those involving fire, soil and watershed, and vegetation (including riparian and upland vegetation) management. Vegetation treatments would restore vegetative communities to resemble more natural ecosystems in the long term, which are important to protecting the identified relevant and important values in some of the ACECs.

Birds of Prey Grasslands

The Birds of Prey Grasslands area contains important avian wildlife resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternatives A and B, this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative, Alternative C, and Alternative D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Birds of Prey Grasslands area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

Under the No Action Alternative, the Birds of Prey Grasslands area (349,355 acres) would not be managed as an ACEC, but would instead be managed according to the following management prescriptions. Mineral leasing decisions for the Birds of Prey Grasslands ACEC are summarized in Table 4-184. Approximately 298,778 acres would be excluded from solar energy development and the remainder open. For wind energy development, 166,059 acres would be open and 174,446 acres would be an avoidance area. Under the No Action Alternative, 201,443 acres under leasables would be open with standard terms and conditions; 349,354 open under salables and locatable minerals would be open on all lands, also with standard terms and conditions. OHV-limited travel as well as livestock grazing would be open on 340,511 acres (97%) under this alternative. According to draft guidelines for raptor conservation in the western United States, surface disturbance from mineral development, renewable energy development, OHV use, and grazing can result in the following effects to avian resources (USFWS 2008):

- physical destruction of important raptor habitat components;
- displacement of raptors from high-valued habitat and use of areas during crucial time periods (i.e., nesting, roosting);
- direct human caused stress, physical impairment, or mortality; and
- exposure to contamination.

Because the No Action Alternative would maintain existing surface-disturbing activities from mineral development and livestock grazing, there is little additional protection to raptor habitat besides the spatial buffers for raptors and the general prescriptions for the Aplomado Falcon which is common to all alternatives, causing an increased potential for the aforementioned effects. Therefore, the No Action Alternative would have the greatest impact on the relevant and important values for the area.

Alternatives A and B

Under Alternatives A and B, approximately 349,355 acres would be designated as the Birds of Prey Grasslands ACEC to protect avian wildlife resources. Mineral leasing decisions for the Birds of Prey Grasslands ACEC are summarized in Table 4-184.

Under both alternatives approximately 348,000 acres would be closed to geothermal development. Both wind and solar development would be excluded from approximately 340,000 acres within this ACEC. (see Table 4-185). All travel would be OHV-limited for both alternatives. Approximately 340,500 acres would be closed to livestock grazing under Alternative A, while only 1,450 acres would be closed to grazing under Alternative B.

Reduced potential for surface disturbance under these alternatives would reduce the potential for adverse effects compared to the No Action Alternative, including physical destruction of important raptor habitat components; displacement of raptors from high-valued habitat and use of areas during crucial time periods (i.e., nesting, roosting); direct human caused stress, physical impairment, or mortality; and exposure to contamination. These management actions would preserve raptor and prey habitat, with indirect positive benefits to other wildlife that use those habitats. Therefore, both alternatives would preserve and protect the relevant and important raptor and avian wildlife values of the area.

Alternative C

Under Alternative C, the Birds of Prey Grasslands area (349,253 proposed acres) would not be managed as an ACEC, but would instead be managed according to the following management prescriptions. Table 4-184 provides mineral leasing options for this alternative by acres of land within the ACEC. Under this alternative, pipelines, transmission lines, and other linear infrastructure would utilize existing corridors, where possible. The BLM would identify corridors through the area for routing infrastructure. Approximately 226,231 acres of the area would be open for geothermal energy development, while 96% would be excluded from solar energy development. The same approximate area percentage (96%) would be classified as an avoidance area to wind energy development (see Table 4-185).

OHV travel would be OHV limited on 97% of the area, and fire suppression, and geophysical exploration would be OHV limited. Livestock grazing would be open for most of the area (97%) under Alternative C. Compared to the No Action Alternative, these management actions would help to preserve raptor habitat, with indirect positive benefits to wildlife that use that type of habitat. The actions would also reduce the potential for stress, impairment, and mortality and reduce exposure to contaminants from resource development. These stipulations and conditions would maintain habitat for important raptor prey species and preserve the relevant and important wildlife values in the area.

Alternative D

Under Alternative D, the Birds of Prey Grasslands area (349,282 acres) would not be managed as an ACEC, but would instead be managed according to the following management prescriptions. Mineral leasing decisions for the Birds of Prey Grasslands ACEC are summarized in Table 4-184. Under Alternative D, leasable mineral would be open with moderate constraints on 27.3% of the area. Approximately 254,500 acres would be open to salable minerals and 349,282 acres would be open to locatable minerals, both under standard terms and conditions. Solar (96%) and wind (96%) renewable energy development would be closed or avoided for most of the area. Travel for the majority of the area (97%) would be classified as OHV limited, and fire suppression, and geophysical exploration would be limited to existing trails/ Livestock grazing would be open in most of the area.

As discussed above, surface disturbance from resource development can result in destruction of habitat; displacement of raptors from habitat during crucial time periods; human-caused stress, physical impairment, or mortality; and exposure to contamination (USFWS 2008). Although this alternative provides increased protection compared to the No Action Alternative, Alternative D has little protection for raptor habitat from surface-disturbing activities caused by mineral development and livestock grazing, causing an increased potential for the aforementioned effects. Therefore, the alternative would reduce protections for the relevant and important values within the area.

Table 4-184. Mineral Leasing Options for the Birds of Prey Grasslands Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***349,355***	***349,355***	***349,355***	***349,253***	***349,282***
Leasable: open with standard terms and conditions	201,443 (58%)	0	0	226,302 (65%)	254,777 (73%)
Leasable: open with moderate constraints (CSU)	138,311 (40%)	91 (<1%)	0	122,951 (35%)	94,504 (27%)
Leasable: open with major constraints (NSO)	0	0	0	0	0
Leasable: closed	9,600 (3%)	349,264 (100%)	349,355 (100%)	0	0
Salable: open with standard terms and conditions	349,354 (100%)	94 (<1%)	0	225,965 (65%)	254,536 (73%)
Salable: open with special terms and conditions (CSU)	0	226,119 (65%)	196,357 (56%)	123,024 (35%)	94,472 (27%)
Salable: avoid	0	0	0	0	0
Salable: closed	0	123,142 (35%)	152,997 (44%)	200 (<1%)	200 (<1%)
Locatable: open with standard terms and conditions	349,354 (100%)	320,594 (92%)	339,547 (97%)	349,253 (100%)	349,282 (100%)
Locatable: recommended for withdrawal	0	28,613 (8%)	9,661 (3%)	0	0

Table 4-185. Renewable Energy Leasing within the Birds of Prey Grasslands Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***349,355***	***349,355***	***349,355***	***349,253***	***340,413***
Geothermal: open	50,578 (14%)	437 (<1%)	596 (<1%)	226,231 (65%)	254,764 (75%)
Geothermal: close	298,778 (86%)	348,918 (99%)	348,755 (99%)	122,998 (35%)	94,502 (25%)
Solar: variance	41,782 (12%)	0	0	4,486 (1%)	4,484 (1%)
Solar: exclude	298,778 (86%)	340,511 (98%)	340,511 (98%)	335,927 (96%)	335,932 (99%)
Wind: open	166,059 (48%)	596 (<1%)	596 (<1%)	596 (<1%)	4,477 (1%)
Wind: avoid	174,446 (50%)	0	0	339,808 (97%)	335,928 (99%)
Wind: exclude	0	339,915 (97%)	339,915 (97%)	0	0

Boot Hill District

The Boot Hill District area contains important cultural and paleontological resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternative B this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative and Alternatives A, C, and D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Boot Hill District area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative actions would not designate the Boot Hill District as an ACEC and would not afford the area special management protection. However, under the No Action Alternative, other resource decisions would continue to protect relevance and important cultural and paleontological values. Cultural and paleontological resources are adversely affected by surface disturbance, where removal of soil and rock can permanently alter or negatively impact the key features or attributes of a cultural or paleontological artifact.

Under the No Action Alternative, 679 acres (64%) would be open with moderate constraints to leasable minerals with standard terms and conditions, and the remainder (387 acres, or 36%) of the area would be open with major constraints. Salable and locatable minerals would be open with standard terms and conditions across the entire 1,065 acres. Renewable wind development would be open on 679 acres (64%) and would be avoided on the remainder (387 acres, or 36%) of the area. Solar energy development would be excluded under the No Action Alternative. Travel would be OHV limited, while fire suppression and geophysical exploration would be restricted to existing routes. Livestock grazing would be open across all 1,065 acres. While this alternative would provide the least amount of protection to cultural and paleontological resources in the area, the stipulations that restrict surface disturbance until a representative area were excavated would reduce the potential for destruction of important cultural and paleontological artifacts and would help preserve the relevant and important cultural and paleontological values in the area.

Alternatives A, C, and D

Alternatives A, C, and D would not designate the Boot Hill District as an ACEC, but special protections would still be in place to preserve relevant and important values. All three alternatives would be only open to leasable minerals development with major constraints for the entire area. Salable mineral development would be closed and locatable mineral development withdrawn from the area. Wind, solar, and geothermal energy would be excluded or closed from the area. OHV use, fire suppression, and geophysical exploration would be restricted to existing routes, and livestock grazing would be open. Compared to the No Action Alternative, restrictions on mineral development, renewable energy development and OHV travel would be greater under Alternatives A, C, and D. The restrictions on development and stipulations on surface-disturbing activities would still provide protection to cultural and paleontological resources in the area and would preserve the relevant and important cultural and paleontological values in the area.

Alternative B

Under Alternative B, the BLM would designate 1,065 acres as the Boot Hill District ACEC. The area would be managed to protect cultural and paleontological resources. The ACEC would be closed to leasable minerals development. Salable mineral development would be closed and locatable mineral development withdrawn from the area. Wind, solar, and geothermal energy would be excluded or closed from the area. OHV use, fire suppression, and geophysical exploration would be restricted to existing routes, and livestock grazing would be open. Compared to the No Action Alternative, the management actions under Alternative B would provide the greatest protections for cultural and paleontological resources. This alternative would protect and preserve relevant and important cultural and paleontological values.

Carlsbad Chihuahuan Desert Rivers

The Carlsbad Chihuahuan Desert Rivers area contains important historic, cultural, scenic, fish and wildlife, karst, paleontological, riparian, soils, and special status plant resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternative A, this area would be designated and managed as an ACEC to protect these values. However, Alternatives B and C would designate portions of the area as the Gypsum Soils ACEC instead. Under the No Action Alternative and Alternative D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Carlsbad Chihuahuan Desert Rivers area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative actions would not designate the Carlsbad Chihuahuan Desert Rivers as an ACEC and would not afford special management protection as the Carlsbad Chihuahuan Desert Rivers ACEC. However, existing special designations provided by the Chosa Draw ACEC, Yeso Hills RNA, Cave Resources SMA, Guadalupe Escarpment Scenic Area, Pecos River Corridor SMA, and the Springs Riparian Habitat Management Area (HMA) would still apply to the area. Table 4-186 provides mineral leasing options for this alternative by acres of land within the ACEC. The vast majority of the area would be open to leasable, salable, and locatable minerals with standard terms and conditions. Solar renewable energy development would be excluded from the majority of the area. Approximately 36% of the area would be open to wind development with the remainder designated as an avoidance area.

Under the No Action Alternative, travel would be OHV limited throughout most of the area (94%), with the remainder of the area closed to OHV travel. Grazing would be open on 94% of the area. Surface disturbance associated with resource development and use can introduce the following effects:

- Negatively impact fish, wildlife, and plant habitat;
- increase erosion of highly erodible soils;
- introduce sediment to streams and karst systems (thereby affecting habitat and karst function); and
- Negatively impact historical, cultural, and paleontological artifacts.

The No Action Alternative would maintain existing actions that open most of the area to mineral development and grazing. This would increase the potential for surface disturbance in the area, causing an increase in the above described effects for the area. These management actions would only protect some, but not all cultural, historic, paleontological, scenic, karst, and soil resources, as well as riparian and karst habitat, with indirect adverse effects to fish, wildlife, and special status plants that use those types of habitat. Therefore, this alternative would provide the least protection to the relevant and important values for the area.

Alternative A

Under Alternative A, 108,474 acres would be designated as the Carlsbad Chihuahuan Desert Rivers ACEC and would be managed to protect historic, cultural, scenic, fish and wildlife, karst, paleontological, riparian, soils, and special status plant resources. In addition, under this alternative, portions of the area would also be designated as the Cave Resources ACEC. In areas where both ACECs occur, the ACEC with more restrictive management actions takes precedence. See the analysis for the Cave Resources ACEC below for more information on management actions under this alternative.

Table 4-186 provides mineral leasing options for this alternative by acres of land within the ACEC. Over 65% of the ACEC would be open to mineral development (leasable, salable, and locatable minerals) under this alternative.

For Alternative A, renewable energy development would be open on 67% of the ACEC with 33% excluded from renewable energy development (see Table 4-187). The ACEC would require BMPs to protect scenic values, particularly along the Black River. Travel would be OHV limited for the majority of the acreage, with 1,953 acres would be closed to OHVs. Livestock grazing would be closed under this alternative. Compared to the No Action Alternative, these management actions would help protect cultural, historic, paleontological, scenic, karst, and soil resources, as well as riparian and karst habitat, with indirect positive benefits to fish, wildlife, and special status plants that use those types of habitat. This alternative would preserve and provide the greatest protection to relevant and important values.

Alternatives B and C

Alternatives B and C would not designate the area as the Carlsbad Chihuahuan Desert Rivers ACEC, but instead would designate approximately 51% of the area as the Gypsum Soils ACEC. Effects to relevant and important values from those alternatives are discussed in the proposed Gypsum Soils ACEC section below.

Alternative D

Under Alternative D, this area would not be designated as an ACEC. Almost 90% of the area would be open to leasable, salable, and locatable mineral development (see Table 4-186) and 87% would be open to renewable energy development (see Table 4-187). For most of the area, travel would be OHV limited and livestock grazing would be open.

The area would be managed under existing prescriptions for riparian areas, floodplains, or wetlands. Existing prescriptions would also be used for cultural resources and threatened and endangered plant species. However, Alternative D would open most of the area to mineral, renewable energy development, and grazing. This would increase the potential for surface disturbance in the area, causing similar effects to those described under the No Action Alternative for the area. The existing prescriptions would only protect some, but not all cultural, historic, paleontological, scenic, karst, and soil resources, as well as riparian and karst habitat, with indirect adverse effects to fish, wildlife, and special status plants that use those types of habitat. Because much of the area is open to mineral leasing with standard terms and conditions, this alternative, along with the No Action Alternative, would have the greatest impact on the relevant and important values for the area.

Table 4-186. Mineral Leasing Options for the Carlsbad Chihuahuan Desert Rivers Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***108,483***	***108,474***	***108,472***	***108,473***	***108,484***
Leasable: open with standard terms and conditions	101,573 (94%)	71,191 (66%)	66,003 (61%)	73,759 (68%)	94,230 (87%)
Leasable: open with moderate constraints (CSU)	0	0	3,196 (3%)	22,719 (21%)	2,847 (3%)
Leasable: open with major constraints (NSO)	4,112 (4%)	10,225 (9%)	32,321 (30%)	5,629 (5%)	8,608 (8%)
Leasable: closed	2,799 (3%)	27,058 (25%)	6,952 (6%)	6,365 (6%)	2,799 (3%)
Salable: open with standard terms and conditions	102,881 (95%)	71,192 (66%)	68,866 (63%)	75,241 (69%)	95,345 (88%)
Salable: open with special terms and conditions (CSU)	0	0	419 (<1%)	20,213 (19%)	3,977 (4%)
Salable: avoid	0	0	0	0	0
Salable: closed	5,566 (5%)	37,290 (34%)	39,192 (36%)	12,981 (12%)	9,147 (8%)

Mineral Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Locatable: open with standard terms and conditions	102,378 (94%)	77,487 (71%)	69,787 (64%)	96,452 (89%)	99,294 (92%)
Locatable: recommended for withdrawal	6,103 (6%)	30,955 (29%)	38,658 (36%)	11,993 (11%)	9,148 (8.4%)

Table 4-187. Renewable Energy Leasing within the Carlsbad Chihuahuan Desert Rivers Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***108,483***	***108,474***	***108,472***	***108,473***	***108,484***
Geothermal: open	4,631	71,181	68,472	73,750	94,223
Geothermal: close	103,833	37,278	40,003	34,725	14,255
Solar: variance	0	69,178 (64%)	66,439 (61%)	66,872 (62%)	90,513 (83%)
Solar: exclude	103,833 (96%)	34,649 (32%)	37,379 34%)	36,943 (34%)	13,316 (12%)
Wind: open	38,930 (36%)	68,679 (63%)	66,409 (61%)	71,113 (66%)	90,054 (83%)
Wind: avoid	64,903 (60%)	0	387 (<1%)	16,030 (15%)	2,998 (3%)
Wind: exclude	0	35,148 (32%)	37,027 (34%)	16,671 (15%)	10,770 (10%)

Cave Resources

The Cave Resources area contains important historic, cultural, fish and wildlife, and karst resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternatives A through D, this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Cave Resources area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

Only the No Action Alternative would not designate the Cave Resources area as an ACEC and would not afford special management protection as the Cave Resources ACEC. However, under the No Action Alternative, existing special designations from the Chosa Draw ACEC, Dark Canyon ACEC, Dry Cave RNA, Cave Resources SMA, and Guadalupe Escarpment Scenic Area would continue to protect many of the relevant and important values for portions of the area. Table 4-188 provides mineral leasing options for this alternative by acres of land within the ACEC. Over 40% of the area would be open to leasable, salable, and locatable minerals with standard terms and conditions. Approximately 92% of the area would be excluded or designated as avoidance from solar and wind renewable energy development (see Table 4-189). Travel would be OHV limited throughout (595 acres would be closed). Livestock grazing would be open under the No Action Alternative.

Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact fish and wildlife habitat;
- introduce sediment to streams and karst systems (thereby affecting habitat and karst function); and
- negatively impact historical and cultural artifacts.

The No Action Alternative would maintain existing actions that open most of the area to mineral development, OHV travel, fire suppression, geophysical exploration, and grazing. This would increase the potential for surface disturbance in the area, causing an increase in the above described effects for the area. These management actions would only protect some, but not all cultural, historic, and karst resources, as well as riparian and karst habitat, with indirect adverse effects to fish and wildlife that use those types of habitat. Therefore, this alternative would provide the least protection to the relevant and important values for the area.

Alternatives A through D

Under Alternatives A through D, 19,625 acres would be designated as the Cave Resources ACEC and would be managed to protect historic, cultural, fish and wildlife, and karst resources. In addition, under Alternative A, portions of the area would also be designated as the Carlsbad Chihuahuan Desert Rivers ACEC, and for Alternatives B and C portions of the area would also be designated as the Gypsum Soils ACEC. In areas where both ACECs occur, the ACEC with more restrictive management actions takes precedence. See the analysis for the Carlsbad Chihuahuan Desert Rivers ACEC above and the Gypsum Soils ACEC below for more information on management actions under these alternatives.

Table 4-188 provides mineral leasing options for this alternative by acres of land within the ACEC. All of the action alternatives would apply limitations to minerals development: over 50% of the ACEC would leasable with major constraints only, and closed to saleable and withdrawn from locatable minerals development. Under this alternative, pipelines, transmission lines, and other linear infrastructure would be excluded from any unit of this ACEC except for valid existing rights. Renewable energy development would be excluded from or closed on all BLM-administered lands in the ACEC.

For Alternatives A through D, travel would be OHV limited (595 acres closed). Livestock grazing would be open for most of Alternatives A and B and all of Alternatives C and D.

Compared to the No Action Alternative, management actions under these alternatives would help protect cultural, historic, and karst resources, as well as karst habitat, with indirect positive benefits to fish and wildlife that use those types of habitat. Alternatives A and B would provide the greatest protection to these relevant and important values as a result of more land being closed to mineral development. However, all action alternatives would preserve the relevant and important historic, cultural, fish and wildlife, and karst values of the area.

Table 4-188. Mineral Leasing Options for the Cave Resources Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on all BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***19,625***	***19,625***	***19,625***	***19,625***	***19,625***
Leasable: open with standard terms and conditions	8,554 (44%)	0	0	0	0
Leasable: open with moderate constraints (CSU)	13 (< 1%)	0	0	0	0
Leasable: open with major constraints (NSO)	0	6,128 (31%)	6,112 (31%)	6,153 (31%)	8,538 (44%)
Leasable: closed	11,058 (56%)	13,497 (69%)	13,513 (69%)	13,473 (69%)	11,087 (56%)
Salable: open with standard terms and conditions	9,105 (46%)	0	0	0	0

Mineral Leasing Options on all BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Salable: open special terms and conditions (CSU)	0	0	0	15 (< 1%)	2,424 (12%)
Salable: avoid	0	0	0	0	0
Salable: closed	10,520 (54%)	19,625 (100%)	19,625 (100%)	19,610 (100%)	17,200 (88%)
Locatable: open with standard terms and conditions	11,079 (56%)	0	6 (< 1%)	798 (4%)	2,424 (12%)
Locatable: recommended for withdrawal	9,141 (47%)	19,625 (100%)	19,625 (100%)	18,827 (96%)	17,201 (88%)

Table 4-189. Renewable Energy Leasing within the Cave Resources Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***19,625***	***19,625***	***19,625***	***19,625***	***19,625***
Geothermal: open	1,475	-	-	798	799
Geothermal: close	18,150	19,625	19,625	18,827	18,827
Solar: variance	682 (3%)	0	0	0	0
Solar: exclude	18,150 (92%)	18,832(96%)	18,832 (96%)	18,832 (96%)	18,832 (96%)
Wind: open	0	0	0	0	0
Wind: avoid	18,237 (97%)	0	0	0	0
Wind: exclude	595 (3%)	18,832 (96%)	18,832 (96%)	18,832 (96%)	18,832 (96%)

Desert Heronries

The Desert Heronries area contains important avian wildlife resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternative B this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative and Alternatives A, C, and D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Desert Heronries area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would not designate the Desert Heronries area as an ACEC and would not afford special management protection as the Desert Heronries ACEC. However, existing special designations such as the Maroon Cliffs CRMA, and Phantom Banks Heronries SMA would continue to protect many of the relevant and important values for portions of the proposed area. Table 4-190 provides mineral leasing options for this alternative by acres of land within the ACEC. Approximately 37% of the area would be open to leasable and 43% salable minerals with standard terms and conditions and 100% of the area would be open to locatable minerals. All of the area would be closed or excluded from geothermal and solar renewable energy development and 65% of the area would be under avoidance for wind energy development (see Table 4-191).

The No Action Alternative also has stipulations that close areas within a 0.25-mile radius of active heronries from mineral disposal and oil and gas activities. OHV limited travel and livestock grazing would be designated throughout (81 acres closed for both travel and grazing).

Surface disturbance associated with resource development and use can negatively impact important wildlife habitat, such as the western soapberry (*Sapindus saponaria* var. *drummondii*) tree stands that are important habitat for nesting herons. The No Action Alternative would maintain existing actions that open most of the area to mineral development, OHV travel, fire suppression, geophysical exploration, and grazing. While this would increase the potential for surface disturbance in the area, the stipulations preventing mineral activities within 0.25 mile of any active heronries would help to protect active nesting areas. A study by Short and Cooper (1985) demonstrates the importance of buffers in minimizing disturbance to heronries during important life stages. These management actions would protect much, but not all heron nesting habitat, with some indirect adverse effects to herons that use certain habitats infrequently. However, because of the stipulations preventing activities near active nests, this alternative would preserve and protect some of the relevant and important wildlife values for the area.

Alternatives A, C, and D

Alternatives A, C, and D would not designate this area as the Desert Heronries ACEC and would be managed to protect wildlife resources. Table 4-190 provides mineral leasing options for this alternative by acres of land within the ACEC. Over 70% of the ACEC would be open to mineral development with standard terms and conditions (leasable, salable, and locatable minerals) under these alternatives, and over 70% of the area would be open for renewable energy development (see Table 4-191).

For Alternatives A, C and D, travel would be OHV limited, with 81 acres closed. Livestock grazing would be open for most of Alternative A and nearly all of Alternatives C and D. These alternatives would open most of the area to mineral development, renewable energy development, and grazing and would increase the potential for surface disturbance in the area. Compared to the No Action Alternative, management actions under these alternatives would have little protection for western soapberry stands that provide critical heron nesting habitat, with indirect adverse effects to herons. Therefore, alternatives would provide the least protection to the relevant and important values of the area.

Alternative B

Under Alternative B, 48,708 acres would be designated as the Desert Heronries ACEC and would be managed to protect wildlife resources. In addition, under this alternative, land in the area would also be designated as the Pope's Well ACEC. In areas where both ACECs occur, the ACEC with more restrictive management actions takes precedence. See the analysis for the Pope's Well ACEC below for more information on management actions under this alternative. Table 4-190 provides mineral leasing options for this alternative by acres of land within the ACEC. Over 70% of the ACEC would be open to mineral development with standard terms and conditions (leasable, salable, and locatable minerals) under this alternative, and over 70% of the ACEC would be open for renewable energy development (see Table 4-191). However, Alternative B also has stipulations that protect active heronries through NSO buffers of 820 feet throughout the year and 3,281-foot buffers from February to July, which is the critical nesting period. A study by Short and Cooper (1985) demonstrates the importance of buffers in minimizing disturbance to heronries during important life stages.

OHV limited travel would be designated throughout the ACEC, with 81 acres closed to OHVs. Livestock grazing would be closed. Surface disturbance associated with resource development and use can negatively impact important wildlife habitat, such as the western soapberry tree stands that are important habitat for nesting herons. Alternative B would open most of the area to mineral development, renewable energy development, and OHV limited travel. While this would increase the potential for surface disturbance in the area, the stipulations preventing mineral activities within 820 feet during most of the year and 3,281-foot buffers during nesting would help to protect active nesting areas. Similar to the No Action Alternative, these management actions would protect much, but not all, heron nesting habitat, with some indirect adverse effects to herons that use certain habitats infrequently. However, because of the stipulations preventing activities near active nests, this alternative would preserve and protect some of the relevant and important wildlife values in the ACEC.

Table 4-190. Mineral Leasing Options for the Desert Heronries Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***48,711***	***48,708***	***48,708***	***48,708***	***48,708***
Leasable: open with standard terms and conditions	18,149 (37%)	33,946 (70%)	33,946 (70%)	35,683 (73%)	37,785 (78%)
Leasable: open with moderate constraints (CSU)	29,761 (61%)	1,737 (4%)	1,737 (4%)	12,224 (25%)	10,122 (21%)
Leasable: open with major constraints (NSO)	801 (2%)	10,823 (22%)	13,025 (27%)	801 (2%)	801 (2%)
Leasable: closed	0 (0%)	2,202 (5%)	0	0	0
Salable: open with standard terms and conditions	20,736 (43%)	33,945 (70%)	33,945 (70%)	45,708 (94%)	47910 (98%)
Salable: open with special terms and conditions (CSU)	0	1,737 (4%)	1,737 (4%)	2,202 (5%)	0
Salable: avoid	0	0	0	0	0
Salable: closed	27,974 (57%)	13,025 (27%)	13,025 (27%)	801 (2%)	801 (2%)
Locatable: open with standard terms and conditions	48,711/ (100%)	35,682 (73%)	35683 (73%)	47,910 (98%)	47,910 (98%)
Locatable: recommended for withdrawal	0	13,025 (27%)	13,025 (27%)	801 (2%)	801 (2%)

Table 4-191. Renewable Energy Leasing within the Desert Heronries Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***48,475***	***48,472***	***48,471***	***48,472***	***48,471***
Geothermal: open	236	35,682	35,682	35,682	37,785
Geothermal: close	48,475	13,025	13,025	13,025	10,923
Solar: variance	0	35,447 (73%)	35,446 (73%)	35,446 (73%)	37,549 (77%)
Solar: exclude	48,475 (100%)	13,025 (27%)	13,025 (27%)	13,025 (27%)	10,923 (23%)
Wind: open	16,764 (34%)	33,709 (70%)	33,831 (70%)	35,446 (70%)	37,547 (77%)
Wind: avoid	31,710 (65%)	1,737 (3.5%)	1,615 (3.5%)	12,224 (25%)	10,122 (21%)
Wind: exclude	0	13,025 (27%)	13,025 (27%)	801 (2%)	801 (2%)

Note: The total geothermal acreage is greater than the ACEC acreage because it includes split estate subsurface acreage.

Gypsum Soils

The Gypsum Soils area contains important historic, cultural, scenic, fish and wildlife, karst, paleontological, riparian, soils, and special status plant resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternatives B and C, this area would be designated and managed as an ACEC to protect these values. However, Alternative A would designate most of the area as the Carlsbad Chihuahuan Desert Rivers ACEC instead. Under the No Action Alternative and Alternative D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Gypsum Soils area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would not designate the Gypsum Soils area as an ACEC. However, existing special designations provided by the Chosa Draw ACEC, Yeso Hills RNA, Cave Resources SMA, Guadalupe Escarpment Scenic Area, Pecos River Corridor SMA, and the Springs Riparian HMA would still apply to the area. Under these existing special designations, NSO stipulations for future mineral leasing would apply, and future ROWs would either avoid sensitive habitat or would be excluded from within the areas. Table 4-192 provides mineral leasing options for this alternative by acres of land within the ACEC. The great majority of the area would be open to leasable, salable, and locatable minerals with standard terms and conditions. Geothermal and solar renewable energy development would be closed and excluded from the area. Approximately 16% of the area would be open to wind development with the remainder designated as an avoidance area for wind energy development (see Table 4-193).

Under the No Action Alternative, OHV travel would be limited throughout most of the area (92%), with the remainder of the area closed. Grazing would be open on 93% of the area. Most lands would be managed for VRM Class III or IV. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact fish, wildlife, and plant habitat;
- increase erosion of highly erodible soils;
- introduce structures that disrupt scenic viewsheds;
- introduce sediment to streams and karst systems (thereby affecting habitat and karst function); and
- negatively impact historical, cultural, and paleontological resources.

The No Action Alternative would maintain existing actions that open most of the area to mineral development, OHV travel, fire suppression, geophysical exploration, and grazing. This would increase the potential for surface disturbance in the area, causing an increase in the above described effects for the area. These management actions would only protect some, but not all cultural, historic, paleontological, scenic, karst, and soil resources, as well as riparian and karst habitat, with indirect adverse effects to fish, wildlife, and special status plants that use those types of habitat. Therefore, this alternative would provide little protection to the relevant and important values for the area.

Alternative A

Alternative A would designate the area as the Carlsbad Chihuahuan Desert Rivers ACEC. Approximately 35% of the area identified as the Gypsum Soils ACEC would be covered as the Carlsbad Chihuahuan Desert Rivers ACEC under Alternative A. Effects to relevant and important values from those alternatives are discussed in the proposed Carlsbad Chihuahuan Desert Rivers ACEC section above.

Alternatives B and C

Under Alternatives B and C, 62,553 acres would be designated as the Gypsum Soils ACEC and would be managed to protect historic, cultural, scenic, fish and wildlife, karst, paleontological, riparian, soils, and special status plant resources. In addition, under both alternatives, portions of the area would also be designated as the Cave Resources ACEC. In areas where both ACECs occur, the ACEC with more restrictive management actions takes precedence. See the analysis for the Cave Resources ACEC above for more information on management actions under this alternative.

Table 4-192 provides mineral leasing options for each action alternative by acres of land within the ACEC. Both alternatives would open leasable and salable mineral development on over 40% of the ACEC, with the remainder of the area either under moderate constraints, major constraints, or closed. Approximately 48% of the ACEC would be open to locatable mineral development under Alternative B and 83% under Alternative C.

Under Alternatives B and C, surface disturbance would not be allowed on slopes greater than 10%. Reserve pits would not be allowed in the ACEC under these alternatives. The ACEC would require BMPs to protect scenic values, such as requiring low profile (8 feet high or less) infrastructure in scenic areas. Renewable wind energy development would be open on 45% and 50% of the ACEC for Alternatives B and C, respectively (see Table 4-193). Travel would be OHV limited throughout with 2,229 acres closed to OHVs under Alternative B and 1,335 acres closed under Alternative C. Livestock grazing would be closed under Alternative B and open under most of Alternative C. Over 25,000 acres would be categorized as VRM Class II for Alternative B and over 11,000 acres under Alternative C. The remainder of the ACEC would be VRM Class III or IV for both alternatives. Under both alternatives, camping would be restricted to designated areas.

Alternatives B and C would open portions of the area to mineral development and renewable energy development. This would increase the potential for surface disturbance in the area, causing an increased potential for effects as described under the No Action Alternative in the area. However, management actions placed under these alternatives would help protect cultural, historic, paleontological, scenic, karst, and soil resources, as well as riparian and karst habitat, with indirect positive benefits to fish, wildlife, and special status plants that use those types of habitat. Compared to the No Action Alternative, designation of this ACEC under these alternatives would provide the greatest protection to these relevant and important values. Therefore, Alternatives B and C would preserve the relevant and important cultural, historic, paleontological, scenic, karst, and soil values in the ACEC.

Alternative D

Under Alternative D, this area would not be designated as an ACEC. Instead, the area would be managed under existing prescriptions for riparian areas, floodplains, or wetlands. Existing prescriptions would also be used for cultural resources and threatened and endangered plant species. Table 4-192 provides mineral leasing options for this alternative by acres of land within the ACEC. The great majority of the area would be open to leasable, salable, and locatable minerals with standard terms and conditions. Renewable energy development also would be open in much of the area (see Table 4-193).

Under Alternative D, OHV limited travel would be designated for most of the area (98%), with the remainder of the area closed. Grazing would be open on 98% of the area. Over 11,000 acres would be managed as VRM Class II under Alternative D. The remainder of the area would be VRM Class III or IV.

Alternative D would open most of the area to mineral development, renewable energy development, and grazing. This would increase the potential for surface disturbance in the area, causing an increased potential for effects as described under the No Action Alternative in the area. Similar to the No Action Alternative, there would be few management actions to protect cultural, historic, paleontological, scenic, karst, and soil resources, as well as riparian and karst habitat. Therefore, this alternative would have the greatest impact on the relevant and important values for the area. This alternative has the potential for adverse effects to sensitive soils, fish, wildlife, and special status plants that use those types of habitat and would provide the least protection to the relevant and important values.

Table 4-192. Mineral Leasing Options for the Gypsum Soils Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on all BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***65,564***	***65,562***	***65,553***	***65,554***	***65,564***
Leasable: open with standard terms and conditions	57,932 (92.5%)	32,575 (51%)	27,961 (44.7%)	33,947 (54%)	53997 (86%)
Leasable: open with moderate constraints (CSU)	0/0	0/0	2,970 (5%)	19,932 (32%)	371 (1%)
Leasable: open with major constraints (NSO)	4,833 (1.2%)	6,263 (10%)	27,531 (42%)	5,067 (8%)	8,397 (13%)
Leasable: closed	2,799 (4%)	26,723 (40%)	7,090 (10%)	6,608 (9%)	2,799 (7%)
Salable: open with standard terms and conditions	59,998 (96%)	32,576 (51%)	30,518 (47%)	33,969 (54%)	53,991 (86%)
Salable: open with special terms and conditions (CSU)	0	0	423 (1%)	19,750 (30%)	2,793 (<1%)
Salable: avoid	0	0	0	0 (1.6%)	0 (<1%)
Salable: closed	5,562 (9%)	32,988 (53%)	34,623 (55.6%)	11,831 (19%)	8,771 (14%)
Locatable: open with standard terms and conditions	59,462 (95%)	36,154 (57.5%)	31,148 (50%)	53,891 (86%)	56,790 (90.6%)
Locatable: recommended for withdrawal	6,100 (3%)	29,404 (44%)	34,412 (52%)	11,668 (17%)	8,766 (16%)

Table 4-193. Renewable Energy Leasing within the Gypsum Soils Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***65,564***	***65,562***	***65,553***	***65,564***	***65,564***
Geothermal: open	3,250	32,565	30,493	33,945	53,991
Geothermal: close	62,302	32,985	35,070	31,617	11,571
Solar: variance	0	31,613 (51%)	29,507 (47%)	29,627 (48%)	51,756 (83%)
Solar: exclude	62,302 (100%)	30,687 (49%)	32,784 (53%)	32,658 (52%)	10,541 (17%)
Wind: open	10,590 (17%)	31,198 (50%)	25,539 (41%)	32,493 (52%)	51,355 (83%)
Wind: avoid	51,711 (83%)	0	18 (74.5%)	14,563 (23%)	381 (1%)
Wind: exclude	0	31,102 (50%)	32,735 (52%)	15,233 (24%)	10,556 (16%)

Laguna Plata

The Laguna Plata area contains important cultural and wildlife resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under

Alternatives A and B, this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative, Alternative C, and Alternative D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Laguna Plata area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would not designate the Laguna Plata area as an ACEC. However, existing special designations under the Laguna Plata SMA would continue to protect many of the relevant and important values for portions of the proposed area. Under these existing special designations, NSO stipulations for future mineral leasing would apply, and future ROWs would either avoid sensitive habitat or would be excluded from within the areas. Table 4-194 provides mineral leasing options for this alternative by acres of land within the ACEC. The vast majority of the area would be open to major constraints to leasable minerals and closed to salable minerals. The entire area would be open to locatable minerals with standard terms and conditions. Geothermal would be managed as closed and solar renewable energy development would be excluded from the area. Only 1% of the area would be open to wind development with the remainder managed as an avoidance area for wind energy development (see Table 4-195).

Under the No Action Alternative, OHV travel would be closed on 67% of the area, with the remainder of the area as OHV. Grazing would be open on the entire area. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact wildlife habitat and
- negatively impact cultural artifacts.

The No Action Alternative would continue existing conditions that limit mineral development, renewable energy development, OHV travel, fire suppression, and geophysical exploration in most of the area. This would reduce the potential for surface disturbance in the area, allowing for increased protection of cultural and wildlife resources. Management actions under this alternative would help protect cultural resources within the Laguna Plata Archeological District and wildlife habitat for the western snowy plover. Therefore, the No Action Alternative would preserve and protect the relevant and important cultural and wildlife values for the area.

Alternatives A and B

Under Alternatives A and B, 4,496 acres would be designated as the Laguna Plata ACEC and would be managed to protect cultural and wildlife resources. Under Alternative, B, the entire acreage of the Laguna Plata ACEC would be within the boundaries of the Salt Playas ACEC. In areas where both ACECs occur, the ACEC with more restrictive management actions takes precedence. See the analysis for the Salt Playas ACEC below for more information on management actions under this alternative. Table 4-194 provides mineral leasing options for this alternative by acres of land within the ACEC. The majority of the area would be open to major constraints to leasable minerals, closed to salable minerals development, and withdrawn from locatable minerals. Renewable energy development would be managed as closed or excluded from the area (see Table 4-195).

For Alternatives A and B, OHV travel, fire suppression, and geophysical exploration would be limited to existing trails. Grazing would be open on the entire area for Alternative A and closed for Alternative B. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact wildlife habitat and
- negatively impact cultural artifacts.

Both alternatives would limit mineral development, renewable energy development, OHV travel, fire suppression, and geophysical exploration in most of the area. Similar to the No Action Alternative, management actions under these alternatives would help protect cultural resources within the Laguna Plata Archeological District and wildlife habitat for the western snowy plover. Alternatives A and B would preserve and provide the greatest protection to the relevant and important cultural and wildlife values of the area.

Alternatives C and D

Alternatives C and D would not designate this area as the Laguna Plata ACEC. Table 4-194 provides mineral leasing options for this alternative by acres of land within the ACEC. The entire area would be open with major constraints to leasable and salable minerals and withdrawn from locatable minerals. Renewable energy development would be managed as closed or excluded from the area (see Table 4-195).

For Alternatives C and D, OHV travel would be limited to existing trails. Grazing would be open on the entire area for both alternatives. Similar to the No Action Alternative, both alternatives would limit mineral development, renewable energy development, OHV travel, fire suppression, and geophysical exploration in most of the area. Management actions under these alternatives would help protect cultural resources within the Laguna Plata Archeological District and wildlife habitat for the western snowy plover. Therefore, Alternatives C and D would preserve and protect the relevant and important cultural and wildlife values of the area.

Table 4-194. Mineral Leasing Options for the Laguna Plata Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***4,496***	***4,496***	***4,496***	***4,496***	***4,496***
Leasable: open with standard terms and conditions	0	0	0	0	0
Leasable: open with moderate constraints (CSU)	41 (< 1%)	1,299 (29%)	0	0	0
Leasable: open with major constraints (NSO)	3,659 (81%)	2,401 (53%)	2,401 (53%)	4,496 (100%)	4,496 (100%)
Leasable: closed	796 (18%)	796 (18%)	796 (18%)	0	0
Salable: open with standard terms and conditions	41 (1%)	0	0	0	0
Salable: open with special terms and conditions	0	0	0	0	0
Salable: avoid	0	0	0	0	0
Salable: closed	4,455 (99%)	4,496 (100%)	4,496 (100%)	4,496 (100%)	4,496 (100%)
Locatable: open with standard terms and conditions	4,496 (100%)	0	0	0	0
Locatable: recommended for withdrawal	0	4,496 (100%)	4,496 (100%)	4,496 (100%)	4,496 (100%)

Table 4-195. Renewable Energy Leasing within the Laguna Plata Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***4,496***	***4,496***	***4,496***	***4,496***	***4,496***
Geothermal: open	0	0	0	0	0
Geothermal: close	4,496 (100%)	4,496 (100%)	4,496 (100%)	4,496 (100%)	4,496 (100%)
Solar: variance	0	0	0	0	0
Solar: exclude	4,496 (100%)	4,496 (100%)	4,496 (100%)	4,496 (100%)	4,496 (100%)
Wind: open	41 (1%)	0	0	0	0
Wind: avoid	4,455 (99%)	0	0	0	0
Wind: exclude	0	4,496 (100%)	4,496 (100%)	4,496 (100%)	4,496 (100%)

Lonesome Ridge

The Lonesome Ridge area contains important scenic, wildlife, geologic, and karst resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under the No Action Alternative and Alternatives A through D, this area would be designated and managed as an ACEC to protect these values. In addition, the Lonesome Ridge WSA overlaps portions of the ACEC and provides additional protections under all alternatives. Impacts to the Lonesome Ridge area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action would continue designation of the Lonesome Ridge area as an ACEC. Therefore, this ACEC would continue to protect the scenic, wildlife, geologic, and karst resources in the area. For the No Action Alternative, 41 acres would be open to leasable minerals with major constraints. The remainder of the ACEC would be closed for leasable minerals. The No Action Alternative would be closed to salable and locatable minerals development. Only 4% of the area would be managed as an avoidance area for wind development with the remainder closed for wind energy development.

OHV travel, fire suppression, and geophysical exploration would be OHV Limited on 41 acres, with the remainder closed to OHVs. Livestock grazing would be open for all of the Lonesome Ridge area under the No Action Alternative. Most of the area would be managed as VRM Class I, with 41 acres managed as VRM Class II.

The No Action Alternative would continue existing actions that limit mineral development, renewable energy development, OHV travel, fire suppression, and geophysical exploration in most of the area. This would reduce the potential for surface disturbance in the area, allowing for increased protection of scenic, wildlife, geologic, and karst resources. Therefore, the No Action Alternative would preserve and protect the relevant and important scenic, wildlife, geologic, and karst values for the area.

Alternatives A through D

Under Alternatives A through D, 3,021 acres would be designated as the Lonesome Ridge ACEC and would be managed to protect scenic, wildlife, geologic, and karst resources. Under these alternatives, all leasable, salable, and locatable minerals would be closed, and the area would be managed as closed or excluded from renewable energy development.

On all alternatives, OHV travel, fire suppression, and geophysical exploration would be closed. Livestock grazing would be open for all alternatives. Most of the area would be managed as VRM Class I, with 41 acres managed as VRM Class II under Alternative B. Similar to the No Action Alternative, management actions under these alternatives would help protect the scenic, wildlife, geologic, and karst resources. The measures would help protect the unique scenery of the Guadalupe Escarpment, rare habitat for nesting birds, and several caves. These alternatives would preserve the relevant and important scenic, wildlife, geologic, and karst values of the area.

Maroon Cliffs

The Maroon Cliffs area contains important cultural resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternative B this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative and Alternatives A, C, and D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Maroon Cliffs area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would not designate the Maroon Cliffs area as an ACEC. However, under the No Action Alternative, existing restrictions under the Maroon Cliffs CRMA/SMA would continue to protect many of the relevant and important values for portions of the proposed area. Table 4-196 provides mineral leasing options for this alternative by acres of land within the ACEC. For the No Action Alternative, 12 acres would be open to leasable, salable, and locatable minerals with standard terms and conditions and 8,647 acres would be open to leasable minerals with major constraints. The alternatives would close 8,647 acres to salable and locatable minerals. Geothermal and solar renewable energy development would be closed and excluded, respectively, from the area. The area would be an avoidance area for wind energy development (see Table 4-197).

Under the No Action Alternative, OHV limited travel would be designated throughout the area. Grazing would be open for the entire area. Surface disturbance associated with resource development and use can negatively impact cultural artifacts and sites. The No Action Alternative would continue existing actions that limit mineral development, renewable energy development, OHV travel, fire suppression, and geophysical exploration in most of the area. This would reduce the potential for surface disturbance in the area, allowing for increased protection of cultural resources. Management actions under this alternative would help protect cultural resources in the Maroon Cliffs area. Therefore, the No Action Alternative would preserve and protect the relevant and important cultural and wildlife values for the area.

Alternatives A, C, and D

Alternatives A, C, and D would not designate this area as the Maroon Cliffs ACEC. Table 4-196 provides mineral leasing options for this alternative by acres of land within the ACEC. Most of the entire area would be open to leasable with major constraints, and closed to salable and withdrawn from locatable development. Renewable energy development would be closed or excluded from the area (see Table 4-197).

Alternatives A, C, and D would apply OHV limited travel throughout the area. Livestock grazing would be open. Surface disturbance associated with resource development and use can negatively impact cultural artifacts and sites. Similar to the No Action Alternative, Alternatives A, C, and D would limit mineral development, renewable energy development, OHV travel, fire suppression, and geophysical exploration in most of the area. This would reduce the potential for surface disturbance in the area, allowing for increased protection of cultural resources. Management actions under this alternative would help protect cultural resources in the Maroon Cliffs area. Alternatives A, C, and D would provide the least protection to the relevant and important values of this area, but would still protect and preserve the relevant and important cultural values.

Alternative B

Under Alternative B, 8,659 acres would be designated as the Maroon Cliffs ACEC and would be managed to protect cultural resources. Table 4-196 provides mineral leasing options for this alternative by acres of land within the ACEC, with the same minerals prescriptions as the other action alternatives.

For Alternative B, travel and livestock grazing would be the same as the other action alternatives. Surface disturbance associated with resource development and use can negatively impact cultural artifacts and sites. Similar to the No Action Alternative, management actions under this alternative would help protect cultural resources within the Maroon Cliffs Archeological District. Surface-disturbing activities under this alternative would be coordinated with the New Mexico SHPO. Alternative B would provide the greatest protection to and would preserve the relevant and important cultural values.

Table 4-196. Mineral Leasing Options for the Maroon Cliffs Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***8,659***	***8,659***	***8,659***	***8,659***	***8,659***
Leasable: open with standard terms and conditions	12 (<1%)	0	0	0	0
Leasable: open with moderate constraints (CSU)	0	0	0	0	0
Leasable: open with major constraints (NSO)	8,647 (99.8%)	8,659 (100%)	8,659 (100%)	8,659 (100%)	8,659 (100%)
Leasable: closed	0	0	0	0	0
Salable: open with standard terms and conditions	12 (<1%)	0	0	0	0
Salable: open special terms and conditions (CSU)	0	0	0	0	0
Salable: avoid	0	0	0	0	0
Salable: closed	8,647 (99%)	8,659 (100%)	8,659 (100%)	8,659 (100%)	8,659 (100%)
Locatable: open with standard terms and conditions	8,659 (100%)	0	0	0	0
Locatable: recommended for withdrawal	0	8,659 (100%)	8,659 (100%)	8,659 (100%)	8,659 (100%)

Table 4-197. Renewable Energy Leasing within the Maroon Cliffs Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	8,659	8,659	8,659	8,659	8,659
Geothermal: open	0	0	0	0	0
Geothermal: close	8,659	8,659	8,659	8,659	8,659
Solar: variance	0	0	0	0	0
Solar: exclude	8,659 (100%)	8,659 (100%)	8,659 (100%)	8,659 (100%)	8,659 (100%)
Wind: open	0	0	0	0	0
Wind: avoid	8,659 (100%)	0	0	0	0
Wind: exclude	0	8,659 (100%)	8,659 (100%)	8,659 (100%)	8,659 (100%)

Pecos Bluntnose Shiner

The Pecos Bluntnose Shiner area contains important fish resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternatives A through D, this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative, the area would be managed as an HMA with existing management direction as provided for in the 1988 RMP. Impacts to the Pecos Bluntnose Shiner area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would continue designation of the Pecos Bluntnose Shiner area (201 acres) as the Bluntnose Shiner HMA, not as an ACEC. For the No Action Alternative, all acres would be open to leasable minerals with major constraints and would be closed to salable and locatable minerals. Geothermal energy development would be closed in the area and solar energy development would be excluded from the area. The area would be managed as an avoidance area for wind energy development. OHV travel would be limited and livestock grazing would be open for all of the Pecos Bluntnose Shiner area under the No Action Alternative. Surface disturbance associated with resource development and use can negatively impact fisheries habitat, either directly or by introduce sediment or contaminants to streams, thereby affecting habitat. Management actions under the No Action Alternative would help protect fish resources. These measures would help protect the unique habitat for the Pecos bluntnose shiner in the area, though grazing would have adverse impact, and would preserve the relevant and important fish values in the area.

Alternatives A through D

Under Alternatives A through D, 201 acres would be designated as the Pecos Bluntnose Shiner ACEC and would be managed to protect fish resources. Under Alternatives A and B, all leasable, salable, and locatable minerals would be closed. Renewable energy development would be excluded for both alternatives. OHV travel would be limited and livestock grazing would be closed.

Alternative C would have leasable minerals open with major constraints and all salable and locatable minerals closed. Alternative D would have all acres open to leasable minerals with moderate constraints and all salable and locatable minerals closed. Renewable energy development would be closed or excluded for Alternative C. The ACEC would be managed as closed to geothermal, excluded from solar, and avoided from wind energy development under Alternative D. OHV travel would be limited and livestock grazing would be closed for both alternatives.

Surface disturbance associated with resource development and use can negatively impact fisheries habitat, either directly through destruction and alteration of habitat or by introducing sediment or contaminants to streams. Management actions under these alternatives would help protect fish resources. Similar to the No Action Alternative, these measures would help protect the unique habitat for the Pecos bluntnose shiner in the area and would preserve the relevant and important fish values in the ACEC.

Pecos River Canyon Complex

The Pecos River Canyons Complex area contains important scenic and plant resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under the No Action Alternative and Alternatives A through C, this area would be designated and managed as an ACEC to protect these values. However, under Alternative D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Pecos River Canyons Complex area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would continue designation of the Pecos River Canyon Complex area (5,688 acres) as an ACEC. Under these existing special designations, NSO stipulations for future mineral leasing would apply, and future ROWs would either avoid sensitive habitat or would be excluded from within the areas. Table 4-198. provides mineral leasing options for this alternative by acres of land within the ACEC. Approximately 25% of the area would be open to leasable and minerals with standard terms and conditions; the area would be closed to salable and locatable minerals development. Geothermal and solar renewable energy development would be closed and excluded from the area. Approximately 5% of the area would be an avoidance area for wind development with the remainder designated as an exclusion area for wind energy development (see Table 4-199).

Under the No Action Alternative, travel would be OHV limited and 942 acres closed. Grazing would be open on the entire area. The ACEC would be managed for VRM Class II. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact plant habitat and
- introduce structures that disrupt scenic viewsheds

The No Action Alternative would maintain existing actions that open some of the area to mineral development and all of the area to grazing. This would increase the potential for surface disturbance in the area, causing an increase in the above described effects for the area. These management actions would protect some, but not all scenic and plant resources. This alternative would provide some protection to the relevant and important values of the area.

Alternatives A through C

Under Alternatives A through C, 4,115 acres would be designated as the Pecos River Canyon Complex ACEC and would be managed to protect scenic and plant resources. Table 4-198. provides mineral leasing options for each action alternative by acres of BLM-administered land within the ACEC. The entire area would be open with major constraints for leasable minerals, closed for salable minerals, and withdrawn from locatable mineral entry. The area would also be closed or excluded from renewable energy development (see Table 4-199). Under Alternatives A through C, travel would be OHV limited and livestock grazing would be open on most of the area for these Alternatives. All of the ACEC under Alternatives A and B would be managed as VRM Class II. Alternative C maintains most of the ACEC as VRM Class II (55% or 2,276 acres) with the remainder VRM Class III. Collecting plants, rocks, and fossils would be prohibited in the ACEC under all alternatives. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact plant habitat and
- introduce structures that disrupt scenic viewsheds

Compared to the No Action Alternative, management actions under these alternatives would help protect the scenic and plant resources. The measures would help protect the unique scenery of Pierce and Cedar Canyons and rare habitat for Tharp’s bluestar. These alternatives would preserve the relevant and important scenic and plant values of the area.

Alternative D

Alternative D would not designate the area as the Pecos River Canyon Complex ACEC. Instead the area would be managed consistent with the management prescriptions for the surrounding area. Table 4-198. provides mineral leasing options for each action alternative by acres of BLM-administered land within the ACEC. Approximately 90% of the area would be open to leasable, salable, and locatable minerals with standard terms and conditions. Renewable energy development would also be managed as variance (solar) or open (wind and geothermal) on 90% of the area (see Table 4-199).

Alternative D maintains most of the ACEC as VRM Class II (2,276 acres) with the remainder VRM Class III (the same as Alternative C). Travel would be OHV limited and livestock grazing would be open for this alternative. There would be no restrictions on plant and rock collection in the area. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact plant habitat and
- introduce structures that disrupt scenic viewsheds

This alternative would protect the plant relevant and important values, but would provide little protection to relevant and important scenic values. Under this alternative, there are few restrictions on surface-disturbing activities, which would introduce structures and other development that would degrade scenic viewsheds.

Table 4-198. Mineral Leasing Options for the Pecos River Canyons Complex Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on BLM-administered Surface Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***5,688***	***4,115***	***4,115***	***4,115***	***4,115***
Leasable: open with standard terms and conditions	1,366 (33%)	0	0	0	3,696 (90%)
Leasable: open with moderate constraints (CSU)	0	0	0	0	1 (<1%)
Leasable: open with major constraints (NSO)	2,743 (67%)	4,115 (100%)	4,115 (100%)	4,115 (100%)	418 (10%)
Leasable: closed	0	0	0	0	0
Salable: open with standard terms and conditions	15 (<1%)	0	0	0	3,697 (90%)
Salable: open with moderate constraints (CSU)	0	0	0	0	0
Salable: avoid	0	0	0	0	0
Salable: closed	4,100 (99%)	4,115 (100%)	4,115 (100%)	4,115 (100%)	418 (10%)
Locatable: open with standard terms and conditions	1,371 (33%)	0	0	0	3,697 (90%)
Locatable: recommended for withdrawal	2,743 (67%)	4,115 (100%)	4,115 (100%)	4,115 (100%)	418 (10%)

Table 4-199. Renewable Energy Leasing within the Pecos River Canyons Complex Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	5,688	4,115	4,115	4,115	4,115
Geothermal: open	0	0	0	0	3,696 (90%)
Geothermal: close	5,688	4,115	4,115	4,115	418
Solar: variance	0	0	0	0	3,696 (90%)
Solar: exclude	5,688 (100%)	4,115 (100%)	4,115 (100%)	4,115 (100%)	419 (10%)
Wind: open	0	0	0	0	1 (< 1%)
Wind: avoid	570 (10%)	0	0	0	1 (<1%)
Wind: exclude	5,118 (90%)	4,115 (100%)	4,115 (100%)	4,115 (100%)	418 (10%)

Pope's Well

The Pope's Well area contains important historic resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternatives B and C, this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative and Alternatives A and D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Pope's Well area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would continue designation of the Pope's Well area as an SMA. Therefore, this SMA would continue to protect the historic resources in the area. For the No Action Alternative, all acres would be open to leasable minerals with major constraints and would be closed to salable minerals and withdrawn from locatable minerals entry. Geothermal and solar energy development would be closed or excluded from the area and the area would be an avoidance area for wind energy development.

OHV travel, fire suppression, and geophysical exploration would be closed in the area and livestock grazing would be closed for all acres of the No Action Alternative. Surface disturbance associated with resource development and use can negatively impact historic sites and artifacts. I this alternative closes the entire area to surface disturbance, it would preserve and provide protection to the relevant and important historic values of the area.

Alternatives A and D

Alternatives A and D would not designate the area as the Pope's Well ACEC. For both alternatives, all acres would be open to leasable minerals with major constraints and would be closed to salable minerals and withdrawn from locatable minerals entry. Geothermal, solar, and wind energy development would be closed and excluded from the area.

OHV travel, fire suppression, and geophysical exploration would be closed in the area and livestock grazing would be closed for all acres of both alternatives. Surface disturbance associated with resource development and use can negatively impact historic sites and artifacts. The impacts would be similar to those discussed for the No Action Alternative because Alternatives A and D close the entire area to surface disturbance, they would preserve and protect the relevant and important historic values of the area.

Alternatives B and C

Under Alternatives B and C, 81 acres would be designated as the Pope's Well ACEC and would be managed to protect historic resources. In addition, under Alternative B, land in the area would also be designated as the Desert Heronries ACEC. In areas where both ACECs occur, the ACEC with more restrictive management actions takes precedence. See the analysis for the Desert Heronries ACEC above for information on management actions under this alternative. For both alternatives, all acres would be open to leasable minerals with major constraints and would be closed to salable minerals and withdrawn from locatable minerals entry. Geothermal, solar, and wind energy development would be closed and excluded from the area.

OHV travel, fire suppression, and geophysical exploration would be closed in the area and livestock grazing would be closed for all acres of both alternatives. Surface disturbance associated with resource development and use can negatively impact historic sites and artifacts. The impacts would be similar to the No Action Alternative because Alternatives B and C close the entire area to surface disturbance, they would preserve and protect the relevant and important historic values of the area.

Salt Playas

The Salt Playas area contains important cultural, fish, and wildlife resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternative B, this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative and Alternatives A, C, and D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Salt Playas area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would not designate the Salt Playas area as an ACEC. However, existing special designations (Laguna Plata Archeological District) would continue to protect the cultural resources for portions of the proposed area. Table 4-200 provides mineral leasing options for each action alternative by acres of BLM-administered land within the ACEC. Most of the acreage for the No Action Alternative would be open with standard terms and conditions for leasable, salable, and locatable minerals. Geothermal and solar energy development would be closed or excluded from the area and 57% of the area would be open for wind energy development (see Table 4-201).

Travel would be OHV limited on 93% of the rest closed to OHVs. Livestock grazing would be open for the entire area under the No Action Alternative. This would increase the potential for surface disturbance at cultural resource sites and important playa habitat for fish and wildlife. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact fish and wildlife habitat;
- introduce sediment to streams (thereby affecting fish habitat); and
- negatively impact cultural artifacts.

While the existing special designation would protect cultural resources in the archeological district, fish and wildlife habitat in other portions of the playas would have little protection from surface disturbance or from changes to water levels during spring and early summer nesting periods. Therefore, this alternative would provide the least protection to the relevant and important, fish, and wildlife values of the area.

Alternatives A, C, and D

Alternatives A, C, and D would not designate this area as the Salt Playas ACEC. Table 4-200 provides mineral leasing options for each action alternative by acres of BLM-administered land within the ACEC. The majority of acreage for these alternatives, mineral leasing would be open with standard terms and conditions for leasable, salable, and locatable minerals. Approximately 86% of the area would be managed as open to geothermal and wind and managed as a variance area for solar energy development.

For all three alternatives, OHV travel would be limited. Livestock grazing would be open for all three alternatives. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact fish and wildlife habitat;
- introduce sediment to streams (thereby affecting fish habitat); and
- negatively impact cultural artifacts.

This would increase the potential for surface disturbance at cultural resource sites and important playa habitat for fish and wildlife. However, there would be some restrictions on the area to protect important values. Compared to the No Action Alternative, Alternatives A, C and D would provide more protection to the relevant and important values of this area. However, habitat for fish and wildlife resources that depend on the playas and cultural resources in the area would have little protection from surface disturbance, thus increasing the potential for adverse effects to those resources. These alternatives would provide little protection to the relevant and important cultural, fish, and wildlife values of the area.

Alternative B

Under Alternative B, 49,772 acres would be designated as the Salt Playas ACEC and would be managed to protect cultural, fish, and wildlife resources. In addition, 4,699 acres of the area would also be designated as the Laguna Plata ACEC under this alternative. On those acres, the BLM would apply the most restrictive actions to protect relevant and important wildlife and cultural resources. See the analysis for the Laguna Plata ACEC above for more information on management actions under this alternative. Table 4-200 provides mineral leasing options for each action alternative by acres of BLM-administered land within the ACEC. Leasable mineral development would be either open with major constraints or closed, salable minerals would be closed, and locatable minerals withdrawn from mineral entry. The area would also be managed as closed to geothermal and excluded from solar and wind energy development (see Table 4-201).

OHV travel would be limited for the entire area. Livestock grazing would be open for all of Alternative B. These restrictions would minimize surface disturbance in the area and would help to protect cultural resource sites and important playa habitat for fish and wildlife. Management actions under this alternative would help protect the cultural, fish, and wildlife resources within the Salt Playas ACEC. Compared to the No Action Alternative, this alternative would preserve and provide the greatest protection to the relevant and important cultural, fish, and wildlife values of the ACEC.

Table 4-200. Mineral Leasing Options for the Salt Playas Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***49,203***	***49,203***	***49,199***	***49,203***	***49,203***
Leasable: open with standard terms and conditions	20,360 (42%)	20,203 (41.5%)	0	20,203 (41.5%)	33,206 (68%)
Leasable: open with moderate constraints (CSU)	22,713 (45.6%)	23,971 (48%)	25 (< 1%)	22,829 (46%)	12,070 (24%)
Leasable: open with major constraints (NSO)	3,659 (7%)	2,401 (8%)	35,582 (94%)	6,740 (14%)	4,496 (9%)
Leasable: closed	3,040 (6%)	3,197 (4.8%)	14,165 (28%)	0 (< 1%)	0
Salable: open with standard terms and conditions	45,316 (92%)	22,672 (47%)	1 (< 1%)	20,203 (41.5%)	33,251 (68%)
Salable: open with special terms and conditions (CSU)	0	20,203 (41%)	47 (< 1%)	22,829 46%)	12,024 (24%)
Salable: avoid	0	0	0	0	0
Salable: closed	4,455 (9%)	6,897 (14%)	49,724 (100%)	6,740 (14%)	4,496 (9%)
Locatable: open with standard terms and conditions	49,771 (100%)	42,875 (87%)	0	45,276 (92%)	45,276 (92%)
Locatable: recommended for withdrawal	0	6,897 (14%)	49,772 (100%)	4,49 (9%)	4,49 (9%)

Table 4-201. Renewable Energy Leasing within the Salt Playas Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	***49,203***	***49,203***	***49,199***	***49,203***	***49,203***
Geothermal: open	569	42,875	-	42,874	43,031
Geothermal: close	49,203	6,897	49,771	6,897	6,740
Solar: variance	0	42,386 (86%)	0	42,386 (86%)	42,543 (86%)
Solar: exclude	49,203 (100%)	6,817 (14%)	49,199 (100%)	6,817 (14%)	6,660 (14%)
Wind: open	27,839 (57%)	20,162 (41%)	0	20,162 (41%)	20,319 (41%)
Wind: avoid	21,364 (43%)	22,224 (45%)	0	22,381 (45%)	24,388 50%
Wind: exclude	0	6,817 (14%)	49,199 (100%)	6,660 (13%)	4,496 (10%

Serpentine Bends

The Serpentine Bends area contains important historic, scenic, wildlife, and plant resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternatives A through D, this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative, the area would be managed in accordance with existing special designations and the management direction provided for other resources and resource uses. Impacts to the Serpentine Bends area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would not designate the Serpentine Bends area (5,019 acres) as an ACEC. However, existing special designations under the Dark Canyon ACEC, Cave Resources SMA, and Dark Canyon Scenic Area would continue to protect the historic, scenic, wildlife, and plant resources for portions of the proposed area. For the No Action Alternative, 1 acre would be open to leasable development, 804 acres for salable, and 809 acres for locatable minerals with standard terms and conditions and 5,018 acres closed to leasable, and approximately 4,215 closed/withdrawn from salable and locatable minerals. Solar energy development would be managed as excluded on 4,195 acres. The remainder (21 acres) would be managed as a variance area for solar development. Wind energy development would be avoided on 3,578 acres and 638 acres excluded from wind energy development.

Travel would be OHV limited on 3,578 acres, while 638 acres would be closed to all OHV travel. Fire suppression, and geophysical exploration would be open on 3,578 acres. Livestock grazing would be open on 4,216 acres of the Serpentine Bends area under the No Action Alternative. Most lands would be managed for VRM Class I (638 acres), II (3,892 acres), or III (492 acres). Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact wildlife and plant habitat;
- introduce structures that disrupt scenic viewsheds; and
- negatively impact cultural artifacts.

I the No Action Alternative closes nearly the entire area to surface disturbance, these measures would help protect the unique scenery of adjacent to Carlsbad Caverns National Park, rare habitat for snakes and nesting raptors, and special status plants. Therefore, the No Action Alternative would preserve the relevant and important historic, scenic, wildlife, and plant resources of the area.

Alternatives A through D

Under Alternatives A through D, 5,019 acres would be designated as the Serpentine Bends ACEC and would be managed to protect scenic, wildlife, geologic, and karst resources. Under these alternatives, leasable, salable, and locatable minerals would be closed on the entire area. Renewable energy development would also be closed or excluded from the area.

On 3,578 acres for all four action alternatives, travel would be OHV limited, with the remainder (638 acres) closed to OHVs. Livestock grazing would be open for all alternatives. The majority of the ACEC under Alternatives A, C, and D (4,381 acres) would be managed as VRM Class II, and all of Alternative B would be managed as VRM Class I. Management actions under these alternatives would help protect the historic, scenic, wildlife, and plant resources. Similar to the No Action Alternative, the measures would help protect the unique scenery of adjacent to Carlsbad Caverns National Park, rare habitat for snakes and nesting raptors, and special status plants. Therefore, these alternatives would preserve the relevant and important scenic, wildlife, geologic, and karst values of the area.

Seven Rivers Hills

The Seven Rivers Hills area contains important scenic, wildlife, karst, soils, and special status plant resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR

1610.7-2 and BLM Manual 1613. Under Alternative B, this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative and Alternatives A, C, and D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Seven Rivers Hills area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would not designate the Seven Rivers Hills area (1,027 acres) as an ACEC. However, existing management actions under the Seven Rivers Hills SMA would continue to protect the scenic, wildlife, karst, soils, and special status plant resources for portions of the proposed area. Table 4-202 provides mineral leasing options for each action alternative by acres of BLM-administered land within the ACEC. For the No Action Alternative, 391 acres would be open to leasables, 505 acres open to salables and locatable minerals with standard terms and conditions, and 636 acres would be open to leasable minerals with major constraints. Approximately 522 acres would also be closed to salable and locatable minerals. Geothermal and solar energy development would be managed as closed and excluded on entire area and wind energy development would be avoided within the area.

The area would be OHV limited throughout and livestock grazing would be open for all of the No Action Alternative. This alternative would designate 644 acres as VRM Class II, 56 acres as VRM Class III, and the remainder (254 acres) as VRM Class IV. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact wildlife and plant habitat;
- increase erosion of highly erodible soils;
- introduce structures that disrupt scenic viewsheds; and
- introduce sediment to karst systems (thereby affecting karst function).

I half of the area is open to mineral development and grazing, habitat for wildlife and special status plants and karst and soil resources would have little protection from surface disturbance, thus increasing the potential for adverse effects to those resources. Therefore, this alternative would provide the least protection to the relevant and important scenic, wildlife, karst, special status plants, and soil values of the area.

Alternative A

Alternative A would not designate this area as the Seven Rivers Hills ACEC. Table 4-202 provides mineral leasing options for each action alternative by acres of BLM-administered land within the ACEC. For Alternative A, 148 acres would be open to leasables, and 535 acres would be open to salable, and locatable minerals with standard terms and conditions, and the remainder of the area would be closed. Approximately 462 acres would be managed as open to wind and 72 acres would be open to geothermal energy development. Approximately 462 acres would also be managed as a variance area for solar energy development. Under Alternative A, 492 acres closed or excluded from renewable energy development, with the exception of geothermal (see Table 4-203).

OHV travel would be limited and livestock grazing would be open for all of Alternative A. This alternative would designate 644 acres as VRM Class II, 56 acres as VRM Class III, and the remainder (254 acres) VRM Class IV. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact wildlife and plant habitat;
- increase erosion of highly erodible soils;
- introduce structures that disrupt scenic viewsheds; and
- introduce sediment to karst systems (thereby affecting karst function).

Similar to the No Action Alternative, because half of the area is open to mineral development and grazing, habitat for wildlife and special status plants and karst and soil resources would have little protection from surface disturbance, thus increasing the potential for adverse effects to those resources. Therefore, this alternative would provide little protection to the relevant and important scenic, wildlife, karst, special status plants, and soil resources of the area.

Alternatives B, C, and D

Under Alternatives B, C, and D, 1,027 acres would be designated as the Seven Rivers Hills ACEC and would be managed to protect scenic, wildlife, karst, soils, and special status plant resources. Table 4-202 provides mineral leasing options for each action alternative by acres of BLM-administered land within the ACEC. Leasable minerals would be open with major constraints, salable minerals would be closed (Alternative B would open 72 acres for salable development), and locatable minerals withdrawn from mineral entry under this alternative. Renewable energy development would be closed or excluded from the ACEC.

OHV travel would be limited and livestock grazing would be open for all three alternatives. Alternatives B and C would designate the entire area as VRM Class II, and Alternative D would designate the entire area VRM Class III. Plant and rock collection would be closed in the area. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact wildlife and plant habitat;
- increase erosion of highly erodible soils;
- introduce structures that disrupt scenic viewsheds; and
- introduce sediment to karst systems (thereby affecting karst function).

The entire area is limited or closed to mineral development, renewable energy, and OHV travel, fire suppression, and geophysical exploration. I of the restrictions, habitat for wildlife and special status plants and karst and soil resources would be protected from surface disturbance, thus reducing the potential for adverse effects to those resources. Compared to the No Action Alternative, management actions under these alternatives would help protect the scenic, wildlife, karst, special status plants, and soil resources within the Seven Rivers Hills ACEC. Therefore, these alternatives would preserve and provide the greatest protection to the relevant and important scenic, wildlife, karst, special status plants, and soil resources of the area.

Table 4-202. Mineral Leasing Options for the Seven Rivers Hills Area of Critical Environmental Concern by Alternative

Mineral Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	**1,027**	**1,027**	**1,027**	**1,027**	**1,027**
Leasable: open with standard terms and conditions	391 (38%)	148 (14%)	0/0	0/0	0/0
Leasable: open with moderate constraints (CSU)	0/0	0/0	0/0	0/0	0/0
Leasable: open with major constraints (NSO)	636/ (62%)	387 (38%)	1,027/ (100%)	1,027/(100%)	1,027/(100%)
Leasable: closed	0/0	492(48%)	0/0	0/0	0/0
Salable: open with standard terms and conditions	505 (49%)	535 (52%)	72/0	0/0	0/0
Salable: open with special terms and conditions(CSU)	0/0	0/0	0/0	0/0	0/0
Salable: avoid	0/0	0/0	0/0	0/0	0/0
Salable: closed	522 (51%)	492/ (48%)	1,027/ (100%)	1,027/ (100%)	1,027/ (100%)
Locatable: open with standard terms and conditions	505/ (49%)	535/ (52%)	0/0	0/0	0/0
Locatable: recommended for withdrawal	522/ (51%)	492/ (48%)	1,027/ (100%)	1,027/ (100%)	1,027/ (100%)

Table 4-203. Renewable Energy Leasing within the Seven Rivers Hills Area of Critical Environmental Concern by Alternative

Renewable Leasing Options on BLM-administered Lands (by acres)	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total acres	**954**	**954**	**954**	**954**	**954**
Geothermal: open	0	534 (52%)	72 (7%)	72 (7%)	72 (7%)
Geothermal: close	954 (100%)	492 (48%)	954 (93%)	955 (93%)	954 (93%)
Solar: variance	0	462 (48%)	0	0	0
Solar: exclude	954 (100%)	492 (52%)	954 (100%)	954 (100%)	954 (100%)
Wind: open	0	462 (48%)	0	0	0
Wind: avoid	954 (100%)	0	0	0	0
Wind: exclude	0	492 (52%)	954 (100%)	954 (100%)	954 (100%)

Six Shooter Canyon

The Six Shooter Canyon area contains important scenic, wildlife, geologic, and plant resources (see Section 3.4.1 for a more detailed description of the relevant and important values in this area). As a result, this area qualifies for management as an ACEC under Criterion 2 found at 43 CFR 1610.7-2 and BLM Manual 1613. Under Alternatives A and B, this area would be designated and managed as an ACEC to protect these values. However, under the No Action Alternative and Alternatives C and D, the area would be managed in accordance with the management direction provided for other resources and resource uses. Impacts to the Six Shooter Canyon area associated with the management direction provided under each of the alternatives are described below.

No Action Alternative

The No Action Alternative would not designate the Six Shooter Canyon area (735 acres) as an ACEC. For the No Action Alternative, 735 acres would be open to leasable, salable, and locatable minerals with standard terms and conditions. Geothermal and solar energy development would be closed and excluded within the entire area and wind energy development would be avoided within the area.

OHV limited travel would be designated on all 735 acres and livestock grazing would be open for all of the Six Shooter Canyon area under the No Action Alternative. The No Action Alternative would manage the entire Six Shooter Canyon area as VRM Class II. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact wildlife and plant habitat;
- introduce structures that disrupt scenic viewsheds; and
- negatively impact or modify geologic formations.

I all of the area is open to mineral development and grazing, habitat for wildlife and special status plants, scenic viewsheds, and geologic formations would have little protection from surface disturbance, thus increasing the potential for adverse effects to those resources. Therefore, the No Action Alternative would provide the least protection to the relevant and important scenic, wildlife, geologic, and plant values of the area.

Alternatives A and B

Under Alternatives A and B, 735 acres would be designated as the Six Shooter Canyon ACEC and would be managed to protect scenic, wildlife, geologic, and plant resources. Under these alternatives, leasable, salable, and locatable minerals would be closed on 735 acres. ROW development would be excluded from the area, plant and rock collection would be prohibited, and the ACEC would be managed as closed and excluded from renewable energy development.

On 735 acres under Alternatives A and B, OHV limited travel and livestock grazing would be open for both alternatives. Under Alternatives A and B, the area would be managed as VRM Class II. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact wildlife and plant habitat;
- introduce structures that disrupt scenic viewsheds; and
- negatively impact or modify geologic formations.

All of the area is closed to mineral development and renewable energy development, and limited to existing trails for OHV travel. I of these restrictions, habitat for wildlife and special status plants, scenic viewsheds, and geologic formations would have protection from surface disturbance. Compared to the No Action Alternative, management actions under these alternatives would help protect the scenic, wildlife, geologic, and plant resources within the Six Shooter Canyon ACEC. Therefore, Alternatives A and B would provide the greatest protection to the relevant and important values, and both alternatives would preserve the relevant and important values of the area.

Alternatives C and D

Alternatives C and D would not designate this area as the Six Shooter Canyon ACEC. Under these alternatives, leasable and salable minerals would be open with moderate constraints and conditions on 735 acres of BLM-administered surface lands. Locatable minerals would be open with standard terms and conditions. The area would be designated as an avoidance area for wind energy development. The area would be closed and excluded from geothermal and solar energy development.

On 735 acres under Alternatives C and D, OHV travel would be limited and livestock grazing would be open for both alternatives. Under both alternatives, the area would be managed as VRM Class II. Surface disturbance associated with resource development and use can introduce the following effects:

- negatively impact wildlife and plant habitat;
- introduce structures that disrupt scenic viewsheds; and
- negatively impact or modify geologic formations.

Compared to the No Action Alternative, Alternatives C and D would provide more protection to the relevant and important values of this area. However, because all of the area is available for mineral and renewable energy development, albeit with some constraints, habitat for wildlife and special status plants, and geologic formations would still have little protection from surface disturbance, thus increasing the potential for adverse effects to those resources. Therefore, these alternatives would provide little protection to the relevant and important scenic, wildlife, geologic, and plant values of the area. Scenic values would be somewhat protected by the VRM Class II prescription.

4.4.2 Wilderness Study Areas

4.4.2.1 Analysis Methods

4.4.2.1.1 Indicators

The Wilderness Act of 1964 established the National Wilderness Preservation System, which identified a system of federally owned areas designated by Congress as —wilderness areas. It mandated that these lands would be administered for the use and enjoyment of U.S. citizens in such a manner as to leave them unimpaired for future use and enjoyment. The goal of the Wilderness Act was to —secure for the American people of present and future generations the benefit of an enduring resource of wilderness.

Section 2(c) of the Wilderness Act identifies the wilderness characteristics used for evaluation of lands proposed for wilderness protections. The characteristics generally used to describe and evaluate effects to WSAs include the following.

- Size: The area must be at least 5,000 contiguous roadless acres, or be large enough to preserve as wilderness;
- Naturalness: The area must be in a generally natural condition;
- Opportunities for solitude and/or primitive recreation: The area must have outstanding opportunities for solitude or a primitive and unconfined type of recreation; and
- Special features: The area may contain ecological, geologic, or other features of scientific, scenic, or historic value.

4.4.2.1.2 Methods and Assumptions

This analysis discloses the effects of management actions on the four wilderness characteristics listed above.

Size – The size of an area with wilderness characteristics is determined by roads, ROWs, or land ownership, but can also be determined by areas of unnaturalness. Impacts to the size requirement would be any types of development that directly affects the naturalness characteristics of the area. For this EIS, the types of development that affect size include linear features, such as pipelines, transmission lines, and roads. In all cases, the WSAs in the planning area are less than 5,000 acres in size, but are contiguous with non-BLM wilderness or WSAs.

Naturalness – Lands with wilderness characteristics must primarily be influenced by the forces of nature with evidence of humankind substantially unnoticeable. Evidence of humankind on the landscape affects the natural character of the area by introducing unnatural actions or objects. This can cause direct impacts to vegetation, wildlife, soils, landforms, water, and wetlands. The types of unnatural objects and actions that affect naturalness include pipelines, utility lines, roads, other structures, or any other ground disturbance (e.g., clearing of vegetation, digging, or grading of soil).

Opportunities for solitude and/or primitive recreation – Opportunities for solitude can be affected by management actions in two ways: whether a visitor can see the project action or hear the project action. In most cases, sound can affect wilderness characteristics for a much greater distance than visual effects noticeably affect characteristics. The presence and noise of people, vehicles, and equipment needed for mineral and renewable energy development, OHV travel, fire suppression, and geophysical exploration would impact opportunities for solitude and primitive recreation in WSAs. Depending upon the terrain, vegetation, atmospheric conditions, etc., outstanding opportunities for solitude and primitive recreation could be lost in a substantial portion or the whole of these areas during development and use. Opportunities for primitive recreation can be affected by management actions that confine primitive recreational use or the area, such as group size limits or designated camping areas.

Special features – Special features (or supplemental values) are those features identified as unique to the specific parcel. Most special features identified for areas with wilderness characteristics are items such as unique plants, wildlife, or geologic features, and are often analyzed in other sections of the EIS. Section 3.4.7 identifies any special features for WSAs in the CFO.

4.4.2.1.3 Direct and Indirect Impacts

Impacts of Actions on Wilderness Study Areas

As discussed in Section 3.4.7, currently, there are four WSAs within the CFO planning area:

- Devils Den (297 acres)
- Lonesome Ridge (3,702 acres)
- McKittrick Canyon (185 acres)
- Mudgett's (2,902 acres)

WSAs are managed under the BLM Manual 6330, Management of Wilderness Study Areas Manual, which directs the BLM to manage the areas so as not to impair their suitability for preservation as wilderness. This management policy applies to all uses and activities in WSAs, but the policy acknowledges there are uses specifically exempted from this standard by FLPMA, such as grandfathered uses and valid existing rights.

No Action Alternative and Alternatives A through D

Under the No Action Alternative and Alternatives A through D, the BLM is required to carry forward the protective standard outlined under BLM Manual 6330 (2012). These areas would be closed to mineral development and renewable energy development. All WSAs would be managed to maintain VRM Class I prescriptions; therefore, there would be no impacts to the wilderness characteristics of the WSAs from implementation of the No Action Alternative or Alternatives A through D.

The four WSAs in the planning area were not recommended for wilderness designation. This RMP does not alter the status of the four WSAs. If Congress accepts those recommendations and the WSA status is removed, for the No Action Alternative, the lands currently in the WSAs would be managed for multiple use under management prescribed in the Carlsbad RMP (BLM 1988) and the Carlsbad RMP Amendment (BLM 1997). Portions of the Mudgett’s WSA and the Lonesome Ridge WSA would revert to management prescriptions under the Dark Canyon ACEC and the Lonesome Ridge ACEC, respectively. See Section 3.4.1 for more information on these ACECs.

Under the No Action Alternative, the Mudgett’s WSA would be closed to leasable and salable minerals and withdrawn from locatable minerals. The other three WSAs would be open with major constraints for leasable minerals, closed for salable minerals, and withdrawn from locatable minerals. Renewable energy development would be excluded from all areas, ROWs would be avoided, OHV travel, fire suppression, and geophysical exploration would be limited to existing trails, and the areas would be managed for VRM Class II. I the area would be closed to surface disturbance and development from mineral or renewable energy development, Therefore, the No Action Alternative would still maintain wilderness qualities in the areas.

For Alternatives A through C, if Congress removes the WSA status, all four areas would be managed as closed to leasable, salable, and locatable minerals, renewable energy would be excluded from the areas, ROWs would be excluded from the area, and OHV travel would be limited to existing routes until a travel management plan were completed. For Alternatives A and B, the areas would be managed for VRM Class I and the areas would be managed for VRM Class II under Alternative C. These alternatives would retain many of the wilderness qualities present in the areas.

For Alternative D, if Congress removes the WSA status, all four areas would be managed as open with major constraints for leasable minerals, open with moderate constraints for salable minerals, and open for locatable minerals. Under Alternative D, renewable energy would be excluded from the areas, the areas would be managed for ROW avoidance, and OHV travel would be limited to existing routes until a travel management plan were completed. For Alternative D, the areas would be managed for VRM Class III. Removal of the WSA status would increase the likelihood of surface disturbance and development in the areas under this alternative, which would result in degradation of all wilderness qualities.

4.4.3 Wild and Scenic Rivers

4.4.3.1 Analysis Methods

4.4.3.1.1 Indicators

In this analysis, potential impacts to eligible WSRs are assessed qualitatively through the potential for development or management actions which would degrade or improve the outstandingly remarkable values, tentative classification, and free flowing status for which the eligible WSR is managed. For example, if a WSR is determined eligible because of the outstandingly remarkable fish and wildlife values, then any development or management actions within the WSR corridor that may disturb or affect habitat for fish and wildlife species would degrade those values. In addition, if any actions introduce development or structures (such as dams, pipelines, or other ROWs) along the river corridor, then the effects from those actions could change the river’s classification (wild, scenic, or recreational) or free flowing status.

4.4.3.1.2 Methods and Assumptions

For the alternatives where eligible rivers would be determined suitable, the BLM would protect the outstandingly remarkable values, tentative classification, and free-flowing water of these rivers to the extent of its authority. The BLM's authority is limited to those portions of the segment where the BLM manages the shoreline or other lands within the corridor, and is subject to valid existing rights. The free-flowing character of eligible river segments would be protected to the extent that modifications such as stream impoundments or channelization would not be permitted along BLM shorelines. However, depending on the alternative, values may be at risk from potential mineral development, renewable energy development, OHV use, or other surface-disturbing activities. Unless public land is somehow involved in a proposed land use, the BLM has no control of potential modifications of the shoreline or other development (including development related to the perfection of water rights) on non-public lands.

4.4.3.1.3 Direct and Indirect Impacts

Impacts of Wild and Scenic Rivers Actions

As part of the RMP planning process, the BLM evaluated a number of river segments within the CFO planning area for eligibility as a WSR. Two river segments, one from the Black River (3.67 miles) and another the Delaware River (8.22 miles), were determined eligible. Appendix N – Wild and Scenic Rivers and Section 3.4.6 provides information on the eligibility and suitability of river segments for inclusion into the NWSRS.

No Action Alternative

Under the No Action Alternative, there are no river segments that have been designated as suitable for inclusion into the NWSRS. However, the segments would be managed as eligible until it is determined if they are suitable for designation in the ROD. Under the No Action Alternative, the Black river corridor would be open with major constraints for leasables, closed to salables and recommended for withdrawal for locatable mineral development. Renewable energy development would be excluded. ROWs would be avoided. OHV travel would be limited to existing routes and the corridor would be managed for VRM Class III.

The Delaware River segment would be open with major constraints to leasable development, closed to salable minerals and recommended for withdrawal from locatable development. Renewable energy development would be closed or excluded. ROWs would be avoided if possible. OHV travel would be open for 6.3 miles and limited to existing routes for 2.2 miles. Approximately 7.3 miles of the corridor would be managed for VRM Class II and 1.2 miles managed for VRM Class IV.

Surface disturbance caused by mineral development, renewable energy development, and OHV travel could affect the outstandingly remarkable values, free-flowing status, and tentative classification as follows:

- negatively impact fish and wildlife habitat;
- introduce structures that alter the river's free-flowing status;
- increase erosion of highly erodible soils;
- introduce structures that disrupt scenic viewsheds;
- negatively impact or modify geologic formations;
- introduce sediment to streams and karst systems (thereby affecting habitat and karst function); and
- negatively impact historical, cultural, and paleontological resources.

For both river segments under the No Action Alternative, because much of both river corridors would be closed to mineral development, renewable energy development, and OHV travel, this could decrease the potential for the above described effects. There would be more protection for fish and wildlife habitat; historical, cultural, and paleontological resources; and geologic formations from surface disturbance. Therefore, this alternative protects both river segments' outstandingly remarkable values, free-flowing status, and tentative classification at least until suitability determinations have been made in this RMP.

Alternative A

Alternative A would recommend both the Black and Delaware River segments as suitable for WSR designation. Under this alternative, the BLM would manage the eligible river segments to protect their outstandingly remarkable values, free-flowing water, and tentative classification to the extent of its authority as identified above, consistent with existing land use plan decisions and subject to valid existing rights. Note that the BLM does not own most of the mineral rights under either river. For both river segments, leasable, salable, and locatable minerals would be closed in the river corridor. Renewable energy development and ROWs would be excluded from the corridor. OHV travel would be limited to designated routes for the Black River segment and limited to existing trails for the Delaware River segment. Both river segments would be managed as VRM Class II.

I this alternative closes the river corridors to mineral and renewable energy development and limits OHV travel to designated routes or existing trails, the outstandingly remarkable values, free-flowing status, and tentative classification would be maintained. Thus, compared to the No Action Alternative, this alternative would provide slightly more protection to the outstandingly remarkable values, free-flowing status, and tentative classification identified for both eligible river segments.

Alternatives B, C, and D

Alternatives B, C, and D would recommend the Black River segment as suitable for WSR designation. Under these alternatives, the BLM would manage the eligible Black River segment to protect its outstandingly remarkable values including scenic resources and tentative classification to the extent of its authority as identified above, consistent with existing land use plan decisions and subject to valid existing rights. For the Black river segment under Alternatives B and C, leasable, salable, and locatable minerals would be closed in the river corridor. Under Alternative D, leasable minerals would be open with major constraints, salable minerals would be closed, and locatable minerals would be withdrawn. For all alternatives, renewable energy development and ROWs would be excluded from the corridor. OHV travel would be limited to designated routes and the river corridor would be managed as VRM Class II.

I these alternatives close the Black River corridor to mineral and renewable energy development and limits OHV travel to designated routes or existing trails, the outstandingly remarkable values, free-flowing status, and tentative classification would be maintained. Thus, compared to the No Action Alternative, these alternatives would provide slightly more protection to the outstandingly remarkable values, free-flowing status, and tentative classification identified for the eligible Black River segment.

Alternatives B, C, and D would not recommend the Delaware River segment as suitable for WSR designation. However, prescriptions from other special designations (such as the Carlsbad Chihuahuan Desert Rivers ACEC or the Gypsum Soils ACEC) would still afford protection to the river corridor, free-flowing water, and river values for Alternatives B and C. For example, surface disturbance restrictions in riparian zones and floodplains under these ACECs would protect river shoreline, riparian areas, and water quality.

For the Delaware River segment, BLM would be open to leasable and salable minerals with standard terms and conditions for 1.0 river miles. Approximately 7.5 miles of the river corridor would be open with major constraints to leasable minerals and closed to salable minerals. Locatable minerals would be open for 2.0 miles and recommended for withdrawal on 6.5 miles of the river corridor. Renewable energy development and ROWs would be avoided from the river corridor if possible. OHV travel would be limited to existing trails and the river corridor would be managed for VRM Class III.

Surface disturbance from mineral development, renewable energy development, and OHV travel could affect the outstandingly remarkable values, free-flowing status, and tentative classification in a number of ways. These alternatives would still allow varying degrees of construction, development, and use in the Delaware River corridor, including mineral development and renewable energy development. These actions would result in some level of surface disturbance and development that could alter fish and wildlife habitat; historical, cultural, and paleontological resources; the river's tentative classification; and free-flowing status. Thus, these alternatives would not provide protection to the outstandingly remarkable values, free-flowing status, and tentative classification identified for the eligible Delaware River segment.

Non-Designation

If Congress decides not to designate a suitable segment as part of the NWSRS, the protection management outlined in this section would no longer apply and these segments would be managed according to direction in other sections of the RMP. For all alternatives on the Black River, non-designation would increase surface disturbance within the river corridor, which would affect the river’s outstandingly remarkable values. In addition, non-designation would increase potential for infrastructure across the river corridor, affecting its free-flowing status. The Delaware River would be protected by other special designations, such as the Carlsbad Chihuahuan Desert Rivers ACEC or the Gypsum Soils ACEC. These alternatives would still afford protection to the river corridor, free-flowing water, and outstandingly remarkable values. Alternative D would increase surface disturbance within the Delaware River corridor, which would affect the river’s outstandingly remarkable values. In addition, non-designation would increase potential for infrastructure across the river corridor.

4.4.4 Backcountry Byways

4.4.4.1 Analysis Methods

4.4.4.1.1 Indicators, Methods, and Assumptions

In this analysis, potential impacts to backcountry byways are assessed qualitatively through the potential for development or management actions which would degrade or improve the scenic and recreation values of the road corridor. For example, development or management actions could introduce structures or unnatural modifications on the landscape. These actions would alter recreation sightseeing or the viewshed of the road corridor, affecting its scenic and recreational sightseeing quality.

4.4.4.2 Direct and Indirect Impacts

4.4.4.2.1 Impacts of Actions on Backcountry Byways

Additional BLM Backcountry Byways and National Recreation Trails may be designated in the future as deemed appropriate with site-specific environmental analysis

4.4.4.2.2 Guadalupe Backcountry Byway

No Action Alternative and Alternatives A through D

For all alternatives (No Action and Alternatives A–D), the CFO would continue designation of 55 miles of NM 137 as the Guadalupe Backcountry Byway. The No Action Alternative would continue to manage the Guadalupe Backcountry Byway as prescribed in the 1995 Byway Plan (BLM 1995). The 1995 Byway Plan incorporates a number of operating procedures for construction of power lines and pipelines along the byway, including guidelines to minimize visibility of infrastructure. These include requirements to use colors that match the surrounding landscape, blading only the minimum amount of the ROW for pipeline burial, and removing vegetation using an irregular contour to minimize stark contrasts in vegetative cover.

Alternatives A through C would also manage the Guadalupe Backcountry Byway as prescribed in the 1995 Byway Plan. These alternatives would maintain scenic quality and improve recreational experiences for Guadalupe Backcountry Byway travelers. Additional signage and interpretation under these alternatives would increase education of byway features and travelers would be provided with quality recreational sightseeing along the byway.

Alternative D would incorporate the same prescriptions and goals and objectives for the Guadalupe Backcountry Byway, except that BLM-administered lands within 1 mile of the roadway would be managed to maintain VRM Class III. Scenic values for the Backcountry Byway would be degraded when compared to the No Action Alternative or Alternatives A through C. However, scenic and recreation values would still be maintained along the Backcountry Byway and travelers would still be provided with quality recreational sightseeing along the byway.

4.4.4.2.3 Dark Canyon Backcountry Byway

No Action Alternative

Under the No Action Alternative, the Dark Canyon Loop Road would not be designated as a BLM Backcountry Byway, but would instead be managed as the part of the Dark Canyon SMA, including the Dark Canyon ACEC and the Dark Canyon Scenic Area. Approximately 3,220 acres would be managed as VRM Class II and 730 acres managed as VRM Class III.

Alternatives A and B

Under Alternatives A and B, 9.5 miles of the Dark Canyon Road loop would be designated as a BLM Backcountry Byway and would be managed with the same prescriptions as the Guadalupe Backcountry Byway. Leasable minerals would be managed as open subject to moderate constraints. BLM-administered lands would be managed as VRM Class II within a 1-mile buffer from either side of the road. Alternatives A and B would maintain scenic quality and recreational experiences for Dark Canyon Backcountry Byway travelers. Restrictions on mineral and renewable energy leasing, OHV restrictions, and the 1-mile VRM Class II buffer would maintain the scenic quality along the route. Designation of the route as a Backcountry Byway under these alternatives would increase education of scenic and recreation features and travelers would be provided with quality recreational sightseeing along the byway.

Alternatives C and D

Alternative C would not designate the Dark Canyon Road loop as a BLM Backcountry Byway. Instead, the area would be managed with the same prescriptions as the Guadalupe Backcountry Byway. BLM-administered lands would be managed as VRM Class II within a 0.5-mile buffer from either side of the road. Despite not designating the route as a Backcountry Byway, Alternative C would maintain scenic quality and recreational experiences for route travelers. Restrictions on mineral and renewable energy leasing, OHV restrictions, and the 0.5-mile VRM Class II buffer would maintain the scenic quality and would provide quality recreational sightseeing along the route.

Alternative D would not designate the Dark Canyon Road loop as a BLM Backcountry Byway. Instead, the area would be managed with the same prescriptions as the Guadalupe Backcountry Byway. BLM-administered lands would be managed as VRM Class III within a 1-mile buffer from either side of the road. Scenic values for the route would be degraded when compared to the No Action Alternative or Alternatives A through C. There are few restrictions on mineral leasing, and the 0.5-mile VRM Class III buffer would not maintain the scenic quality and travelers would have reduced recreational sightseeing experiences along the route.

4.5 SOCIAL AND ECONOMIC

4.5.1 Tribal Rights and Interests

This section summarizes the impacts to tribal rights and interests from management actions discussed in Chapter 2. Existing conditions concerning tribal rights and interests across the planning area, as they are known, are described in Chapter 3 (see Section 3.5.1).

Management decisions that result in the degradation or removal of access to lands with tribal significance, including sacred site and TCPs, are considered adverse to tribal rights and interests. Degradation can include the disturbance of native land conditions considered significant to tribes, which can reduce the amount of land on which tribes can exercise their rights to hunt, gather, fish, and conduct ceremonies on federal land. Native plant communities, wildlife habitats, and cultural resource sites are more likely to be impacted from surface disturbance compared to areas left undisturbed. Actions that conserve or restore those lands considered significant to tribes, such as the protection of high-value wildlife habitat and native vegetation restoration programs, are considered beneficial to tribal rights and interests. This is because the native conditions of lands with tribal significance are more likely to be maintained or restored compared to those management decisions that allow surface disturbance to occur.

Prior to implementing management decisions with potential effects to places of traditional religious and cultural importance to tribes, the BLM CFO would comply with the following:

- NHPA
- Native American Graves Protection and Repatriation Act
- Executive Memorandum of April 29, 1994, on Government-to-Government Relations with Native American Tribal Governments
- EO 13007 Regarding Indian Sacred Sites
- EO 13175 Consultation and Coordination with Indian Tribal Governments

Government-to-government consultation would occur prior to implementing projects that follow the management actions considered in the RMP. Implementation level planning would address potential impacts to tribal rights and interests at the project level.

4.5.1.1 Summary of Potential Impacts to Tribal Rights and Interests

The BLM CFO has limited information about the specific areas of significance to tribes, including locations of TCPs and sacred sites, in the planning area. Section 3.5.1, Tribal Rights and Interests, identifies several types of TCPs and their associated resources of recognition that could be valued by tribes with interest in the planning area. Furthermore, the *Ethnographic and Archaeological Inventory with the Mescalero Apache Tribe of Potential Traditional Cultural Properties within the Vicinity of the Permian Basin MOA* (Brown et al. 2010) and the *Class I Overview of Cultural Resources within the Bureau of Land Management's Carlsbad Field Office Region* (Railey 2012) provide insights into geographic features and resources with potential significance to tribes.

Based on this information, three indicators have been identified to assist the reader in understanding potential impacts to tribal rights and interests from management decisions considered in this RMP. These indicators are management decisions associated with cultural resources, acres of BLM-administered land identified for disposal, and management decisions associated with riparian resources. However, not all impacts to cultural resources and riparian areas, nor all land tenure decisions, directly result in impacts to tribal rights and interests because not all BLM-administered lands hold tribal significance.

Cultural resource sites can be affiliated with prehistoric occupations that are significant to Native American tribes with interest in the planning area today. The impacts from allocations and management actions identified for cultural resources would also apply to tribal rights and interests if a particular archaeological site holds tribal significance. Management decisions that allow surface disturbance, increased noise levels, and cause visual resource impacts, such as constructing infrastructure within viewing distance of a significant site, to cultural resources with significance to tribes would impede the ability of Native Americans to use areas associated with these cultural resources. Although a significant site many not be directly impacted by nearby surface disturbance, indirect impacts, such as noise intrusion and visual resource impairment, could introduce elements that alter the local setting, thereby reducing the integrity of the site (NPS 1998). Further, unlike sites of purely archaeological or historical interest, impacts to TCPs and sacred sites may not be suitably mitigated through the recovery of scientific information because the significance of a site may be intangible or have supernatural connotations (NPS 1998). Instead, resolution of adverse effects would need to occur during project-specific tribal consultation activities, in accordance with Section 106 of NHPA and EO 13007 (Advisory Council on Historic Preservation [ACHP] 2012). Section 106 of the NHPA requires federal agencies to take into account the effects of an undertaking on historic properties, which could include properties of traditional religious and cultural significance to tribes. EO 13007, "requires Federal land managing agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites" (ACHP 2013). For a detailed discussion of impacts to cultural resources from implementing the alternatives, see Section 4.1.6.5.

Decisions made by the BLM to dispose of land could have an adverse impact to tribal rights and interests, by reducing the amount of public land available for tribal access to exercise rights and interests, such as ceremonies, hunting, plant gathering, etc. Adverse impacts to tribal rights and interests are most likely to occur when the land is located near, provides access to, or contains a TCP and is transferred to private ownership where access to non-owners is typically restricted. The presence of TCPs has not been identified for those lands considered for disposal in this RMP. However, the locations of all TCPs within the planning area are not known by the BLM CFO. All lands identified for disposal would undergo a cultural resource investigation and government-to-government consultation prior to approval of the disposal action, which could lead to the identification of a TCP. If a TCP is identified on lands identified for disposal, the discovery could lead to cancellation of the transaction or resolution of adverse effects resulting from the disposal action, in accordance with Section 106 of NHPA and EO 13007. Not all lands identified for disposal would have an adverse impact on tribal rights and interests. For example, those BLM-administered lands within Carlsbad Caverns National Park, if made available for exchange with the NPS, would remain under federal management. Therefore, tribal access would be maintained per EO 13007. Additionally, the disposal of lands with no associated tribal interests (TCPs or sacred sites) would not impact tribal rights. For a detailed discussion of impacts to cultural resources from implementing the land tenure alternatives, see Section 4.3.7, Land Tenure.

Native riparian plant communities can sustain valuable plant and animal species sought in hunting, gathering, and ceremonial activities. The *Ethnographic and Archaeological Inventory with the Mescalero Apache Tribe of Potential Traditional Cultural Properties within the Vicinity of the Permian Basin MOA* (Brown et al. 2010) identifies several TCPs important to the Mescalero Apache Tribe located near riparian areas in the planning area. Management decisions that emphasize the protection or restoration of riparian areas through such actions as placing surface disturbance buffers around springs and seeps and managing mineral allocations within riparian areas as closed or open with constraints, would have beneficial impacts to tribal rights and interests because native riparian vegetation would be more likely to occur in the protected areas. In addition, riparian areas can provide favorable habitat for tribally important animals (e.g., bald eagles, elk, and mule deer) and may be geographic features desired for ceremonies. Management decisions that allow surface disturbance to occur within riparian areas would have adverse impacts to tribal rights and interests if those areas open to disturbance contained TCPs or other significance to tribes (such as species of importance). For a detailed discussion of impacts to riparian areas from implementing the alternatives, see Section 4.2.3.2, Riparian Resources.

Impacts resulting from wildland fire management, mineral development, land use authorizations, livestock grazing, noxious weeds, recreation, renewable energy, soils, travel management, water resources, lands with wilderness characteristics, vegetation, VRM, wildlife, and special designations are not included in this analysis because the resulting impacts from these resources and resource uses are captured in the analysis for the indicators described above.

Impacts resulting from management decisions for air resources, backcountry byways, karst resources, public health and safety, and paleontological resources are not anticipated to impact tribal rights and interests based on the limited information provided by tribes with interest in the planning area.

4.5.2 Social and Economic Conditions

This section describes the potential effects on social and economic conditions from the implementation of the proposed BLM CFO management alternatives.

As described in Chapter 3, the social and economic study area (SESA) was defined to include all of Chaves, Eddy, and Lea Counties to capture the potential impacts of proposed BLM CFO management decisions on communities in and around the planning area (see Figure 3.5-1). The CFO planning area includes lands in all of Eddy and Lea Counties and a portion in Chaves County.

4.5.2.1 Analysis Methods

This section identifies the quantitative and qualitative indicators used in the analysis to evaluate changes in social and economic conditions, and presents the methods and key assumptions used in the analysis.

4.5.2.1.1 Indicators

The following indicators were used to assess economic effects of the alternatives:

- Direct output, employment, and labor earnings from economic activities in the CFO planning area affected by the alternatives. Throughout this section, all dollar values are reported in constant, 2014 dollars and do not include any effects from future inflation. Employment is reported in terms of combined numbers of annual full- and part-time jobs.
- Secondary output, employment, and labor earnings throughout the SESA resulting from economic activities in the CFO planning area affected by the alternatives (also known as “multiplier” effects)
- Tax revenues to state and local governments resulting from direct and secondary economic effects of the alternatives
- Non-market values associated with lands in the CFO planning area, including economic benefits to recreationists, ecosystem services, and passive or existence values. Changes in these values were evaluated in qualitative terms.

The following indicators were used to assess social effects of the alternatives:

- Potential changes in the number of residents in the SESA resulting from economic effects.
- Potential changes in the number of households in the SESA and corresponding demand for housing.
- Potential changes in the number of school-aged children in the SESA and corresponding demand for public education.
- Potential effects from the perspective of varied communities of interest (ranchers, recreationists, individuals who prioritize resource use, and individuals who prioritize resource protection). These effects were qualitatively assessed.

Environmental justice was assessed based on whether disadvantaged or minority populations identified in Chapter 3 would suffer disproportionate adverse effects from any of the alternatives.

4.5.2.1.2 Methods and Assumptions

Economic models were developed to estimate the direct output, employment, and labor earnings associated with oil and gas development, potash mining, and grazing activity. These models and other assumptions used in the economic and social effects analysis are described below.

Economic Models

A model was developed to estimate the direct output, employment and labor income effects associated with new well development (exploration, drilling and completion), and with the ongoing support and maintenance of wells after they are put into production.

Direct effects of oil and gas activity on SESA employment and other economic metrics were projected based on the combination of the number of new wells drilled in each year and the number of existing wells in active production during the year. This approach is consistent with the methodology used in numerous prior environmental impact studies for BLM RMPs involving substantial oil and gas activity[3] and in other studies of the oil and gas industry.[4]

The oil and gas direct economic effects model was initially calibrated based on statewide data on the number of wells completed and operating in New Mexico from 2007 through 2011 (New Mexico Energy, Minerals, and Natural Resources Department [EMNRD] 2012) and the number of statewide employees in the sectors of oil and gas extraction, oil and gas support activities, and drilling oil and gas wells (Bureau of Labor Statistics 2013). The statewide model was then adjusted to fit data from the SESA based on the number of wells completed and operating on federal lands (BLM 2011a), the estimate that federal lands account for 40% of oil and gas wells in the study area (RFD), and economic data for the oil and gas sectors in the SESA (IMPLAN 2011).

Based on the analysis just described, the annualized direct employment associated with oil and gas activity in the SESA was estimated at 3.7 jobs per new well drilled each year (in drilling and support activities) and 0.31 jobs per existing well active in the study area (in extraction and support activities). While these ratios may appear low relative to the comparatively large number of workers typically involved during the drilling of new wells, it should be recognized that these are annualized employment figures—while the period of time associated with drilling an individual well is typically much shorter than a full year. These figures also exclude indirect impacts on other industries such as subcontractors in construction-type industries. Indirect jobs are accounted for through analysis using the IMPLAN regional input-output model, described later in this section. Overall, applying these ratios from the oil and gas direct economic effects model to the estimated number of wells completed and active in 2010 indicates a direct oil and gas workforce of nearly 14,000 workers in 2010, which is consistent with baseline economic data from these sectors from the IMPLAN model for that year.

A model was also developed to estimate the direct output, employment, and labor income effects associated with grazing lands. The economic value of grazing lands was modeled by estimating the annual market value resulting from the grazing that occurs on federal lands. The total amount of grazing is represented by the number of AUMs actually used (billed use) on CFO lands by area ranchers. The corresponding value per AUM was calculated based on inventory and sales data from the 2007 Census of Agriculture. As discussed in a previous section, it was assumed that beef cattle represented the most significant source of demand for grazing lands. Therefore, the total inventory in the three-county SESA was 192,999 beef cattle and calves or about 1.2 million AUMs.[5] The inflation adjusted 2014 value of this inventory was approximately $483 per head or $81 per AUM.[6]

These results were used in conjunction with the IMPLAN input-output model to estimate the employment and labor income effects. Current grazing permits on federal lands allow 367,656 AUMs. The maximum number of AUMs actually used (billed) from 2000 through 2010 was 267,902 in 2009. Based on the IMPLAN model developed for this study, the maximum historical billed use supported an estimated total of 137 jobs, including secondary employment effects discussed below. I of the prevalence of private grazing lands within the SESA, federally owned grazing lands only represent a portion, and not the entirety, of the local grazing economy.

[3] See for example the White River Field Office RMP Amendment EIS (BLM 2012), Lander Draft RMP EIS (BLM 2011b), the Kemmerer Proposed RMP EIS (BLM 2008c) and the Casper Draft RMP EIS (BLM 2007c).
[4] See for example *Assessment of Oil and Gas Industry, 2012 Industry Economic and Fiscal Contributions in Colorado*, Business Research Division, University of Colorado, 2012; and *Wyoming Oil and Gas Economic Contribution Study*, Booz/Allen/Hamilton, 2008.
[5] The estimated number of AUMs was derived based on the total number of cattle and calves, divided by two to represent cow/calf pairs and multiplied by 12 to convert to total animal unit months over a full year.
[6] Because Chaves County cattle sales data were suppressed in the 2007 Census of Agriculture, the value per AUM was based on the total value of cattle sales in Eddy and Lea Counties in 2007, divided by the total AUMs in those two counties, then updated for inflation from 2007 dollars to 2014 dollars using the national consumer price index.

Direct jobs in oil and gas, agriculture, recreation, and other activities supported by the federal lands administered by the CFO produce additional economic activity in the study area as directly affected businesses purchase goods and services from other firms, and as the employees of these businesses purchase household goods and services. These additional rounds of local spending are often referred to by economists as indirect and induced effects (and by others as "multiplier effects"). To avoid confusion with NEPA terminology regarding indirect effects, these effects are referred to in this analysis as "secondary" economic effects.

Secondary economic effects from activities supported (at least in part) by BLM-administered lands, and potentially affected by the management alternatives, were estimated using the IMPLAN regional input-output model. IMPLAN is an input/output modeling system originally developed for the USFS and is widely used by both private- and public-sector economists for impact analyses throughout the United States. For consistency with the description of existing economic conditions provided in Chapter 3 (which was developed in 2011–2012), the IMPLAN model incorporated 2010 data for the SESA.

Additional Assumptions

Other assumptions used in the economic models and other portions of the economic and social effects analysis are described below:

- The potential number of wells completed in each year is based on the total number of wells projected to be developed under each alternative, divided by the 20 years in the planning period for this RMP.
- Development of ancillary oil and gas facilities (e.g., pipelines, compressor stations, gas plants) is assumed to be proportional to number of wells developed.
- Projected economic effects from oil and gas development are based on the potential number of wells completed each year under each alternative and the modeling approach described previously. The actual number of wells developed will be influenced by market conditions. It may also be affected by BLM management actions under the alternatives that would affect the cost and complexity of oil and gas development. These management actions are discussed in the economic analysis, but their effects on actual oil and gas development cannot be quantified. However, the relative effects from these actions across the four action alternatives (and the No Action Alternative) generally mirror the relative number of wells projected to be developed under each alternative based on land use limitations and stipulations.
- Projected economic effects from other mineral-related activities are based on assumptions regarding future mineral activity, and the effects of the management alternatives on that activity. These assumptions are described in Section 4.3.1.1, Solid Leasable Minerals; Section 4.3.1.2, Locatable Minerals; and Section 4.3.1.3, Salable Minerals. Section 4.3.1.1 concluded that a total of two new mines would be added to the three operating potash mines and the recently permitted mine by the end of the 20-year planning period. New mines were assumed to be comparable in size (employment and output) to the existing mines. The projected economic effects from these projected new operations reflect impacts from operations and do not include short-term economic effects from construction of new mines.
- Projected billed AUMs under each alternative are used to calculate the potential economic value of grazing lands based on the model described previously. The large difference between the number of available (or potential) AUMs on CFO lands, and the number of AUMs actually used (billed use), somewhat complicates this analysis. Under several of the management alternatives, the number of permitted AUMs would be considerably less than the number permitted under existing conditions, but still more than the number of AUMs that have been actually used historically. Consequently, the study team estimated a range of potential grazing impacts under two alternative perspectives. The "minimum effect" estimate assumed that ranchers would be able to move their cattle to different locations, if necessary, to take advantage of any available (permitted) AUMs. The "maximum effect" estimate assumed that the historical slack in the system (represented by the difference between permitted AUMs and actual use) reflects, at least in part, geographic limitations on where ranchers can utilize available AUMs. For this estimate, billed use was assumed to decline in proportion to any reduction in permitted AUMs relative to existing conditions.

- For purposes of the economic analysis, the value per AUM was based on cattle grazing. As described in Chapter 3, cattle comprise about 90% of all animals grazed on lands managed by the CFO.
- The USFS and BLM define an AUM as a cow-calf pair. To calculate AUMs, the Census of Agriculture inventory of beef cattle, including calves was divided by two to account for cow-calf pairs. Dairy cattle were excluded from the analysis.
- Due to privacy disclosure restrictions, the Census of Agriculture did not report complete cattle sales data for Chaves County. Therefore, data from this county were not used in estimating the average value per AUM.
- The assessment of effects on the recreation-related economy is based primarily on the evaluation of recreation effects from the management alternatives (see Section 4.3.6). Management alternatives deemed in that evaluation to have positive effects on recreation, recreation opportunities, the recreation experience, or recreation satisfaction would generally have positive effects on the recreation-related economy. This reflects the assumptions that satisfied recreational users would be more likely to return to the area in the future and/or new recreational visitors may be attracted to the area based on positive referrals from satisfied users.
- Current employment effects from recreation on BLM-managed lands were based on annual visitation estimates and previous estimates of the employment effects of recreation on BLM-administered lands in New Mexico, described in Chapter 3. It was not, however, possible to quantify differences in future visitation levels (and corresponding economic effects) among the alternatives. Most recreational users in the CFO are local residents, and overall visitation is expected to continue to increase under any of the alternatives due to future population growth (BLM 2014b).
- Fiscal effects on state and local and federal tax revenues for each alternative were based on the IMPLAN modeling's tax impact results for that alternative. Tax revenue estimates from IMPLAN are industry and location-specific, but the specific allocation of these revenues among their sources is generic. In general, industry-related tax revenues include indirect business taxes such as sales taxes, property taxes, severance taxes and royalties, corporate profits taxes and personal income and social insurance taxes, among other sources (IMPLAN 2015). I the economic effects from recreation were estimated based on the CFO's share of statewide recreation on BLM-administered lands, estimates of the fiscal effects of recreation on state, local, and federal tax revenues were not available.
- For purposes of estimating demographic impacts, and potential effects on demands for housing and other public services, this analysis uses a set of ratios based on information from the 2010 Census for the SESA. Each new job is assumed to result in an additional 1.9 residents living in the study area. There are assumed to be 2.8 residents per household in the study area for purposes of estimating housing demand corresponding to the economic and demographic projections. Finally, 20% of all new residents are assumed to be school-age children (U.S. Census Bureau 2010). The demographics of the oil and gas workforce, and the potash mining workforce, may differ from these averages, but no specific data is available regarding industry-specific demographic characteristics.

4.5.2.2 Economic Direct and Indirect Impacts

This section focuses on five categories of potential economic effects, including actions affecting

- oil and gas–related economic activity,
- other mineral-related economic activity,
- agricultural economic activity,
- recreation-related economic activity, and
- non-market economic values.

Within each of these categories, the assessment initially focuses on impacts from management actions common to all alternatives, and then describes impacts from management actions common to all action alternatives. Distinguishing aspects of the management strategies under each of the five potential management alternatives (No Action and Alternatives A–D) are then evaluated.

This section concludes with a summary of the projected direct and indirect economic effects for each of the alternatives.

4.5.2.2.1 Actions Affecting Oil and Gas-related Economic Activity

As described in Chapter 3, the mining sector (which includes oil and gas activity in standard economic classification systems, such as the North American Industry Classification System) supports the most jobs in two of the three counties (Eddy and Lea Counties) that comprise the SESA. Although the mining sector includes potash mining, caliche mining, and other important mineral activities, from an economic standpoint it is dominated by oil and gas-related activities, which account for the large majority of mining-related output, value-added, and employment. This initial portion of the economic direct and indirect effects assessment focuses on oil and gas-related economic activity. Other economic activity related to minerals is assessed in the following section.

Proposed BLM management actions in several categories may impact future oil and gas development by either increasing or decreasing the cost and complexity of oil and gas development and production or by limiting or otherwise restricting the areas open to new oil and gas leases.

Impacts from Management Common to All

Proposed BLM management actions common to all alternatives related to oil and gas development generally continue existing practices intended to facilitate oil and gas development while minimizing impacts on resources and other resource uses. Management actions common to all alternatives in the following categories are particularly relevant to future oil and gas development (and the oil and gas-related economy). These actions are consistent with the BLM's existing practices and would have no economic effect relative to current conditions.

Special Designations – Wilderness Study Areas

WSAs would be closed to leasing (unless and until they may be determined to not be designated as wilderness areas) and existing leases would not be reissued when they expire. While these management actions common to all alternatives represent a continuation of current practices, the various alternatives involve different sets of potential WSAs to which these management actions would be applied. Alternative-specific differences in management alternatives are discussed later.

Visual Resource Management

Oil and gas development in leased areas with scenic quality is expected to be planned to maintain visual resource quality by using utility corridors to accommodate pipelines, power lines, access roads, and other necessary infrastructure.

Impacts from Management Common to All Action Alternatives

In addition to the management actions common to all alternatives (which include the No Action Alternative), there are also management actions that would be common to all action alternatives, but would not be in effect under the No Action Alternative. Management actions common to all action alternatives in the following categories are particularly relevant to future oil and gas development (and the oil and gas-related economy).

Air Resources

All new and existing drill rig, completion rig, work-over rig, and fracturing pump engines would be required to meet EPA Tier 4 Standards for Nonroad Diesel Emissions within 1 year of the ROD. This management action common to all action alternatives could impose additional costs on some existing wells by requiring them to retrofit with newer engines.

Impacts from the No Action Alternative

Under the No Action Alternative, the BLM would continue to manage oil and gas development on federal lands in the same manner that it does at present. BLM management actions would not change the cost or complexity of oil and gas operations on BLM-administered lands, the amount of BLM-administered land open to oil and gas leasing, or the stipulations and conditions for oil and gas development on available lands.

Projected Direct/Indirect Oil and Gas-related Economic Effects of the No Action Alternative

At present (2017), there are approximately 16,400 active wells on lands managed by the CFO and split estate lands, out of a total of about 32,000 active wells located within the SESA. Under the No Action Alternative, 5,874 new wells are projected to be drilled on BLM-administered lands over the 20-year period of analysis for this RMP, or an average of about 294 new wells per year.

Some of the 16,400 existing wells administered by BLM will be retired (plugged) during the 20-year period of analysis. Based on historical data from the past decade, an average of 255 wells on BLM-administered lands is projected to be retired from production each year (BLM 2014b).

Since the annual rate of new well development is projected to be larger than the annual rate of existing well retirement, the total number of active wells on BLM-administered lands is projected to increase over the planning period. By the 20th and final year of the planning period, there are projected to be over 17,100 active wells on BLM-administered and split estate lands.

As discussed in Analysis Methods information earlier in this section, the economic effects from oil and gas-related activity were estimated based on an economic model derived from statewide information on New Mexico oil and gas activity and employment, which was calibrated for the SESA based on local data for year 2010. Annual direct employment, labor earnings, and regional output in oil and gas sectors was projected based on the number of new wells drilled in each year and the number of existing, active wells (which require operations and maintenance). Secondary jobs in other sectors supported by purchasing from oil and gas-related businesses, and their employees, were estimated using the IMPLAN model.

In 2017, oil and gas activity on BLM-administered and split estate lands directly and indirectly supports nearly 10,800 jobs in the SESA (out of a total number of approximately 22,300 jobs supported by oil and gas activity in the SESA, including jobs related to wells on State and private lands). Direct oil and gas jobs include jobs in the following sectors, as defined by IMPLAN: drilling oil and gas wells, oil and gas extraction (maintenance), and support activities (which can be related to either drilling or maintenance of existing wells). Based on the proportions of employment in these oil and gas subsectors, and historical fluctuations in employment relative to the number of wells completed in each year, approximately 20% to 25% of direct and indirect oil and gas employment in the SESA is related to current drilling activity, while the remaining 75% to 80% of oil and gas employment is related to overall production from the area and maintaining existing wells. Under the No Action Alternative, the number of jobs directly and indirectly supported by oil and gas activity on BLM-administered lands is projected to increase over the 20-year planning period due to the increase in the total number of active wells described previously. By the end of the planning period, oil and gas activity on BLM-administered and split estate lands is projected to directly and indirectly support about 11,200 jobs.

Further detail regarding the projected economic effects of oil and gas activity on lands managed by the BLM under the No Action Alternative is provided in Table 4-204. By the end of the planning period (year 20), total employment (direct and indirect) related to oil and gas activity on BLM-administered lands is projected to increase by about 400 jobs under the No Action Alternative. Annual labor earnings are projected to increase by $33 million and annual regional economic output related to oil and gas activity on BLM-administered lands is projected to increase by $88 million.

It is important to recognize that projections of future oil and gas activity, and corresponding regional economic activity, are inherently uncertain. The data provided in the effects tables in this section are based on the simplifying assumption that the annual numbers of new wells will be constant throughout the 20-year study period, with the number of new wells in each year being 1/20th of the total number of wells projected to be drilled over the 20-year period. In reality, of course, the pace of drilling activity would likely rise and fall from year to year, depending on external factors including the demand and price for oil and gas resources. History suggests there would likely be periods of relative “boom” and periods of relative “bust” during the 20-year study horizon.

Table 4-204. Projected Direct/Indirect Economic Effects from Oil and Gas Activity on BLM-administered Lands under the No Action Alternative

Direct/Indirect Effects	Projections for No Action Alternative		Projected Differences from Existing Conditions	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Number of acres available for leasing*	2,555,280	2,555,280	0	0
Annual number of wells drilled	294	294	0	0
Total active wells	16,774	17,162	388	777
Drilling-related jobs†	1,851	1,851	0	0
Maintenance-related jobs†	9,140	9,352	212	424
Total jobs†	10,991	11,203	212	424
Total labor earnings† (millions of 2014 dollars)	$817	$833	$17	$33
Total regional output† (millions of 2014 dollars)	$2,283	$2,327	$44	$88

* Open with standard terms and conditions or open with moderate constraints (CSU).
† Includes direct effects and secondary regional economic effects estimated using IMPLAN.

Impacts from Alternative A

Specific management actions and requirements under Alternative A would likely increase the complexity and cost of oil and gas development. The following are examples of these types of management actions and requirements.

Actions Affecting Cost and Complexity of Oil and Gas Operations

Air Resources

Alternative A would require VRUs for all new wells and production facilities. Dust suppression would be required for construction areas and roads. Emission controls to limit VOCs would be required for tanks and dehydrators. At least 70% of gas compressors and well head pumps would need to be powered by electricity.

The effects of these types of actions and requirements could affect the financial viability of some future oil and gas developments, particularly during periods when oil and gas prices are low. Based on the more detailed assessment of these actions and requirements in Section 4.3.1.1 (Fluid Leasable Minerals), their effects are likely minor in comparison to the effects of excluding additional lands from oil and gas development, or imposing additional restrictions on surface use, under Alternative A. Quantitative estimates of impacts on oil and gas development in Section 4.3.1.1 are based entirely on the projected changes in the amount of land available for oil and gas development, and the conditions that would be imposed for oil and gas development on those lands.

Actions Affecting Land Available to Oil and Gas Development and Potential Number of Wells Developed

Measurable effects of land exclusions and restrictions on oil and gas development, and the associated regional economic impacts, can be estimated since they directly relate to access to federal minerals. In contrast, quantifying the impacts associated with actions affecting cost and complexity of oil and gas development is less straightforward because the decision to pursue development remains largely on proponents' evaluations of the financial viability of development which is function of various other factors. Alternative A would exclude or substantially restrict more land from oil and gas development than the No Action Alternative. Under Alternative A, approximately 1,942,451 acres of BLM-administered and split estate land would be open to oil and gas leasing with standard lease terms and conditions or with moderate constraints such as CSU. This is approximately 24% fewer acres than under the No Action Alternative. The number of future wells that would be developed is assumed to be reduced by the same proportion.

Projected Direct/Indirect Oil and Gas-related Economic Effects of Alternative A

Under Alternative A, 1,409 fewer new wells on BLM-administered lands are projected to be developed over the 20-year planning period than under the No Action Alternative. Correspondingly fewer jobs would be directly and indirectly supported by oil and gas activity on BLM-administered lands. Table 4-205 summarizes the projected differences between oil and gas-related economic activity under Alternative A, relative to the No Action Alternative. To help place these effects estimates in context, the table also shows estimated current (2017) values for each metric. By year 10 of the planning period, oil and gas-related activity on BLM-administered lands is projected to support about 790 fewer jobs in the SESA than under the No Action Alternative, along with about $54 million less in annual labor earnings and $164 million less in annual regional economic output. These differences increase by year 20, when Alternative A is projected to support 1,175 fewer jobs related to oil and gas activity on BLM-administered lands than the No Action Alternative.

The economic estimates just described are relative to the projections under the No Action Alternative, which anticipate ongoing growth in oil and gas-related employment and other economic measures over the 20-year planning period. Relative to current conditions (2017), Alternative A is projected to support fewer oil and gas-related jobs throughout the planning period.

Table 4-205. Projected Direct/Indirect Economic Effects from Oil and Gas Activity on BLM-administered Lands under Alternative A

Direct/Indirect Effects	Projections for Alternative A		Projected Differences Between Alternative A and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Number of acres available for leasing*	1,942,451	1,942,451	-612,829	-612,829	-612,829	-612,829
Annual number of wells drilled	223	223	-71	-71	-71	-71
Total active wells	16,069	15,817	-316	-568	-704	-1,345
Drilling-related jobs†	1,407	1,407	-444	-444	-444	-444
Maintenance-related jobs†	8,793	8,621	-134	-307	-346	-731
Total jobs†	10,200	10,028	-578	-751	-790	-1,175
Total labor earnings† (millions of 2014 dollars)	$763	$750	-$38	-$51	-$54	-$83
Total regional output† (millions of 2014 dollars)	$2,119	$2,083	-$119	$155	-$164	-$244

* Open with standard terms and conditions or open with moderate constraints (CSU).
† Includes direct effects and secondary regional economic effects estimated using IMPLAN.

Impacts from Alternative B

Under Alternative B, BLM management actions would have similar effects to Alternative A in terms of future oil and gas development and related economic activity.

Actions Affecting Cost and Complexity of Oil and Gas Operations

Like Alternative A, Alternative B includes actions and requirements that could affect the financial viability of some future oil and gas developments, particularly during periods when oil and gas prices are low. However, the more detailed assessment of these actions and requirements in Section 4.3.1.1 (Fluid Leasable Minerals) indicates their effects are likely minor in comparison to the effects of excluding additional lands from oil and gas development or imposing additional restrictions on surface use under Alternative B.

Air Resources

Most of the management requirements affecting oil and gas operations are the same as under Alternative A, though the sound deadening and lighting requirements would be limited to specified areas (such as LPC areas, SRMAs and ERMAs, and in proximity to human habitation and riparian areas) under Alternative B.

Actions Affecting Land Available to Oil and Gas Development and Potential Number of Wells Developed

Under Alternative B, approximately 1,539,240 acres of BLM-administered land would be open to oil and gas leasing with standard lease terms and conditions or with moderate constraints such as CSU. This is approximately 40% fewer acres than under the No Action Alternative and about 21% fewer acres than under Alternative A. The number of future wells that would be developed is assumed to be reduced by the same proportion.

Projected Direct/Indirect Oil and Gas-related Economic Effects of Alternative B

Under Alternative B, 2,336 fewer new wells on BLM-administered and split estate lands are projected to be developed over the 20-year planning period than under the No Action Alternative (and 927 fewer wells than under Alternative A). Correspondingly fewer jobs would be directly and indirectly supported by oil and gas activity on BLM-administered lands. Table 4-206 summarizes the projected differences between oil and gas-related economic activity under Alternative B, relative to the No Action Alternative. By year 10 of the planning period, oil and gas-related activity on BLM-administered lands is projected to support about 1,310 fewer jobs in the SESA than under the No Action Alternative, along with about $89 million less in annual labor earnings and $271 million less in annual regional economic output. These differences increase by year 20, when Alternative B is projected to support 1,948 fewer jobs related to oil and gas activity on BLM-administered lands than the No Action Alternative.

Relative to current conditions (2017), Alternative B would support about 1,098 fewer oil and gas-related jobs by year 10 of the planning period. By year 20, Alternative B is projected to support 1,524 fewer jobs than existing conditions.

Table 4-206. Projected Direct/Indirect Economic Effects from Oil and Gas Activity on BLM-administered Lands under Alternative B

Direct/Indirect Effects	Projections for Alternative B		Projected Differences Between Alternative B and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Number of acres available for leasing*	1,539,240	1,539,240	-1,016,040	-1,016,040	-1,016,040	-1,016,040
Annual number of wells drilled	177	177	-117	-117	-117	-117
Total active wells	15,762	14,982	-623	-1,403	-1,012	-2,180
Drilling related jobs†	1,115	1,115	-736	-736	-736	-736
Maintenance-related jobs†	8,566	8,140	-362	-787	-574	-1,212
Total jobs†	9,681	9,255	-1,098	-1,523	-1,310	-1,948
Total labor earnings† (millions of 2014 dollars)	$727	$695	-$73	-$106	-$89	-$138
Total regional output† (millions of 2014 dollars)	$2,012	$1,923	-$227	$316	-$271	-$404

* Open with standard terms and conditions or open with moderate constraints (CSU).
† Includes direct effects and secondary regional economic effects estimated using IMPLAN.

Impacts from Alternative C

Under Alternative C, more acres would be open for oil and gas development or available for development with moderate constraints than under Alternatives A or B. Consequently, under Alternative C, BLM management actions would have less adverse impact on future oil and gas development on BLM-administered lands, and related economic activity, than under Alternatives A or B.

Actions Affecting Cost and Complexity of Oil and Gas Operations

While Alternative C also includes actions and requirements that could adversely affect the cost and complexity of future oil and gas developments relative to the No Action Alternative, there are fewer such requirements than under Alternatives A or B. Like the other action alternatives, the more detailed assessment of these actions and requirements in Section 4.3.1.1 (Fluid Leasable Minerals) indicates their effects are likely minor in comparison to the effects of excluding lands from oil and gas development or imposing additional restrictions on surface use.

Air Resources

Under Alternative C, VRUs would be required for new wells on a case-by-case basis, rather than as a general practice. Emission controls to limit VOC emissions would be required only for larger emission sources. Electric compressor and well head pump engines would not be required.

Actions Affecting Land Available to Oil and Gas Development and Potential Number of Wells Developed

Under Alternative C, approximately 2,537,155 acres of BLM-administered and split estate land would be open to oil and gas leasing with standard lease terms and conditions or with moderate constraints such as CSU. This figure is approximately 1% fewer acres than under the No Action Alternative, but about 31% more acres than under Alternative A and 65% more acres than under Alternative B. The number of future wells that would be developed has been estimated based on these acreage projections.

Projected Direct/Indirect Oil and Gas-related Economic Effects of Alternative C

Under Alternative C, 42 fewer new wells on BLM-administered lands are projected to be developed over the 20-year planning period than under the No Action Alternative (but 1,367 more wells than under Alternative A and 2,294 more wells than under Alternative B). Table 4-207 summarizes the projected differences between oil and gas-related economic activity under Alternative C relative to the No Action Alternative. By year 10 of the planning period, oil and gas-related activity on BLM-administered and split estate lands is projected to support about 23 fewer jobs in the SESA than under the No Action Alternative, along with about $2 million less in annual labor earnings and $5 million less in annual regional economic output. These differences increase slightly by year 20, when Alternative C is projected to support 34 fewer jobs related to oil and gas activity on BLM-administered lands than the No Action Alternative.

Relative to Alternatives A or B, however, Alternative C is projected to support at least 765 more oil and gas-related jobs in year 10 of the planning period and at least 1,140 more oil and gas-related jobs by the end of the planning period in year 20.

Relative to current conditions (2017), Alternative C would support more oil and gas-related jobs from activity on BLM-administered lands throughout the entire planning period. By the end of the planning period, projected oil and gas-related employment would be 11,169 jobs, 390 more jobs than in 2017.

Table 4-207. Projected Direct/Indirect Economic Effects from Oil and Gas Activity on BLM-administered Lands under Alternative C

Direct/Indirect Effects	Projections for Alternative C		Projected Differences Between Alternative C and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Number of acres available for leasing*	2,537,155	2,537,155	-18,125	-18,125	-18,125	-18,125
Annual number of wells drilled	292	292	-2	-2	-2	-2
Total active wells	16,753	17,121	189	390	-23	-34
Drilling-related jobs†	1,838	1,838	-13	-13	-13	-13
Maintenance-related jobs†	9,129	9,330	202	403	-10	-21
Total jobs†	10,968	11,169	189	390	-23	-34
Total labor earnings† (millions of 2014 dollars)	$815	$831	$15	$30	-$2	-$2
Total regional output† (millions of 2014 dollars)	$2,278	$2,320	$39	$81	-$5	-$7

* Open with standard terms and conditions or open with moderate constraints (CSU).
† Includes direct effects and secondary regional economic effects estimated using IMPLAN.

Impacts from Alternative D

Among the four action alternatives, Alternative D would be the only alternative that would increase future oil and gas development on BLM-administered lands beyond the No Action Alternative.

Actions Affecting Cost and Complexity of Oil and Gas Operations

Air Resources

Relatively few new requirements would be imposed on oil and gas operations for air resource purposes under Alternative D. VRUs would not be required. Other requirements are generally the same as under Alternative C.

Actions Affecting Land Available to Oil and Gas Development and Potential Number of Wells Developed

Under Alternative D, approximately 2,629,315 acres of BLM-administered and split estate land would be open to oil and gas leasing with standard lease terms and conditions or with moderate constraints such as CSU. This figure is approximately 3% more acres than under the No Action Alternative and 35% to 71% more acres than under Alternatives A or B. It is also about 4% more acres than under Alternative C. The number of future wells that would be developed has been estimated based on these acreage projections.

Projected Direct/Indirect Oil and Gas-related Economic Effects of Alternative D

Under Alternative D, 170 more new wells on BLM-administered and split estate lands are projected to be developed over the 20-year planning period than under the No Action Alternative. Alternative D is the only action alternative that is projected to result in more oil and gas development on BLM-administered lands than the No Action Alternative. Table 4-208 summarizes the projected differences between oil and gas-related economic activity under Alternative D relative to the No Action Alternative. By year 10 of the planning period, oil and gas-related activity on BLM-administered lands is projected to support about 96 more jobs in the SESA than under the No Action Alternative, along with about $7 million more in annual labor earnings and $20 million more in annual regional economic output. These differences increase by year 20, when Alternative D is projected to support 142 more jobs related to oil and gas activity on BLM-administered lands than the No Action Alternative.

The differences in projected oil and gas-related economic activity between Alternative D and the other action alternatives are larger than the differences between Alternative D and the No Action Alternative. By the end of the planning period in year 20, Alternative D is projected to support more than 1,300 more oil and gas-related jobs than Alternatives A or B. Alternative D is projected to support about 175 more oil and gas-related jobs in year 20 than Alternative C.

Relative to current conditions (2017), Alternative D would see the largest growth in oil and gas-related employment during the planning period. By the end of the planning period, projected oil and gas-related employment would be approximately 11,345 jobs, almost 570 more jobs than in 2017.

Table 4-208. Projected Direct/Indirect Economic Effects from Oil and Gas Activity on BLM-administered Lands under Alternative D

Direct/Indirect Effects	Projections for Alternative D		Projected Differences Between Alternative D and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Number of acres available for leasing*	2,629,315	2,629,315	74,035	74,035	74,035	74,035
Annual number of wells drilled	302	302	8	8	8	8
Total active wells	16,859	17,332	474	947	85	170
Drilling-related jobs†	1,905	1,905	54	54	54	54
Maintenance-related jobs†	9,181	9,440	254	513	42	88

Direct/Indirect Effects	Projections for Alternative D		Projected Differences Between Alternative D and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Total jobs†	11,086	11,345	308	567	96	142
Total labor earnings† (millions of 2014 dollars)	$823	$843	$23	$43	$7	$10
Total regional output† (millions of 2014 dollars)	$2,303	$2,356	$64	$118	$20	$29

* Includes direct effects and secondary regional economic effects estimated using IMPLAN.
† Includes direct effects and secondary regional economic effects estimated using IMPLAN.

4.5.2.2.2 Actions Affecting Other Mineral-related Economic Activity

Salable minerals (also referred to as mineral materials), such as caliche, sand, gravel, and other minerals used in construction, are prevalent throughout the CFO planning area. As shown in I 3.3-12 in Chapter 3, caliche sales account for most mineral material sales activity within the planning area in recent years. Caliche sales have been primarily due to oil and gas development. The BLM also can provide free gravel, sand, caliche, or other mineral materials to governments and non-profit organizations.

Other economic activity related to mineral resources managed by the CFO includes jobs from potash and sodium mining. As described in Chapter 3, as of 2011 the three active potash mines operating within the CFO employed more than 1,200 workers. The one active sodium mine employed about 75 workers in 2011. The following socioeconomic effects assessment focuses on the key effects on solid leasable minerals described in Section 4.3.1.1.2 and their potential economic ramifications.

Impacts from the No Action Alternative

Under the No Action Alternative, 2,637,465 acres would be available for salable mineral development, while 146,568 acres would be closed to salable mineral development. These allocations are the same as under existing conditions and consequently would not affect the availability or cost of salable mineral development.

Under the No Action Alternative, 174,391 acres (6% of BLM-administered lands in the planning area) would continue to be closed to solid leasable mineral development. Potash mining is expected to expand over the 20-year planning period. In addition to the three mines that were operating in 2011, a new in-situ mine was recently permitted and another proposed mine is currently under consideration. The assessment of solid leasable minerals in Section 4.3.1.1.2 concluded that a total of two new mines would be added to the three operating mines and the recently permitted mine by the end of the 20-year planning period.

Table 4-209 summarizes the projected direct and indirect economic effects of potash mining on lands managed by the CFO over the 20-year planning period. Including the recently permitted in-situ mine and the two new mines projected to be added over the planning period, total potash-related employment is projected to double from 2,076 jobs in the SESA in 2011 to 4,152 potash-related jobs by planning year 20. Annual regional economic output related to potash mining would also double from $370 million in 2011 to $740 million by planning year 20.

Table 4-209. Projected Direct/Indirect Economic Effects from Potash Mining on BLM-administered Lands under the No Action Alternative

Direct/Indirect Effects	Current (2011)	Projected Changes from Current	
		Planning Year 10	Planning Year 20
Number of active mines	3	2	3
Total jobs*	2,076	1,384	2,076
Total labor earnings* (millions of 2014 dollars)	$148	$98	$148
Total regional output* (millions of 2014 dollars)	$370	$246	$370

* Includes direct effects and secondary regional economic effects estimated using IMPLAN.

Impacts from Alternative A

Under Alternative A, 1,179,104 acres would be open without constraints to salable mineral development, about 55% less than under the No Action Alternative. A total of 561,995 acres would be closed to salable mineral development, and 1,043,152 acres would be classified as “avoid,” or open with moderate constraints, Relative to the No Action Alternative, Alternative A would reduce flexibility in where salable minerals can be acquired and potentially increase costs in acquiring these materials.

Under Alternative A, approximately 761,404 acres (27% of BLM-administered lands) would be closed to solid leasable mineral development. However, because relatively little of the lands with high or moderate potential for potash development would be within areas closed to development, this more restrictive allocation of lands for solid leasable mineral development is not anticipated to effect the number of mines that would be active during the planning period. Consequently, the economic effects from potash mining under Alternative A would be the same as under the No Action Alternative.

Impacts from Alternative B

Under Alternative B, 1,122,020 acres would be open without constraints to salable mineral development, about 57% less than under the No Action Alternative. A total of 936,799 acres would be closed to salable mineral development, and 725,368 acres would be classified as “avoid,” or open with moderate constraints, Alternative B would be similar to Alternative A, though slightly more restrictive, in terms of the availability of salable minerals and would further reduce flexibility in where salable minerals can be acquired and increase costs in acquiring these materials.

Alternative B would close 1,082,972 acres (39% of BLM-administered lands) to solid leasable mineral development. These lands are not expected to include substantial acreages with high or moderate potential for potash development and Alternative B is also not anticipated to affect the number of mines that would be active during the planning period. Consequently, the economic effects from potash mining under Alternative B would be the same as under the No Action Alternative.

Impacts from Alternative C

Under Alternative C, 1,784,431 acres would be open without constraints to salable mineral development, about 32% less than under the No Action Alternative, but 51% to 59% more than under Alternatives A or B. A total of 247,323 acres would be closed to salable mineral development, and 752,286 acres would be classified as “avoid,” or open with moderate constraints, Relative to the No Action Alternative, Alternative C would reduce flexibility in where salable minerals can be acquired and potentially increase acquisition costs, but these effects would be less than under Alternatives A or B.

Alternative C would close a little over 88,500 acres to solid leasable mineral development, far less than under Alternatives A or B. However, the same number of mines is projected to be developed under Alternative C as under the other alternatives. Consequently, the economic effects from potash mining under Alternative C would be the same as under the No Action Alternative or the other action alternatives.

Impacts from Alternative D

Under Alternative D, 2,028,324 acres would be open without constraints to salable mineral development, about 23% less than under the No Action Alternative, but considerably more than under the other action alternatives. A total of 153,174 acres would be closed to salable mineral development, and 602,621 acres would be classified as “avoid,” or open with moderate constraints, Alternative D would have little impact on the flexibility in where salable minerals can be acquired and their acquisition costs relative to the No Action Alternative or existing conditions.

Alternative D would close just about 84,700 acres to solid leasable mineral development, similar to Alternative C and much less than under Alternatives A or B. The economic effects from potash mining under Alternative D would be the same as under the No Action Alternative or the other action alternatives.

4.5.2.2.3 Actions Affecting Agricultural (Grazing-related) Economic Activity

Agriculture, largely but not entirely based on raising cattle for meat and dairy production, is also an important component of the regional economy in the SESA (as described in Chapter 3). Just over 200 operators are permitted to graze livestock on federal lands managed by the CFO, which provided grazing totaling approximately 260,000 AUMs in 2010. As noted in Chapter 3, billed grazing use on CFO lands increased from 2000 through 2010, but remained nearly 30% or more below the full amount of potential grazing permitted or leased to operators during each year in the preceding decade.

Impacts from the No Action Alternative

Some management actions under the No Action Alternative would tend to promote grazing use and corresponding economic activity. Increased vegetation would be made available to any applicant who meets the mandatory qualifications. Nearly 17,000 AUMs that are inactive or in suspension would be made available to authorized permittees when resource conditions and vegetation monitoring indicate these AUMs can be supported.

Relatively minor adjustments would be made under the No Action Alternative that would slightly reduce grazing. Almost 5,000 acres in 13 SMAs would be removed from grazing to reduce potential conflicts with sensitive habitats and other multiple use values. Any AUMs retired in the LPC and DSL areas would be allocated to wildlife use. Any AUMs relinquished in the Hope Study area or LPC Isolated Population Area would be retired to benefit wildlife and watershed health. Also, livestock use would be deferred for a minimum of two growing seasons following herbicide application in all locations.

Currently there are approximately 2 million acres of federal lands open for grazing within the SESA, on which there are 367,656 annual permitted AUMs. Under the No Action Alternative, the acreage open to grazing would be reduced by 1,939 acres, and the number of permitted AUMs would be reduced by 341.

Projected Direct/Indirect Grazing-related Economic Effects of the No Action Alternative

Based on IMPLAN analysis, the maximum historical billed use of CFO grazing lands (267,900 AUMs) supports approximately 137 direct and secondary jobs, as well as $3.7 million in labor earnings and $36 million in annual economic output. Table 4-210 summarizes the economic effects of current grazing activity (based on the maximum historical billed use in 2009). As shown in the table, the No Action Alternative would maintain current grazing conditions and have no effect on the agricultural economy relative to existing conditions.

Table 4-210. Potential Direct/Indirect Economic Effects from Grazing Activity on BLM-administered Lands under the No Action Alternative

Direct/Indirect Effects	Projections for No Action Alternative	Projected Differences from 2014 Conditions
Total number of open acres	2,086,107	None
Total permitted AUMs (potential use)*	367,315	None
Total billed AUMs (actual use†	267,900	None
Total jobs‡	136.6	0
Total labor earnings‡ (thousand 2014 dollars)	$3,696	$0
Total regional output‡ (thousand 2014 dollars)	$36,233	$0

* Maximum number of AUMs available.
† Projected AUMs actually used (see text). Existing conditions based on 2009 actual AUMs (highest number during 2000-2010 period).
‡ Includes direct effects and secondary regional economic effects estimated using IMPLAN.

The estimated economic contribution from grazing on CFO land provided in the preceding table may be a conservative estimate. This estimate reflects only the proportion of the value of the cattle that corresponds to the proportion of their lives spent grazing on public lands. However, studies have noted that the economic contribution from grazing on public lands may go beyond just the proportionate share of time that cattle are grazed on such lands. Some ranching operations may not be viable without access to seasonal grazing on public lands (Torrell 2014).

Impacts from Alternative A

Under Alternative A, less vegetation production would be allocated to grazing than under the No Action Alternative. In all, 487,909 fewer acres would be open for grazing and 86,350 fewer annual AUMs would be permitted annually than under the No Action Alternative.

Projected Direct/Indirect Grazing-related Economic Effects of the Alternative A

Table 4-211 summarizes the potential economic impacts of Alternative A compared to the No Action Alternative. As described in the assumptions discussion earlier in this section, the study team estimated a range of potential effects on grazing use, and the grazing-related economy. The “minimum effect” assumes ranchers would be able to reallocate their livestock, as necessary, to take advantage of any available (permitted) AUMs throughout the planning area. The “maximum effect” assumes that actual (billed) use would decline in proportion to the reduction in permitted AUMs compared to the No Action Alternative. Based on these varied assumptions, Alternative A is projected to result in a decrease of between 0 and 32 agriculture-related jobs and a reduction of between $0 and $0.9 million in labor earnings annually. Annual agriculture-related economic output in the SESA directly and indirectly related to grazing would be reduced by between $0 and $8.5 million.

Table 4-211. Potential Direct/Indirect Economic Effects from Grazing Activity on BLM-administered Lands under Alternative A

Direct/Indirect Effects	Projections for Alternative A		Projected Differences Between Alternative A and Existing Conditions		Projected Differences from No Action Alternative	
	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect
Total number of open acres	1,598,198		-487,909		-487,909	
Total permitted AUMs (potential use)*	280,965		-86,350		-86,350	
Total billed AUMs (actual use)†	267,900	204,921	0	-62,979	0	-62,979
Total jobs‡	136.6	104.5	0.0	-32.1	0.0	-32.1
Total labor earnings‡ (thousand 2014 dollars)	$3,696	$2,827	$0	-$869	$0	-$869
Total regional output‡ (thousand 2014 dollars)	$36,233	$27,715	-$0	-$8,518	-$0	-$8,518

* Maximum number of AUMs available.
† Projected AUMs actually used (see text).
‡ Includes direct effects and secondary regional economic effects estimated using IMPLAN.

Impacts from Alternative B

Alternative B would reduce the number of acres available for grazing and number of permitted AUMs relative to existing conditions or the No Action Alternative, but would permit more AUMs than Alternative A.

Projected Direct/Indirect Grazing-related Economic Effects of the Alternative B

Table 4-212 summarizes the potential economic impacts of Alternative B compared to the No Action Alternative. The “minimum effect” assumes ranchers would be able to reallocate their livestock, as necessary, to take advantage of any available (permitted) AUMs throughout the planning area. The “maximum effect” assumes that actual (billed) use would decline in proportion to the reduction in permitted AUMs compared to the No Action Alternative. Based on these varied assumptions, Alternative B is projected to result in a decrease of between 0 and 10 agriculture-related jobs and a reduction of between $0 and $268,000 in annual labor earnings. Annual agriculture-related economic output in the SESA directly and indirectly related to grazing would be reduced by between $0 and $2.6 million.

Table 4-212. Potential Direct/Indirect Economic Effects from Grazing Activity on BLM-administered Lands under Alternative B

Direct/Indirect Effects	Projections for Alternative B		Projected Differences Between Alternative B and Existing Conditions		Projected Differences from No Action Alternative	
	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect
Total number of open acres	1,937,725		-148,382		-148,382	
Total permitted AUMs (potential use)*	340,656		-26,659		-26,659	
Total billed AUMs (actual use)†	267,900	248,456	0	-19,444	0	-19,444
Total jobs‡	136.6	126.7	0.0	-9.9	0.0	-9.9

Direct/Indirect Effects	Projections for Alternative B		Projected Differences Between Alternative B and Existing Conditions		Projected Differences from No Action Alternative	
	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect
Total labor earnings‡ (thousand 2014 dollars)	$3,696	$3,428	$0	-$268	$0	-$268
Total regional output‡ (thousand 2014 dollars)	$36,233	$33,603	$0	-$2,630	$0	-$2,630

* Maximum number of AUMs available.
† Projected AUMs actually used (see text).
‡ Includes direct effects and secondary regional economic effects estimated using IMPLAN.

Impacts from Alternative C

Compared to Alternatives A and B, Alternative C would withdraw fewer areas from grazing use and support more permitted AUMs.

Projected Direct/Indirect Grazing-related Economic Effects of the Alternative C

Table 4-213 summarizes the projected regional economic differences between Alternative C and the No Action Alternative. The "minimum effect" assumes ranchers would be able to reallocate their livestock, as necessary, to take advantage of any available (permitted) AUMs throughout the planning area. The "maximum effect" assumes that actual (billed) use would decline in proportion to the reduction in permitted AUMs compared to the No Action Alternative. Under either assumption, the projected economic effects of Alternative C on agriculture-related jobs, labor earnings and economic output would be minimal.

Table 4-213. Potential Direct/Indirect Economic Effects from Grazing Activity on BLM-administered Lands under Alternative C

Direct/Indirect Effects	Projections for Alternative C		Projected Differences Between Alternative C and Existing Conditions		Projected Differences from No Action Alternative	
	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect
Total number of open acres	2,083,232		-2,875		-2,875	
Total permitted AUMs (potential use)*	366,229		-1,086		-1,086	
Total billed AUMs (actual use)†	267,900	267,108	0	-792	0	-792
Total jobs‡	136.6	136.2	0.0	-0.4	0.0	-0.4
Total labor earnings‡ (thousand 2014 dollars)	$3,696	$3,685	$0	-$11	$0	-$11
Total regional output‡ (thousand 2014 dollars)	$36,233	$36,126	$0	-$107	$0	-$107

* Maximum number of AUMs available.
† Projected AUMs actually used (see text).
‡ Includes direct effects and secondary regional economic effects estimated using IMPLAN.

Impacts from Alternative D

Like Alternative C, Alternative D would withdraw fewer areas from grazing use and support more AUMs than Alternative A or Alternative B.

Projected Direct/Indirect Grazing-related Economic Effects of the Alternative D

Table 4-214 summarizes the potential regional economic differences between Alternative D and the No Action Alternative.

The “minimum effect” assumes ranchers would be able to reallocate their livestock, as necessary, to take advantage of any available (permitted) AUMs throughout the planning area. The “maximum effect” assumes that actual (billed) use would decline in proportion to the reduction in permitted AUMs compared to the No Action Alternative. Under either assumption, the projected economic effects of Alternative D on agriculture-related jobs, labor earnings and economic output would be minimal.

Table 4-214. Potential Direct/Indirect Economic Effects from Grazing Activity on BLM-administered Lands under Alternative D

Direct/Indirect Effects	Projections for Alternative D		Projected Differences Between Alternative D and Existing Conditions		Projected Differences from No Action Alternative	
	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect	Minimum Effect	Maximum Effect
Total number of open acres	2,087,759		1,652		1,652	
Total permitted AUMs (potential use)*	367,024		-291		-291	
Total billed AUMs (actual use)†	267,900	267,688	0	-212	0	-212
Total jobs‡	136.6	136.5	0.0	-0.1	0.0	-0.1
Total labor earnings‡ (thousand 2014 dollars)	$3,696	$3,693	$0	-$3	$0	-$3
Total regional output‡ (thousand 2014 dollars)	$36,233	$36,204	$0	-$29	$0	-$29

* Maximum number of AUMs available.
† Projected AUMs actually used (see text).
‡ Includes direct effects and secondary regional economic effects estimated using IMPLAN.

4.5.2.2.4 Actions Affecting Recreation-related Economic Activity

Lands managed by the CFO provide an important contribution to recreation-related economic activity in the SESA, such as sales of food, gasoline, lodging, services, and other retail goods to recreationists. As described in Chapter 3, there was an average of nearly 100,000 recreational visits to CFO-managed lands from 2007 to 2011 and expenditures by these visitors were estimated to average approximately $5.4 million per year. BLM data indicate that the lands managed by the CFO accounted for about 4.7% of all recreation visits to BLM-administered lands in New Mexico in 2010. Based on this proportion, CFO recreation is estimated to support approximately 62 direct jobs in the SESA and 92 total jobs—including indirect and induced economic effects. These totals are little less than 5% of the 1,327 direct jobs and 1,953 total jobs, supported by recreation on all BLM-administered lands in New Mexico.

Proposed BLM management actions in several categories may impact future recreation and corresponding economic activity in the SESA related to recreation on CFO-managed lands. The recreation effects assessment (see Section 4.3.5) provides greater detail regarding the effects of management actions on recreation. The following discussion of impacts of the management alternatives on the recreation-related economy summarizes findings from the recreation effects assessment to highlight the management actions likely to have the largest effects on recreation and recreation-related economic activity.

Impacts from Management Common to All

Management actions common to all alternatives in a number of areas would continue to protect and enhance recreation opportunities and the recreational experience on CFO-managed lands, as well as the recreation-related economy. As described in Section 4.3.5, management actions common to all in the following areas have implications for recreation (and, consequently, for the recreation-related economy):

- Recreation
- Air Quality
- Backcountry Byways
- Cave and Karst Resources
- Wildland Fire Management
- Minerals
- Livestock Grazing
- Special Designation (WSA)
- Travel Management
- Vegetation
- Visual Resources

Impacts from Management Common to All Action Alternatives

Management actions common to all action alternatives in many of the same areas listed above would also affect recreation use and recreation-related economic activity.

Impacts from the No Action Alternative

Under the No Action Alternative, Hackberry Lake and the Pecos River Corridor would be designated as SRMAs. These designations would benefit different groups of recreation users, as described in in Section 4.3.5, potentially encouraging recreation activity, spending and economic activity.

Most recreationists on lands managed by the CFO are residents of the region and recreation visits are increasing with regional population growth (BLM 2014b). Based on projected population growth in the region from the University of New Mexico (2012), Table 4-215 depicts projected recreation visits and economic activity directly and indirectly supported by recreation on CFO lands over the 20-year planning period.

Table 4-215. Projected Recreation Visits to the Planning Area and Direct/Indirect Economic Effects of Recreation under the No Action Alternative

Direct/Indirect Effects	Current (2011)	Projected Changes from Current	
		Planning Year 10	Planning Year 20
Annual recreation visits	99,393	12,921	25,842
Recreation spending (millions in 2014 dollars)	$5.4	$0.7	$1.4
Total jobs*	***92***	***12***	***24***

* Includes direct effects and secondary regional economic effects based on USDI estimates of recreation employment supported by BLM-administered lands in New Mexico (2011).

Impacts from Alternative A

Under Alternative A, additional areas would be designated as SRMAs. Designation of the Alkali Lake SRMA would likely improve long-term recreation opportunities for OHV users, while designations of SRMAs at Conoco Lake and La Cueva would benefit non-mechanized recreationists. Square Lake would be designated as an ERMA, with long-term beneficial effects for OHV users.

However, the recreation management actions under any of the action alternatives are unlikely to have a quantifiable effect on recreation visits to the planning area. Residents that want to recreate outdoors will adapt to the alternatives and continue to use the BLM-administered lands (BLM 2014b). Consequently, the economic effects of recreation on BLM-administered lands are projected to remain the same under Alternative A as under the No Action Alternative**.**

Impacts from Alternative B

Recreation management actions under Alternative B would generally be similar to those under Alternative A, with the exceptions that the West Wells Dune would be designated as an ERMA and the Pecos River Equestrian area and Hay Hollow Equestrian area would be designated as ERMAs.

These management actions would particularly benefit equestrian users, but impacts on overall recreation visitation, spending and economic activity cannot be projected. The overall economic effects of recreation on BLM-administered lands are projected to remain the same under each of the action alternatives as under the No Action Alternative**.**

Impacts from Alternative C

Recreation management actions under Alternative C would generally be similar to those under Alternative B, with the following exceptions. Alkali Lake would be designated as an ERMA, rather than a SRMA, and the Hay Hollow Equestrian area would not receive a designation. Consequently, there would likely be less beneficial effects for recreation users (particularly equestrian users) under Alternative C than under Alternative B, but impacts on overall recreation visitation, spending and economic activity cannot be projected. The overall economic effects of recreation on BLM-administered lands are projected to remain the same under each of the action alternatives as under the No Action Alternative**.**

Impacts from Alternative D

In general, recreation management actions under Alternative D would be similar to Alternative C. As described previously for Alternative A, the economic effects of recreation on BLM-administered lands are projected to remain the same under each of the action alternatives as under the No Action Alternative**.**

4.5.2.2.5 Actions Affecting Non-Market Economic Values

Historically, economic evaluations associated with public lands have focused primarily on market values, capturing the contribution of public lands to the value of goods and services that are traded in the economy. The preceding sections discussing the effects of the management alternatives on the oil and gas-related economy, other minerals-related economic activity, the agricultural economy, and the recreation-related economy are examples of this type of economic analysis known as a regional economic impact analysis.

There is increasing recognition that public lands provide economic values that are not necessarily part of traditional market transactions. “Non-market” economic values include both values received by public land users (typically recreation users) that are not fully captured in the market place and passive or non-use values that may accrue to people even if they never actually visit or otherwise use the public lands.

Non-market recreation values reflect how much people value their own participation in recreation activities, over and above what they have to pay to participate. This concept can also be described in terms of “consumer’s surplus,” or the amount that individuals would be willing to pay to be able to participate in particular recreation activities (or how much they would be willing to accept to forego participation in those activities), net of the costs they actually incur for the recreational experience.

Passive or non-use values include amenity values and the value of ecosystem support services. There is growing evidence that people value the experience of living in proximity to relatively pristine, undeveloped public lands. Studies indicate a migration trend motivated by natural amenities and quality of life considerations (Cordell et al. 2011; Johnson and Rasker 1995; McGranahan 1999; Rudzitis 1999). This “amenity migration” is especially prevalent in rural areas of western states and represents a shift from traditional western migration, which centered on employment opportunities, often related to resource extraction. In this relatively new amenity-based trend, location choices are influenced by natural landscapes, scenery, recreation opportunities, and climate more than economic opportunity. A 2011 USFS study estimated the impacts of specific natural amenities on rural population migration through a regression analysis of over 2,000 rural counties in the United States. These results indicate that federally managed lands, open rangeland, forest land, and pasture lands are all correlated with higher rates of migration to rural counties.

Recently, there has also been greater effort to identify and quantify the value of the ecological, or ecosystem, resources provided by public lands. Forest, shrub lands, wetlands, and other undeveloped lands provide a host of ecological services, including carbon sequestration, water filtering and purification, erosion control, and habitat for a diversity of species. While there is a growing body of literature on this topic and rough value estimates have been developed for some of these services, this form of economic valuation is still in the relatively early stages of development.

BLM guidance documents require that at least a qualitative assessment should be provided regarding impacts to non-market values and that these values should be quantified where relevant and feasible (BLM IM 2013-131). Given very limited information on current non-market values associated with the lands managed by the CFO, the following assessment is qualitative in nature.

The results of this assessment should not be compared to the results of the regional economic impact analyses in the preceding sections. As described previously, the regional economic impact analyses track estimates of the *economic activity* that a given management decision is expected to create within the SESA. This level of analysis provides important information on the distributional effects of a management decision. Assessing non-market values explicitly considers the value of a good or service as measured by “consumer surplus” – consumer surplus is a measure of social welfare and is not comparable with indicators of economic activity.

Impacts from Management Common to All

In general, the following types of management actions will likely tend to increase the non-market values associated with lands managed by the CFO by maintaining or improving resource conditions:

- Actions that enhance the quality or opportunities for recreation users that prefer a natural-appearing environment with little evidence of disturbance
- Actions that preserve relatively pristine and undeveloped areas
- Actions that preserve cultural sites
- Actions that maintain or enhance visual resource qualities
- Actions that promote the health and survival of fish and wildlife

Management actions common to all alternatives include actions that would continue to be undertaken under the No Action Alternative, as well as under any of the action alternatives. Management actions common to all alternatives relevant to non-market values include the following resource management areas.

Land Tenure

All lands not specifically identified for disposal in the RMP would continue to be owned by the federal government and managed for multiple uses. This action would protect and maintain current non-market values associated with BLM-administered lands.

Special Designations – Wilderness Study Areas

WSAs would be closed to oil and gas leasing unless and until it is determined that they will not be designated as wilderness. These areas would be managed in accordance with the BLM’s Management of Wilderness Study Areas Manual. This action would also protect and maintain current non-market values associated with BLM-administered lands.

Travel Management

Motorized cross country travel for lessees and permittees would be limited to travel necessary to administer their lease or permit. They would not be allowed to drive cross-country for other purposes like hunting or recreation. The Phantom Banks Heronries would be designated as limited to OHV use and seasonal limitations would be imposed to protect active heronries. These actions would protect and maintain current non-market values associated with BLM-administered lands.

Under all of the alternatives, including No Action, travel would be either OHV limited or closed, and there would be no open areas with unrestricted travel.

Visual Resource Management

Scenic leased areas would have planned utility corridors to minimize cumulative impacts to visual resource quality. This action would also protect and maintain current non-market values associated with CFO lands.

Collectively, these and other management actions common to all alternatives do not represent a change from existing management conditions. However, these ongoing management measures would continue to protect and promote non-market values.

Impacts from Management Common to All Action Alternatives

Management actions common to all action alternatives that are relevant to non-market values include the following resource management areas.

Land Tenure

The BLM would seek to close springs and seeps to salables and mineral disposal and withdraw these areas from locatable mineral development. These actions would protect existing non-market values.

Recreation

Two management actions common to all action alternatives would help preserve non-market values. Camping would be prohibited within 300 feet of any water sources and no permanent rock climbing aids (e.g., bolts, anchors) would be allowed to be placed on routes without prior coordination with the CFO.

Areas of Critical Environmental Concern

Each of the action alternatives would designate at least five ACECs to protect important biological, cultural, scenic, or historic resources. These actions would help to preserve and enhance non-market values.

Travel Management

All of the action alternatives would require the removal of any road surfacing material when oil and gas wells are abandoned. This action would reduce the long-term visual impact of oil and gas development and would enhance non-market values.

Impacts from the No Action Alternative

Minerals Allocations

The No Action Alternative would close approximately 174,000 acres to leasable mineral development (e.g., oil and gas, potash, sodium) and place major constraints such as NSO on an additional 55,000 acres. While these restrictions would tend to protect non-market values, the total acreage closed or open with major constraints under the No Action Alternative is less than under any of the action alternatives except Alternative D.

Lands with Wilderness Characteristics

Under the No Action Alternative, no lands would be managed as lands with wilderness characteristics. Consequently these types of lands, and the non-market values associated with them, would receive the least protection under the No Action Alternative.

Areas of Critical Environmental Concern

No areas would be designated as ACECs under the No Action Alternative. Consequently, these types of lands, and the non-market values associated with them, would receive the least protection under the No Action Alternative.

Wild and Scenic Rivers

Under the No Action Alternative, neither the Black River nor the Delaware River would be managed as WSRs, pending designation by Congress. The non-market values associated with these rivers would not receive the additional protection provided by managing to WSR objectives.

Overall, the No Action Alternative likely would provide the least protection for non-market values among the alternatives being considered in this RMP.

Impacts from Alternative A

Minerals Allocations

Alternative A would close approximately 761,000 acres to leasable mineral development (e.g., oil and gas, potash, sodium) and place major constraints such as NSO on an additional 80,000 acres. Among all of the alternatives, only Alternative B would close or place major restrictions on more land for leasable mineral development. Mineral allocations under Alternative A would be highly protective of non-market values related to lands managed by the CFO.

Lands with Wilderness Characteristics

Alternative A would manage 11 units totaling almost 67,000 acres as lands with wilderness characteristics. This is the most acreage that would be managed to preserve wilderness characteristics under any of the alternatives and these actions would serve to protect and enhance non-market values associated with these lands.

Areas of Critical Environmental Concern

Alternative A would designate nine areas as ACECs. This is fewer than would be designated as ACECs under Alternative B (15 areas) and similar to the eight areas that would be designated as ACECs under Alternative C. These designations would tend to preserve and enhance non-market values.

Wild and Scenic Rivers

Under Alternative A, both the Black River and the Delaware River would be managed as WSRs, pending designation by Congress. The non-market values associated with these rivers would receive the additional protection provided by managing to WSR objectives.

Overall, Alternative A would do more to protect and enhance non-market values than the No Action Alternative, Alternative C, or Alternative D.

Impacts from Alternative B

Minerals Allocations

Alternative B would close approximately 1,083,000 acres to leasable mineral development (e.g., oil and gas, potash, sodium) and place major constraints such as NSO on an additional 162,000 acres. Among all of the alternatives, Alternative B would close or place major restrictions on the most land for leasable mineral development. Mineral allocations under Alternative B, like Alternative A, would be highly protective of non-market values related to lands managed by the CFO.

Lands with Wilderness Characteristics

Alternative B would manage about 48,000 acres to protect lands with wilderness characteristics. This is less acreage that would be managed to preserve wilderness characteristics than Alternative A, but slightly more than under Alternative C. Managing these areas as lands with wilderness characteristics would serve to protect and enhance non-market values associated with these lands.

Areas of Critical Environmental Concern

Alternative B would designate 15 areas as ACECs, the most under any of the alternatives. These designations would tend to preserve and enhance non-market values.

Wild and Scenic Rivers

Under Alternative B, the Black River would be managed as a WSR, pending designation by Congress, but the Delaware River would not. The non-market values associated with the Black River would receive the additional protection provided by managing to WSR objectives.

Overall, the Alternative B would provide a similar level of protection for non-market values to Alternative A.

Impacts from Alternative C

Minerals Allocations

Alternative C would close approximately 89,000 acres to leasable mineral development (e.g., oil and gas, potash, sodium) and place major constraints such as NSO on an additional 158,000 acres. Alternative C would close or place major restrictions on substantially less land for leasable mineral development than Alternatives A and B, but would close or restrict more land than Alternative D or the No Action Alternative.

Lands with Wilderness Characteristics

Alternative C would manage about 5,119 acres to protect lands with wilderness characteristics. This is much less acreage that would be managed to preserve wilderness characteristics than Alternative B, but more than under Alternative D. Managing these areas as lands with wilderness characteristics would serve to protect and enhance non-market values associated with these lands.

Areas of Critical Environmental Concern

Alternative C would designate eight areas as ACECs, similar to Alternative A, less than Alternative B, but more than Alternative D. These designations would tend to preserve and enhance non-market values.

Wild and Scenic Rivers

Under Alternative C, like Alternative B, the Black River would be managed as a WSR but the Delaware River would not. The non-market values associated with the Black River would receive the additional protection provided by managing to WSR objectives.

Overall, the Alternative C would provide less protection for non-market values than Alternatives A or B, but more protection than Alternative D or the No Action Alternative.

Impacts from Alternative D

Minerals Allocations

Alternative D would close approximately 85,000 acres to leasable mineral development (e.g., oil and gas, potash, sodium) and place major constraints such as NSO on an additional 70,000 acres. Overall, Alternative D would restrict the fewest acres from mineral development with surface occupancy and would provide the least protection for non-market values in this regard.

Lands with Wilderness Characteristics

Alternative D would manage about 1,221 acres to protect lands with wilderness characteristics. This is considerably less acreage than would be managed to preserve wilderness characteristics under the other action alternatives and would provide less protection for non-market values associated with these lands.

Areas of Critical Environmental Concern

Alternative D would designate five areas as ACECs, again the least of any of the action alternatives. As these designations tend to preserve and enhance non-market values, Alternative D would again provide the least protection for the non-market values associated with these lands among the action alternatives.

Wild and Scenic Rivers

Under Alternative D, like Alternatives B and C, the Black River would be managed as a WSR but the Delaware River would not. The non-market values associated with the Black River would receive the additional protection provided by managing to WSR objectives.

Overall, the Alternative D would provide the least protection for non-market values among the action alternatives. By including some lands that would be managed as lands with wilderness characteristics, ACECs, or WSRs, Alternative D offers more protection for non-market values in certain respects than the No Action Alternative. However, the No Action Alternative would restrict more land from mineral development with surface occupancy than Alternative D.

4.5.2.2.6 Summary of Economic Effects by Alternative

The following discussion summarizes projected effects on the SESA economy from activities on CFO-managed lands under each of the alternatives. In addition to the projected effects from mineral, grazing, and recreation-related activities described earlier in this section, this summary also notes the regional economic effects from direct BLM employment and expenditures, but does not attempt to project BLM budgets or expenditures in the future (which depend on Federal budget priorities). For purposes of simplicity and presentation, projected economic effects from grazing are based on the midpoint of the ranges of potential effects projected earlier for each alternative. The discussion concludes with a summary of effects on state, local, and federal tax revenues for each alternative.

Projected Economic Effects from the No Action Alternative

Currently (2017), CFO direct expenditures and activities on BLM-managed and split estate lands support almost 13,100 jobs in the SESA. Under the No Action Alternative, more than 1,600 more jobs would be supported by the tenth year of the planning period and about 2,500 more jobs would be supported by the end of the planning period. Most of the employment growth would be due to increases in oil and gas-related activity and additional potash mining. Table 4-216 summarizes projected employment directly and indirectly related to activities on BLM-managed lands, as well as BLM direct employment and expenditures, under the No Action Alternative. BLM employment and expenditures are driven by federal budget priorities and processes and were not projected over the 20-year planning period.

Table 4-216. Summary of Projected Direct/Indirect Employment Effects under the No Action Alternative

Jobs	Projections for No Action Alternative		Projected Differences from Existing Conditions	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	10,991	11,203	212	424
Other mineral-related	3,460	4,152	1,384	2,076
Grazing-related	137	137	None	None
Recreation-related	104	116	12	24
BLM employment and spending-related*	NA	NA	NA	NA
Total jobs	***14,692***	***15,608***	***1,608***	***2,524***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
* BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Activities on BLM-managed and split estate lands and direct employment and expenditures by the CFO currently generate an estimated $155 million per year in state and local tax revenues. Under the No Action Alternative, annual state and local tax revenues related to the CFO are projected to grow by approximately $17 million by year 10 of the planning period and by $27 million per year by the end of the planning period. These increases in tax revenues are due to projected increases in oil and gas and potash activity, as summarized in Table 4-217.

Table 4-217. Summary of Projected Direct/Indirect Effects on Annual State and Local Tax Revenues under the No Action Alternative (millions of 2014 dollars)

Revenues	Projections for No Action Alternative		Projected Differences from Existing Conditions	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$134.9	$137.7	$2.9	$5.7
Other mineral-related	$36.2	$43.4	$14.5	$21.7
Grazing-related	$1.1	$1.1	$0.0	$0.0
Recreation-related*	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA
Total revenues	***$172.2***	***$182.2***	***$17.4***	***$27.4***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
* Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Activities on BLM-managed lands and direct employment and expenditures by the CFO currently generate an estimated $204 million per year in federal tax revenues. Under the No Action Alternative, annual federal revenues related to the CFO are projected to grow by approximately $27 million by year 10 of the planning period and by $43 million per year by the end of the planning period. These increases in tax revenues are due to projected increases in oil and gas and potash activity, as summarized in Table 4-218.

Table 4-218. Summary of Projected Direct/Indirect Effects on Annual Federal Tax Revenues under the No Action Alternative (millions of 2014 dollars)

Revenues	Projections for No Action Alternative		Projected Differences from Existing Conditions	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$170.4	$172.7	$3.3	$6.7
Other mineral-related	$59.9	$71.9	$24.0	$35.9
Grazing-related	$1.1	$1.1	$0.0	$0.0
Recreation-related*	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA
Total revenues	***$231.4***	***$246.7***	***$27.3***	***$42.6***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
* Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Non-market values associated with lands managed by the CFO could not be quantified. However, as discussed earlier, the No Action Alternative is likely the least protective of these values among all of the alternatives and would likely result in the lowest total non-market value associated with BLM-managed lands.

Projected Economic Effects from Alternative A

Table 4-219 summarizes projected employment directly and indirectly related to activities on BLM-managed lands under Alternative A.

Alternative A is projected to support approximately 935 fewer jobs by year 10 of the planning period than the No Action Alternative and approximately 1,383 fewer jobs by the end of the 20-year planning period. These projected employment effects are primarily due to fewer oil and gas-related jobs, as well as a smaller reduction in grazing-related employment. However, total employment supported by BLM-managed lands under Alternative A during the planning period is still projected to exceed employment levels under existing conditions.

Table 4-219. Summary of Projected Direct/Indirect Employment Effects under Alternative A

Jobs	Projections for Alternative A		Projected Differences Between Alternative A and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	10,201	10,028	-578	-750	-790	-1,175
Other mineral-related	3,460	4,152	1,384	2,076	0	0
Grazing-related	121	121	-16	-16	-16	-16
Recreation-related	104	116	12	24	0	0
BLM employment and spending-related*	NA	NA	NA	NA	NA	NA
Total jobs	***13,886***	***14,417***	***802***	***1,333***	***-807***	***-1,191***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
* BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

State and local tax revenues under Alternative A are projected to be approximately $8 million less than under the No Action Alternative in year 10 of the planning period and approximately $13 million per year less than under the No Action Alternative by the end of the planning period. Tax revenues under Alternative A are, however, projected to be larger than under existing conditions due to projected increases in revenues from future potash mines (“other mineral-related” revenues). These effects are summarized in Table 4-220.

Table 4-220. Summary of Projected Direct/Indirect Effects on Annual State and Local Tax Revenues under Alternative A (millions of 2014 dollars)

Revenues	Projections for Alternative A		Projected Differences Between Alternative A and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$126.9	$125.1	-$5.1	-$7.0	-$8.0	-$12.7
Other mineral-related	$36.2	$43.4	$14.5	$21.7	$0	$0
Grazing-related	$0.9	$0.9	-$0.2	-$0.2	-$0.2	-$0.2
Recreation-related*	NA	NA	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA	NA	NA
Total revenue	***$164.0***	***$169.4***	***$9.2***	***$14.5***	***-$8.2***	***-$12.9***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
*Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Under Alternative A, annual federal revenues related to the CFO are projected to be approximately $12 million lower than under the No Action Alternative by year 10 of the planning period and about $18 million per year lower than the No Action Alternative by the end of the planning period. Like state and local tax revenues, however, federal tax revenues under Alternative A are projected to be larger than current revenues (existing conditions). These effects are summarized in Table 4-221.

Table 4-221. Summary of Projected Direct/Indirect Effects on Annual Federal Tax Revenues under Alternative A (millions of 2014 dollars)

Revenues	Projections for Alternative A		Projected Differences Between Alternative A and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$158.0	$155.9	-$9.0	-11.2	-$12.3	-$17.8
Other mineral-related	$59.9	$71.9	$24.0	$35.9	$0	$0
Grazing-related	$0.9	$0.9	-$0.2	-$0.2	-$0.2	-$0.2
Recreation-related*	NA	NA	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA	NA	NA
Total revenue	***$218.8***	***$228.7***	***$14.8***	***$24.5***	***-$12.5***	***-$18.0***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
*Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Alternative A, along with Alternative B, would do the most to protect and enhance non-market values among all of the alternatives considered in this RMP.

Projected Economic Effects from Alternative B

Table 4-222 summarizes projected employment directly and indirectly related to activities on BLM-managed lands under Alternative B.

Alternative B is projected to support approximately 1,315 fewer jobs by the tenth year of the planning period than the No Action Alternative and approximately 1,953 fewer jobs by the end of the 20-year planning period. These projected employment effects are primarily due to fewer oil and gas-related jobs, as well as a smaller reduction in grazing-related employment. Overall, Alternative B would support the fewest jobs among all of the alternatives considered in this RMP. However, total employment supported by BLM-managed lands under Alternative B during the planning period is still projected to exceed current employment levels.

Table 4-222. Summary of Projected Direct/Indirect Employment Effects under Alternative B

Jobs	Projections for Alternative B		Projected Differences Between Alternative B and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	9,681	9,255	-1,098	-1,523	-1,310	-1,948
Other mineral-related	3,460	4,152	1,384	2,076	0	0
Grazing-related	132	132	-5	-5	-5	-5
Recreation-related	104	116	12	24	0	0
BLM employment and spending-related*	NA	NA	NA	NA	NA	NA
Total jobs	***13,377***	***13,655***	***293***	***572***	***-1,315***	***-1,953***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
* BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

State and local tax revenues under Alternative B are projected to be approximately $12 million less than under the No Action Alternative in year 10 of the planning period and approximately $21 million per year less than under the No Action Alternative by the end of the planning period. State and local tax revenues are, however, projected to be larger under Alternative B than existing conditions. These effects are summarized in Table 4-223.

Table 4-223. Summary of Projected Direct/Indirect Effects on Annual State and Local Tax Revenues under Alternative B (millions of 2014 dollars)

Revenues	Projections for Alternative B		Projected Differences Between Alternative B and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$122.8	$117.1	-$9.2	-$14.9	-$12.1	-$20.6
Other mineral-related	$36.2	$43.4	$14.5	$21.7	$0	$0
Grazing-related	$0.9	$0.9	-$0.2	-$0.2	-$0.2	-$0.2
Recreation-related*	NA	NA	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA	NA	NA
Total revenue	***$159.9***	***$161.4***	***$5.1***	***$6.6***	***-$12.3***	***-$20.8***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
*Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Under Alternative B, annual federal revenues related to the CFO are projected to be approximately $19 million lower than under the No Action Alternative by year 10 of the planning period and about $29 million per year lower than the No Action Alternative by the end of the planning period. Due to projected increases in federal revenues from “other mineral-related activity” (new potash mines), federal revenues are projected to be greater under Alternative B than under existing conditions. These effects are summarized in Table 4-224.

Table 4-224. Summary of Projected Direct/Indirect Effects on Annual Federal Tax Revenues under Alternative B (millions of 2014 dollars)

Revenues	Projections for Alternative B		Projected Differences Between Alternative B and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$151.3	$144.6	-$15.8	-$22.5	-$19.1	-$29.1
Other mineral-related	$59.9	$71.9	$24.0	$35.9	$0	$0
Grazing-related	$0.9	$0.9	-$0.2	-$0.2	-$0.2	-$0.2
Recreation-related*	NA	NA	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA	NA	NA
Total revenue	***$212.1***	***$217.4***	***$8.0***	***$13.2***	***-$19.3***	***-$29.3***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
*Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Alternative B, along with Alternative A, would do the most to protect and enhance non-market values among all of the alternatives considered in this RMP.

Projected Economic Effects under Alternative C

Table 4-225 summarizes projected employment directly and indirectly related to activities on BLM-managed lands under Alternative C.

Alternative C is projected to support approximately 24 fewer jobs by the tenth year of the planning period than the No Action Alternative and approximately 35 fewer jobs by the end of the 20-year planning period. These projected employment effects reflect fewer oil and gas-related jobs. However, total employment related to BLM-managed lands and direct BLM activities under Alternative C would increase over the planning period relative to current conditions and would be more than 1,000 jobs higher than under either Alternative A or B by the end of the planning period.

Table 4-225. Summary of Projected Direct/Indirect Employment Effects under Alternative C

Jobs*	Projections for Alternative C		Projected Differences Between Alternative C and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	10,968	11,169	189	390	-23	-34
Other mineral-related	3,460	4,152	1,384	2,076	0	0
Grazing-related	136	136	-1	-1	-1	-1
Recreation-related	104	116	12	24	0	0
BLM employment and spending-related*	NA	NA	NA	NA	NA	NA
Total jobs	***14,668***	***15,573***	***1,584***	***2,489***	***-24***	***-35***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
* BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

State and local tax revenues under Alternative C are projected to be approximately $200,000 less than under the No Action Alternative in year 10 of the planning period and approximately $400,000 per year less than under the No Action Alternative by the end of the planning period. State and local tax revenues are, however, projected to be larger under Alternative C than existing conditions. These effects are summarized in Table 4-226.

Table 4-226. Summary of Projected Direct/Indirect Effects on Annual State and Local Tax Revenues under Alternative C (millions of 2014 dollars)

Revenues	Projections for Alternative C		Projected Differences Between Alternative C and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$134.6	$137.4	$2.6	$5.3	-$0.2	-$0.4
Other mineral-related	$36.2	$43.4	$14.5	$21.7	$0	$0
Grazing-related	$1.1	$1.1	$0.0	$0.0	$0.0	$0.0
Recreation-related*	NA	NA	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA	NA	NA
Total revenue	***$171.9***	***$181.9***	***$17.1***	***$27.0***	***-$0.2***	***-$0.4***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
*Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Under Alternative C, annual federal revenues related to the CFO are projected to be approximately $400,000 to $500,000 lower than under the No Action Alternative. Federal revenues are projected to be greater under Alternative C than under existing conditions. These effects are summarized in Table 4-227.

Table 4-227. Summary of Projected Direct/Indirect Effects on Annual Federal Tax Revenues under Alternative C (millions of 2014 dollars)

Revenues	Projections for Alternative C		Projected Differences Between Alternative C and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$170.0	$173.2	$3.0	$6.1	-$0.4	-$0.5
Other mineral-related	$59.9	$71.9	$24.0	$35.9	$0	$0
Grazing-related	$1.1	$1.1	$0.0	$0.0	$0.0	$0.0
Recreation-related*	NA	NA	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA	NA	NA
Total revenue	***$231.0***	***$246.2***	***$27.0***	***$42.0***	***-$0.4***	***-$0.5***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
*Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Alternative C would provide less protection for non-market values than Alternatives A or B, but more protection than Alternative D or the No Action Alternative.

Projected Economic Effects under Alternative D

Table 4-228 summarizes projected employment directly and indirectly related to activities on BLM-managed lands, as well as BLM direct employment and expenditures, under Alternative D. BLM employment and expenditures are budget constrained and are projected to remain the same under any of the alternatives.

Alternative D is projected to support approximately 96 more jobs by the tenth year of the planning period than the No Action Alternative and approximately 142 more jobs by the end of the 20-year planning period. Alternative D is the only action alternative projected to support more total employment than the No Action Alternative.

Table 4-228. Summary of Projected Direct/Indirect Employment Effects under Alternative D

Jobs	Projections for Alternative D		Projected Differences Between Alternative D and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	11,086	11,345	308	567	96	142
Other mineral-related	3,460	4,152	1,384	2,076	0	0
Grazing-related	137	137	0	0	0	0
Recreation-related	104	116	12	24	0	0
BLM employment and spending-related*	NA	NA	NA	NA	NA	NA
Total jobs	***14,787***	***15,750***	***1,704***	***2,667***	***96***	***142***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
* BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Alternative D would also produce the most state and local tax revenue among the alternatives. State and local tax revenues under Alternative D are projected to be approximately $1.0 million more than under the No Action Alternative in year 10 of the planning period and approximately $1.6 million per year more than under the No Action Alternative by the end of the planning period. These effects are summarized in Table 4-229.

Table 4-229. Summary of Projected Direct/Indirect Effects on Annual State and Local Tax Revenues under Alternative D (millions of 2014 dollars)

Revenues	Projections for Alternative D		Projected Differences Between Alternative D and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$135.8	$139.3	$3.8	$7.3	$1.0	$1.6
Other mineral-related	$36.2	$43.4	$14.5	$21.7	$0	$0
Grazing-related	$1.1	$1.1	$0.0	$0.0	$0.0	$0.0
Recreation-related*	NA	NA	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA	NA	NA
Total revenue	***$173.1***	***$183.8***	***$18.3***	***$29.0***	***$1.0***	***$1.6***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
*Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Similarly, annual federal revenues related to the CFO are projected to be approximately $1.5 million more than under the No Action Alternative by year 10 of the planning period and about $2.2 million per year more than the No Action Alternative by the end of the planning period. These effects are summarized in Table 4-230.

Table 4-230. Summary of Projected Direct/Indirect Effects on Annual Federal Tax Revenues under Alternative D (millions of 2014 dollars)

Revenues	Projections for Alternative D		Projected Differences Between Alternative D and Existing Conditions		Projected Differences from No Action Alternative	
	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20	Planning Year 10	Planning Year 20
Oil and gas-related	$171.9	$175.9	$4.8	$8.9	$1.5	$2.2
Other mineral-related	$59.9	$71.9	$24.0	$35.9	$0	$0
Grazing-related	$1.1	$1.1	$0.00	$0.00	$0.0	$0.0
Recreation-related*	NA	NA	NA	NA	NA	NA
BLM employment and spending-related†	NA	NA	NA	NA	NA	NA
Total revenue	***$232.9***	***$248.9***	***$28.8***	***$44.8***	***$1.5***	***$2.2***

Note: Data include direct effects and secondary regional economic effects estimated using IMPLAN.
*Recreation fiscal effects not available as described in assumptions at the beginning of this section.
† BLM employment and spending are driven by federal budgetary decisions independent of the management alternatives.

Alternative D would provide the least protection for non-market values among the action alternatives.

4.5.2.3 Social Direct/Indirect Impacts

4.5.2.3.1 Projected Effects on SESA Demographics and Demand for Public Services

Potential effects on SESA demographics from the management alternatives were estimated based on the total employment effects described in the preceding section combined with the ratios of key demographic metrics to total employment identified in the Methods and Assumptions discussion near the beginning of this section.

Demographic and Public Service Effects from the No Action Alternative

To facilitate comparisons to current SESA demographic conditions described in Chapter 3 and assessment of effects on demand for housing, schools, and other public services, the demographic effects of each alternative are presented in terms of changes from current conditions. Table 4-231 summarizes the projected effects of the No Action Alternative on key SESA demographic metrics.

Table 4-231. Summary of Projected Demographic Effects under the No Action Alternative

Direct/Indirect Effects	Projected Changes from Current Conditions	
	Planning Year 10	Planning Year 20
New jobs*	1,608	2,524
New residents	3,055	4,796
New households	1,091	1,713
New school children	611	959

*Includes direct effects and secondary regional economic effects described earlier in this section.

As described in greater detail in Chapter 3, the SESA had a total population of over 184,000 residents in 2010. The employment growth projected to occur over the 20-year planning period due to activities on BLM-managed lands under the No Action Alternative would lead to an increase in population of about 4,800 residents, equivalent to less than 3% of the 2010 total population. Consequently, this level of population growth would be considered a minor demographic effect. Whether the effect is considered beneficial or adverse is largely a matter of perspective.

Employment growth under the No Action Alternative would also lead to demand for over 1,700 housing units. As described in Chapter 3, there were approximately 7,800 vacant housing units in the SESA in 2010. Although the housing market in the SESA may have tightened since 2010 (as it has across most of the nation), it appears likely that the SESA could accommodate the increase in housing demand under the No Action Alternative over the 20-year planning period without too much difficulty. In some other parts of the western United States, including the Williston Basin in North Dakota and Montana, intensive oil and gas drilling activity has led to strong demand for short-term accommodations such as motel rooms, RV spaces and campgrounds. Under the No Action Alternative, however, the rate of drilling activity is projected to continue at the same pace as experienced in recent years under existing conditions. The projected increase in demand for housing over time under this alternative is due primarily to increases in the number of relatively permanent jobs required to maintain the increasing number of existing oil and gas wells and to the projected development of additional potash mines.

Similarly, the 959 new school-aged children anticipated under the No Action Alternative would represent less than a 3% increase in the number of school-aged children in the SESA in 2010. Given the length of the planning period during which this growth would occur, the increase in school-aged children would again represent a minor increase in demand for public education services.

Demographic and Public Service Effects from Alternative A

Table 4-232 summarizes the projected effects of Alternative A on key SESA demographic metrics.

Table 4-232. Summary of Projected Demographic Effects under Alternative A

Direct/Indirect Effects	Projected Changes from Current Conditions	
	Planning Year 10	Planning Year 20
New jobs*	802	1,333
New residents	1,523	2,533
New households	544	905
New school children	305	507

*Includes direct effects and secondary regional economic effects described earlier in this section.

The employment growth projected to occur over the 20-year planning period due to activities on CFO-managed lands under Alternative A would lead to an increase in population of about 2,500 residents, equivalent to less than 2% of the 2010 total population. This relative level of population growth over the 20-year planning period would likely constitute a minor demographic effect.

Employment growth under Alternative A would also lead to demand for about 900 housing units. Over a 20-year period, this would again represent a relatively minor increase in housing demand.

The 507 new school-aged children anticipated over the next 20 years under Alternative A would represent less than a 2% increase in the number of school-aged children in the SESA in 2010. The increase in school-aged children would again represent a minor increase in demand for public education services.

Demographic and Public Service Effects from Alternative B

Table 4-233 summarizes the projected effects of Alternative B on key SESA demographic metrics.

Table 4-233. Summary of Projected Demographic Effects under Alternative B

Direct/Indirect Effects	Projected Changes from Current Conditions	
	Planning Year 10	Planning Year 20
New jobs*	293	571
New residents	557	1,086
New households	199	388
New school children	111	217

*Includes direct effects and secondary regional economic effects described earlier in this section.

Alternative B’s effects on the SESA population are smaller than the projected effects under Alternative A. This relative level of population growth over the 20-year planning period would be a minor demographic effect.

Employment growth under Alternative B would lead to demand for about 400 housing units, about 500 fewer units than under Alternative A. Over a 20-year period, this would again represent a relatively minor increase in housing demand.

The 217 new school-aged children anticipated under Alternative B would represent less than a 1% increase compared to the number of school-aged children in the SESA in 2010. This would represent a minor increase in demand for public education services.

Demographic and Public Service Effects from Alternative C

Table 4-234 summarizes the projected effects of Alternative C on key SESA demographic metrics.

Table 4-234. Summary of Projected Demographic Effects under Alternative C

Direct/Indirect Effects	Projected Changes from Current Conditions	
	Planning Year 10	Planning Year 20
New jobs*	1,584	2,489
New residents	3,010	4,729
New households	1,075	1,689
New school children	602	946

*Includes direct effects and secondary regional economic effects described earlier in this section.

Alternative C would have larger effects on the SESA population than Alternative A or Alternative B, but smaller effects than under the No Action Alternative. Once again, the projected increase in population due to activities on BLM-managed lands would represent a minor demographic effect over the 20-year planning period.

Employment growth under Alternative C would lead to demand for about 1,700 housing units, slightly less than under the No Action Alternative. This would again represent a relatively minor increase in housing demand over the 20-year period.

The increase in demand for public education of 946 additional school-aged children by the end of the 20-year planning period is similar to the projected effect under the No Action Alternative and represents a minor increase in demand for public education services.

Demographic and Public Service Effects from Alternative D

Table 4-235 summarizes the projected effects of Alternative D on key SESA demographic metrics.

Table 4-235. Summary of Projected Demographic Effects under Alternative D

Direct/Indirect Effects	Projected Changes from Current Conditions	
	Planning Year 10	Planning Year 20
New jobs*	1,704	2,666
New residents	3,237	5,066
New households	1,156	1,809
New school children	647	1,013

*Includes direct effects and secondary regional economic effects described earlier in this section.

Alternative D would have the largest effect on the SESA population of any of the alternatives. However, the nearly 5,100 new residents projected to live in the SESA due to activities on BLM-managed lands would still represent a minor demographic effect over the 20-year planning period and would be less than 3% of the 2010 population of the area.

Employment growth under Alternative D would lead to demand for over 1,800 housing units, more than under the No Action Alternative. This would again represent a negligible increase in housing demand over the 20-year period.

The increase in demand for public education of 1,013 additional school-aged children by the end of the 20-year planning period is slightly larger than the projected effect under the No Action Alternative and again represents a minor increase in demand for public education services given the length of the planning period.

4.5.2.3.2 Other Social Effects

The social effects of rapid development of natural gas, oil, coal, power plants and other energy, and extractive resources have been studied by sociologists and others for nearly 40 years. Most recently, the energy "booms" in areas such as the Williston Basin in North Dakota and the Marcellus Shale in Pennsylvania have spurred a number of studies regarding social effects on small communities experiencing rapid development (North Dakota State University 2011; Brasier and Kelsey 2012; Montana All Threat Intelligence Center and North Dakota State and Local Intelligence Center 2012; Montana Board of Crime Control 2013).

After more than 40 years of study in various locations, the potential social impacts arising from rapid natural resource development are widely recognized. Such effects can include changes in how residents perceive their lives and their community, including:

- Changes in the density of acquaintanceship (see Freudenberg 1986 for example). This may sometimes be expressed in statements like "we used to know everyone, now there are a lot of strangers in our community."
- Declines in local identity, solidarity, and trust in other community members (see Greider et al. 1991).
- Fear of crime (see Krannich et al. 1985).
- Less control of deviant behavior, reduced respect for law and order, and less effective socialization of youth (see Freudenberg 1986).
- Diminished community satisfaction and reduced attachment to the community (see Brown et al. 1989).

These effects can vary based on both the nature of the resource activity and the existing characteristics of the affected communities. In general, the pace of development, the stage of development, and the prior experience of the community with natural resource and extractive industry appear to be important determinants of the nature and magnitude of social impacts (Montana Board of Crime Control 2013).

The residents and communities in the SESA have extensive experience with energy development and other extractive industries, as described in Chapter 3. Projected development of oil and gas and other mineral resources under any of the proposed alternatives would not represent a substantial change from the type or pace of development that the area has experienced over at least the past decade. Consequently, the probability of the residents of the SESA experiencing the types of "boomtown" social effects that have occurred in smaller communities with little previous experience with rapid industrial development appears to be low under any of the proposed alternatives.

In the Analysis of the Management Situation developed near the beginning of this RMP process, four general groups were identified based on varied perspectives on the use and management of public lands within the SESA. These groups included ranchers, recreationists, individuals who prioritize natural resource uses and individuals who prioritize resource protection. The four groups are not necessarily mutually exclusive and individuals residing in the SESA (or elsewhere) may align with more than one group, or even align differently depending on the particular issue in question. However, this simple structure provides a useful way to consider the effects on different interests from the CFO management alternatives. The following discussion focuses on how each of these groups may perceive and be affected by the various management alternatives.

Other Social Effects from the No Action Alternative

Effects on Ranchers

The No Action Alternative would largely maintain the status quo in terms of grazing use of BLM-managed lands. The potential for conflicts with other uses and users of the public lands is likely to gradually increase as both oil and gas and recreation uses increase over the 20-year planning period.

Effects on Recreationists

The No Action Alternative would also largely maintain the status quo in terms of recreation use. Relative to the action alternatives, this alternative may be perceived as the most favorable by current OHV users because it creates the fewest restrictions on off-highway travel. Conflicts between OHV users and non-motorized recreationists would likely increase over the planning period as recreation activity levels continue to grow. Conflicts between all types of recreationists and other users of the lands are likely to gradually increase as both oil and gas and recreation uses increase over the 20-year planning period.

Effects on Individuals Who Prioritize Natural Resource Uses

The No Action Alternative, along with Alternative D, is likely to be perceived as the most favorable alternatives among individuals that prioritize natural resource development on public lands. The No Action Alternative would allow nearly as much oil and gas development as Alternative D, but also involves the least change in BLM management policies from the status quo. Changes in management policies and regulation require adaptation and can create uncertainty from an industry perspective.

Effects on Individuals Who Prioritize Resource Protection

The interests of individuals that place their highest priority on protecting resources and the environment may be most closely aligned with the alternatives that would offer the most protection for non-market economic values. Since the No Action Alternative likely provides the least protection for these values, it would likely be the least favorable alternative for this community.

Other Social Effects from Alternative A

Effects on Ranchers

Alternative A would reduce the number of AUMs available for grazing and would reallocate increased vegetation from restoration efforts away from grazing use. Although this alternative could also reduce the potential for conflicts with other users of public lands over the planning period, ranchers and livestock producers may perceive Alternative A as having an adverse impact on their abilities to maintain current stocking levels.

Effects on Recreationists

OHV recreational users would benefit from the designation of the Alkali Lake SRMA while designations of SRMAs at Conoco Lake and La Cueva would benefit non-mechanized recreationists. Square Lake would be designated as an ERMA, with long-term beneficial effects for OHV users.

Effects on Individuals Who Prioritize Natural Resource Uses

Alternative A, is likely to be perceived as one of the least favorable alternatives among individuals that prioritize natural resource development on public lands. Alternative A provides a greater emphasis on resource protection relative to resource development, and may consequently be seen as having a negative effect on resource use options by these individuals.

Effects on Individuals Who Prioritize Resource Protection

Alternative A provides the highest level of resource protection among the options being considered in this RMP. Alternative A would protect and enhance multiple ecosystems, and would probably enhance non-market values associated with BLM-managed lands. Consequently, Alternative A is likely to be perceived as a beneficial and preferred alternative by these individuals.

Other Social Effects from Alternative B

Effects on Ranchers

Alternative B would reduce the number of AUMs available for grazing compared to the No Action Alternative or Alternative A. However, Alternative B would allocate a portion of increased vegetation from restoration efforts, and a portion of suspended or inactive AUMs to grazing use (with the rest being allocated to other purposes). Like Alternative A, this alternative could also reduce the potential for conflicts with other users of the lands over the planning period, but it is likely that ranchers and livestock producers would perceive Alternative B as having a negative effect on their ability to maintain stocking rates and, consequently, production levels.

Effects on Recreationists

Individuals prioritizing recreational uses would benefit from additional recreation management under Alternative B. Equestrian users, in particular, would benefit from the designation of the Pecos River Equestrian area and Hay Hollow Equestrian area as ERMAs.

Effects on Individuals Who Prioritize Natural Resource Uses

Alternative B is likely to be perceived as the least favorable alternative by this group. Like Alternative A, this alternative places more emphasis on resource protection than resource development and is likely to be seen as an adverse option by this group.

Effects on Individuals Who Prioritize Resource Protection

Alternative B, together with Alternative A, provides the highest level of resource protection among the options being considered in this RMP. Alternative B would protect and enhance non-market values associated with BLM-managed lands and is likely to be seen as a beneficial option by this group.

Other Social Effects from Alternative C

Effects on Ranchers

Alternative C would allow more grazing than any of the other alternatives, including the No Action Alternative. This alternative could also somewhat reduce the potential for conflicts with other users of BLM-managed lands, particularly relative to the No Action Alternative. Alternative C could be perceived as providing a minor benefit to this group, relative to the No Action Alternative, and would likely be perceived as substantially beneficial relative to Alternative A or Alternative B.

Effects on Recreationists

Individuals who prioritize recreational uses of BLM-managed lands would likely perceive Alternative C to be less beneficial than Alternative B, but more beneficial than the No Action Alternative. Alkali Lake would be designated as an ERMA, rather than a SRMA, and the Hay Hollow Equestrian area would not receive a designation.

Effects on Individuals Who Prioritize Natural Resource Uses

Alternative C attempts to balance natural resource development with resource protection. As such, this alternative is likely to be perceived as more favorable than Alternative A or B, and less favorable than the No Action Alternative or Alternative D by this group.

Effects on Individuals Who Prioritize Resource Protection

For the same reasons just described, Alternative C is likely to be seen as a more favorable option (or providing at least a minor benefit) than Alternative D or the No Action Alternative by individuals that prioritize resource protection. Alternative C would likely be considered less favorable than Alternative A or B by this group.

Other Social Effects from Alternative D

Effects on Ranchers

Alternative D would make approximately the same amount of grazing land available as Alternative C, with slightly fewer permitted AUMs. This alternative could also somewhat reduce the potential for conflicts with other users of BLM-managed lands, particularly relative to the No Action Alternative. Alternative D, like Alternative C, could be perceived as providing a minor benefit to this group, relative to the No Action Alternative. Alternative D would likely be perceived as substantially beneficial relative to Alternative A or Alternative B.

Effects on Recreationists

Alternative D would likely be perceived as the last beneficial action alternative by those who prioritize recreational use of BLM-managed lands**.** Fewer areas would be designated as SRMAs or ERMAs and actively managed to for recreational purposes than under the other action alternatives.

Effects on Individuals Who Prioritize Natural Resource Uses

Alternative D provides the most emphasis on natural resource development among all of the alternatives. As such, this alternative is likely to be perceived as the most favorable option by this group.

Effects on Individuals Who Prioritize Resource Protection

Alternative D is likely to be seen as the worst management alternative among individuals that prioritize resource protection.

4.5.2.4 Environmental Justice

EO 12898, dated February 11, 1994, established the requirement to address environmental justice concerns within the context of federal agency operations. Fundamental principles of environmental justice require that federal agencies:

- Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations;
- Ensure the full and fair participation by all potentially affected communities in the decision-making process; and
- Prevent the denial of, reduction in, or significant delay in the receipt of benefits of the project by minority and low-income populations.

Evaluation of environmental justice impacts requires identification of minority and low-income populations (including Native American tribes) within the SESA and evaluation of the potential for the alternatives to have disproportionately high and adverse impacts on such populations.

As described in Chapter 3, the SESA as a whole has a high percentage of minority residents, most of whom are Hispanic. The communities of Roswell, Dexter, Hagerman, Lake Arthur, Artesia, Loving, Hobbs, Lovington, and Jal all have minority populations over 50% and are considered “minority population areas” under environmental justice standards. Other potential environmental justice populations, determined by low-income status, are Hagerman, Roswell, Artesia, and Loving.

In general, and to varying degrees as described earlier in this section, each of the alternatives would allow for continuing economic and population growth in the SESA due to activities on BLM-managed lands. Employment growth, in particular, can provide additional economic opportunities for low-income residents. Rapid employment and population growth, however, can also present challenges for low-income residents (particularly the unemployed) due to increases in housing costs and household commodity prices that may accompany this type of economic expansion. As described in the preceding discussions regarding projected demographic and social effects, none of the alternatives considered in this RMP/EIS are projected to lead to substantial or sudden increases in the rate of economic or demographic growth in the SESA.

RMP alternatives, such as those evaluated in this EIS, are challenging to evaluate in terms of more geographically specific environmental justice concerns. RMPs reflect resource planning and management at the landscape scale and generally do not prescribe or evaluate specific locations of future activities that could affect the most closely proximate communities. To the extent that nearby residents may be disproportionately adversely affected by the environmental impacts of industrial developments, such as oil and gas drilling or potash mining (e.g., additional truck traffic, reduced air quality, additional noise, and visual impacts), there is more potential risk of disproportionate adverse effects on minority or low-income communities under the alternatives that would make the most land available for such development—Alternatives C and D—than under the alternatives that would emphasize the protection of natural resources—Alternative A and Alternative B. The No Action Alternative would fall in the middle of the five alternatives. Should specific industrial developments be proposed under any alternative in the future, further assessment of impacts to environmental justice populations will be part of the compliance and permitting processes at that time. Without being able to forecast the specific locations of future industrial activities that may occur under any of the alternatives, the BLM CFO concludes that none of the alternatives described in this document are likely to result in disproportionate adverse impacts to environmental justice populations identified within the SESA.

4.5.3 Health and Safety

4.5.3.1 Analysis Methods

Section 3.5.3, Health and Safety, identifies authorized activities and uses of public lands that have inherent and recognized risks. These activities and uses include motorized vehicle use, recreational activities, energy development, authorized use of hazardous materials, and the presence of physical hazards (including abandoned mine land [AML] sites). Management actions detailed in Chapter 2 that are identified to have impacts to health and safety are discussed as causing an increase or decrease to the risks associated with these activities and uses. The BLM's Manual 1703-1 Hazard Management and Resource Restoration (2009) provides management guidance with regard to BLM's responsibilities to maintain and protect public health.

4.5.3.1.1 Methods and Assumptions

Management actions related to the following resource areas were analyzed in detail: public safety, recreation, travel management, minerals, wildland fire and fuels, and special designations. Management actions related to the following resources and resource uses are not expected to either increase or decrease risks associated with the activities and uses identified above and in Chapter 3 and are therefore not analyzed in detail below: air resources, soils, water, karst, vegetative communities, fish and wildlife, special status species, noxious weeds and invasive species, cultural resources, paleontological resources, lands with wilderness characteristics, visual resources, renewable energy, livestock grazing, land use authorizations and land tenure, and social and economic conditions.

The BLM identified the following analysis assumptions related to the impacts discussion:

- The BLM assumes all ATV users would follow manufacturer recommended safety guidelines, as well as all state laws, and adhere to all warning signs.
- The BLM assumes all oil and gas or mining industry personnel working on BLM-administered lands would follow all safety procedures and guidelines as regulated by OSHA, USDI Safety & Health Handbook 485 DM, BLM Manual 1703-1, and BLM Manual Handbook H 1112-2.
- The BLM assumes oil and gas operators would disclose all hazardous materials or wastes used for operations, and that all federal, state, and local regulations regarding use of hazardous materials would be adhered to.

4.5.3.2 Direct and Indirect Impacts

4.5.3.2.1 Impacts of Health and Safety Actions

Section 3.5.3, Health and Safety, identifies H_2S as a safety issue in the planning area because of the associated risks of exposure to the public. Chapter 2 includes management common to all alternatives related to H_2S, as well as proposed management common to all action alternatives. No management is proposed that varies across alternatives. Therefore, only management common to all and management common to all action alternatives are discussed below.

Impacts from Management Common to All

Following hazardous materials management requirements described in BLM Manual 1703-1 and BLM Manual Handbook 1112-2, Chapter 28, Toxic and Explosive Gas Protection, is applicable to all alternatives. Following these requirements reduces risk of contamination of air, soil, or water from a leak or spill of hazardous materials by requiring remediation of contaminated sites and restoring natural resources injured by releases of hazardous substances and petroleum products.

Impacts from Management Common to All Action Alternatives

Under all action alternatives the BLM would develop a BLM employee database and use the Safety Management Information System database to track the occurrence of H_2S monitor incidents. This would decrease future risk to BLM employees and others that may be in the vicinity of wells with H_2S exposure risk by collecting data and mapping certain areas where H_2S often occurs. Collection of information regarding H_2S monitor incidents would allow the BLM to warn potential users of H_2S occurrences, which would decrease the risk from exposure to H_2S.

4.5.3.2.2 Impacts of Recreation Actions on Health and Safety

As discussed in Section 3.5.3, Health and Safety, authorized recreational uses of BLM-administered lands include caving, horseback riding, biking, hiking, rock climbing, camping, and OHV use. Recreational shooting, other than hunting, is not a sanctioned use of public lands. The primary issues with safety and recreational users are conflicts between OHV riders within designated areas and oil and gas development in the form of aboveground pipelines and potential exposure to H_2S near recreational areas. Chapter 2 identifies current management designed to reduce these conflicts that would be brought forward under all action alternatives and is analyzed under management common to all below. No new management is proposed under the action alternatives specific to health and safety, and therefore only management common to all is discussed below.

Impacts from Management Common to All

Under all alternatives the BLM would manage the OHV high-use areas Alkali Lake ERMA, Hackberry Lake SRMA, Dunes RMZ, and Trails RMZ to continue to reduce conflicts with energy development and other users by requiring flags on OHVs, posting signage wherever H_2S might occur, and requiring all pipelines be buried. Current trends show that OHV-user conflicts with current and future energy development, will continue.

4.5.3.2.3 Impacts of Travel Management Actions on Health and Safety

Section 3.5.3, Health and Safety, identifies OHV use and the trend of increasing OHV use as a safety issue for the planning area. Travel management decisions from Chapter 2 include designating areas in one of two categories: limited, or closed to motorized travel. This analysis uses the assumption that cross-country travel is more risky for OHV riders than travel on existing or designated routes because of the presence of physical hazards such as aboveground pipelines, dips in topography, AML sites, illegal waste sites, existing oil and gas facilities, and other physical hazards. Therefore, the greater the acres closed to overland travel corresponds to a reduced overall risk to OHV riders. Table 4-236 identifies the travel management designations across alternatives. The travel management designations vary by alternative and the different impacts are described below.

Table 4-236. Travel Management Designations in Acres by Alternative

Management	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Limited	2,035,307	2,039,299	2,049,391	2,052,582	2,052,584
Closed	55,966	52,028	41,936	38,738	38,737
Total	***2,091,273***	***2,091,326***	***2,091,327***	***2,091,320***	***2,091,321***

Impacts from the No Action Alternative

Under the No Action Alternative, 2,035,307 (97% of BLM-administered lands in the planning area) would be managed as OHV limited; the remaining acreage would be closed to motorized travel. Current trends regarding conflicts between OHVs and other uses/users detailed above and in Chapter 3 would continue.

Impacts from Alternative A

Under Alternative A, 2,039,299 (98% of BLM-administered lands in the planning area) would be managed as OHV limited. Current trends regarding conflicts between OHVs and other uses/users detailed above and in Chapter 3 would continue. Safety risks and conflicts with other uses associated with OHV travel would be similar to the No Action Alternative.

Impacts from Alternative B

Under Alternative B, 2, 2,049,391 (98% of BLM-administered lands in the planning area) would be managed as OHV limited. This would increase the potential for user conflict and safety risks slightly as compared to the No Action Alternative.

Impacts from Alternative C

Under Alternative C, 2,052,582 (98% of BLM-administered lands in the planning area) would be managed as OHV limited. This would increase the potential for user conflict and safety risks slightly as compared to the No Action Alternative.

Impacts from Alternative D

Under Alternative D, 2,052,584 (98% of BLM-administered lands in the planning area) would be managed as OHV limited. This would increase the potential for user conflict and safety risks slightly as compared to the No Action Alternative.

4.5.3.2.4 Impacts of Minerals Actions on Health and Safety

Section 3.5.3, Health and Safety, identifies oil and gas exploration, potash mining, and hazardous materials used in oil and gas development and potash mining as safety issues in the planning area. In addition, transportation related to mineral extraction activities is a safety concern because of risk to the public from traffic accidents. Mineral development decisions from Chapter 2 include actions that may increase or decrease risks to health and safety from activities and uses. The discussion details impacts from the following activities and uses:

- Oil and gas exploration
    - well drilling and operations
    - installation and operation of pressurized pipelines
    - authorized use of hazardous materials
    - industrial traffic on area highways
    - presence of H_2S
- Potash mining
- Remediation of abandoned mine sites

Oil and Gas Exploration

Well drilling and operation, and installation of transport and connection pipelines and pipeline facilities, such as compressor stations, are predicted to continue in the planning area and in some areas may increase. Well drilling requires the use of hazardous materials and associated pipelines carry hazardous materials and have potential for leaks or ruptures, which can pose safety and environmental risks. In addition, in some areas, H_2S is prevalent and risk of exposure to H_2S must be managed. In addition, oil and gas exploration requires the use of industrial truck traffic, which increases the risk of accidents on area highways. In this analysis the assumption is made that the greater the number of acres potentially disturbed for energy development over the term of the RMP (20 years) correlates to the potential risks to health and safety from the use of hazardous materials and the use of truck traffic associated with those activities. Potential impacts from any spills or releases would be adverse and long term. Predicted levels of oil and gas development and associated surface disturbance vary across alternatives, and the analysis by alternative is presented below. Table 4-237 compares the total predicted surface disturbance for oil and gas development by alternative, after reclamation.

Table 4-237. Potential Surface Disturbance in Acres, on BLM-administered Lands, by Alternative

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
8,636	6,565	5,202	8,575	8,887

Impacts from Management Common to All

Under all of the alternatives the BLM would require adherence to hazardous materials management practices for protection of public health and safety. The operators installing and operating oil and gas wells, facilities, and pipelines would be responsible for complying with the applicable laws and regulations governing hazardous materials and following all hazardous spill response plans and stipulations. These requirements would provide a detailed strategy and process for responding to releases of hazardous substances, therefore reducing short-term impacts from contamination. The CFO routinely inspects and monitors these operations to ensure operator compliance. Compliance with, and BLM enforcement of, federal and state requirements would continue current trends with regard to the potential risk of and impacts to health and safety from leaks or spills of hazardous materials.

For management of risks related to H_2S exposure, all alternatives include measures to flare or vent gas and require the use of stock tank vapor recovery systems. These measures would continue current trends with regard to the risks of potential for explosions or settling of gas in caves or low-lying areas and risk of human contact with H_2S.

Impacts from the No Action Alternative

Under the No Action Alternative, 8,636 acres would be disturbed by future oil and gas development. Current trends regarding uses of hazardous materials and potential for leaks or spills and risks related to traffic accidents would continue.

Impacts from Alternative A

Under Alternative A, 6,565 acres would be disturbed by oil and gas development. This is approximately 24% less disturbance than the No Action Alternative. Potential risks related to release of hazardous materials, traffic accidents, and conflicts with other uses would also be reduced.

Impacts from Alternative B

Under Alternative B, 5,202 acres would be disturbed by oil and gas development. This is approximately 40% less disturbance than the No Action Alternative. Potential risks related to the release of hazardous materials, traffic accidents, and conflicts with other uses would also be reduced.

Impacts from Alternative C

Under Alternative C, 8,575 acres would be disturbed by oil and gas development. This is very similar to the predicted disturbance under the No Action Alternative. Potential risks related to release of hazardous materials, traffic accidents, and conflicts with other uses would be similar to the No Action Alternative.

Impacts from Alternative D

Under Alternative D, 8,887 acres would be disturbed by oil and gas development. This is approximately 3% more disturbance than the No Action Alternative. Potential risks related to release of hazardous materials, traffic accidents, and conflicts with other uses would increase.

Potash Mining

Potash mining in the planning area is expected to increase over the life of the RMP as the demand of fertilizer-based products increases. Safety issues related to potash mining are primarily when mining and oil and gas operations conflict. Conflicts between oil and gas and mining are mainly the risk of harm to mine workers from migration of gas or hazardous materials, including H_2S, into mines. Mining also utilizes hazardous materials with associated potential for leaks and spills. Management actions related to safety issues and potash mining do not vary across alternatives; therefore, only impacts from management common to all are discussed.

Impacts from Management Common to All

All exploration and operations activities in the Secretary's Potash Area authorized on BLM-administered lands are required to comply with the Secretarial Order for Co-Development of Oil & Gas and Potash Resources in Southeast New Mexico. This secretarial order includes measures to prevent the infiltration of oil, gas, or water in formations containing potash deposits or into mines or workings being utilized in the extraction of such deposits. Adhering to these measures would reduce risk of harm to workers and reduce potential for migration of hazardous materials into mine cavities. Similar to oil and gas operators, mine operations are also subject to BLM inspections and MSHA regulations for worker and mine safety. In addition, operators must adhere to Mine Safety and Health Administration safety standards for active mines for all safety related to mining activities on CFO-administered lands. Adherence to these safety regulations continues current trends related to health and safety risks to mine workers.

Remediation of Abandoned Mine Sites

Section 3.5.3, Health and Safety, details the risks and hazards associated with abandoned mine sites on public lands. The BLM's AML program seeks to reduce or eliminate the effects of past hard rock mining in order to enhance public safety and improve water quality. Management actions related to AML sites are contained in Chapter 2 and do not vary across action alternatives; therefore, only impacts from management common to all action alternatives are discussed below. No corresponding action exists under the No Action Alternative.

Impacts from Management Common to All Action Alternatives

Under all action alternatives, the BLM would coordinate with the New Mexico Abandoned Mine Programs and follow federal AML regulations, etc., to continue to locate, inventory, and close abandoned mines. These measures would reduce risk to the public by posting warning signs at any unstable AML sites and closing and remediating AML sites when funding is available.

4.5.3.2.5 Impacts of Wildland Fire and Fuels Management Actions on Health and Safety

Section 3.5.3, Health and Safety, identifies the risks to life and property from wildfires. The BLM seeks to reduce risks to life and property from the spread of wildfire through fire management and emergency response planning. Management of wildfire prevention and response is detailed in Chapter 2. Those actions related to health and safety and preservation of life and property do not vary across alternatives; therefore, only management common to all alternatives is discussed below.

Impacts from Management Common to All

Under all alternatives the BLM would update and amend the CFO FMP (BLM 2010), as necessary, to prioritize firefighter and public safety during wildfire response actions or approved prescribed burn actions. The BLM would work together with other fire management agencies such as federal, state, and local agencies to maintain community wildfire protection plans that include risk reduction implementation plans. These measures would continue to manage risks to life and property from wildfire on public lands by fostering communication among agencies and updating methods and responses to wildfire as previous methods and plans become outdated.

4.5.3.2.6 Impacts of Special Designations Actions on Health and Safety

During the RMP process the BLM seeks to designate ACECs that have recognized relevant and important values, such as cultural, scenic, wildlife, and natural processes and hazards, as well as provide management for WSRs and WSAs. Those areas specifically designated for recreational use are discussed above (see Impacts of Recreation Actions on Health and Safety). During the internal evaluation of ACECs, the BLM identified four proposed ACECs that possess the relevant and important criteria of natural hazards in the form of undeveloped caves (Table 4-238). All undeveloped caves contain some hazards, such as total darkness, loose rocks, low ceilings, low tight passages, slippery surfaces, and steep, unstable, and uneven floors.

Table 4-238. Area of Critical Environmental Concern Designations with Identified Natural Hazards by Alternative

ACEC	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Carlsbad Chihuahuan Desert Rivers		X			
Cave Resources		X	X	X	X
Gypsum Soils			X	X	
Seven Rivers Hills			X	X	X

Note: ACECs proposed under each alternative are designated by an "X."

The BLM action of creating designated areas can encourage or promote visitation of these areas by highlighting the amenities of scenery, remoteness, primitive recreational opportunities, caving, or other activities. The primary risks to health and safety related to visitation of ACECs, WSRs, lands with wilderness characteristics, and WSAs are hazards of visiting remote areas where communications and emergency services are far away or unavailable, and where hostile wildlife, and natural physical hazards such as steep topography, unstable areas, and caving hazards mentioned above exist.

The BLM seeks to reduce recognized risks to visitors by reducing conflicts between visitors and other uses, such as oil and gas development, and by recognizing and warning the public regarding natural hazards found in some designated areas. Through the designation process, the BLM can manage visitor and other uses accordingly. The action of evaluating and designating certain areas for special management reduces risks to the public by publicizing where hazards occur and what type of risks are present, and by requiring adherence to rules and guidelines meant to protect the public from potential harm.

Impacts from the No Action Alternative

Under the No Action Alternative, the proposed ACECs recognized to possess natural hazards would not be managed to protect health and safety through ACEC designation. Current trends regarding visitor use of these areas and potential risk to visitors would continue.

Impacts from Alternative A

Under Alternative A, two ACECs with recognized natural hazards would be designated, Carlsbad Chihuahuan Desert Rivers and Cave Resources. Potential risks to health and safety related to visitation of these areas would be reduced by the adoption of the following management prescriptions by limiting visitor use and publicizing dangers from natural hazards:

- Limit camping to designated areas (Carlsbad Chihuahuan Desert Rivers ACEC).
- Develop a comprehensive ACEC management plan to direct the management of cave visitor use, scientific research, and other cave related projects (all units of Cave Resources ACEC).

Impacts from Alternative B and C

Under Alternative B and C, three ACECs with recognized natural hazards would be designated, Cave Resources, Gypsum Soils, and Seven Rivers Hills. Potential risks to health and safety related to visitation of these areas would be reduced by the adoption of the following management prescriptions by limiting visitor use and publicizing dangers from natural hazards:

- Develop a comprehensive ACEC management plan to direct the management of cave visitor use, scientific research, and other cave related projects (all units of Cave Resources ACEC).
- Limit camping to designated areas (Gypsum Soils ACEC).
- Complete limited OHV designation and implement plan to restrict vehicles to designated routes. Close the route(s) over sink holes. Default to the travel allocations and defer route designation to TMP (Seven Rivers Hills ACEC).

Impacts from Alternative D

Under Alternative D, two ACECs with recognized natural hazards would be designated, Cave Resources and Seven Rivers Hills. Potential risks to health and safety related to visitation of these areas would be reduced by the adoption of the following management prescriptions by limiting visitor use and publicizing dangers from natural hazards:

- Develop a comprehensive ACEC management plan to direct the management of cave visitor use, scientific research, and other cave related projects (all units of Cave Resources ACEC).
- Complete limited OHV designation and implement plan to restrict vehicles to designated routes. Close the route(s) over sink holes. Default to the travel allocations and defer route designation to the travel management plan (Seven Rivers Hills ACEC).

4.6 CUMULATIVE IMPACTS

Cumulative impacts occur when there are multiple impacts on the same resources. These are incremental impacts of proposed activities or projects when combined with past, present, and future actions. As stated in 40 CFR 1508.7 (1997), a "cumulative impact" is the impact on the environment that 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. For the purposes of this analysis, the area considered for cumulative impacts is the 6.2-million-acre CFO planning area.

Resource decisions from this RMP could combine with other past, present, and reasonably foreseeable future actions to produce cumulative impacts to resources and resource uses within the planning area. Co-occurring planning projects in the region that could contribute to cumulative impacts include activities in the Lincoln National Forest, Carlsbad Caverns National Park, and Guadalupe Mountains National Park, as well as projects conducted by the Bureau of Reclamation, U.S. Department of Energy, and the BLM Roswell, Las Cruces, Oklahoma, and Amarillo Field Offices. Activities on state lands, private lands, and in city and county use plans for surrounding communities could have cumulative impacts where land is developed adjacent to BLM-administered lands.

Past actions that affected the resources in the planning area are reflected in Chapter 3 – Affected Environment. Impacts from past and present actions within the 6.2-million-acre planning area include approximately 317,000 acres of surface-disturbing activities, including past-construction of gas plants, potash mines, oil and gas well pads, access roads, transmission lines, and other linear features.

Reasonably foreseeable future actions are uses and activities that are planned to occur within the planning area in the foreseeable future. The RMP/EIS takes into account those proposed actions that are actively being proposed by other agencies, organizations, or governments that would impact resources within the planning area. The BLM considered those projects that were within the planning area and of sufficient scope to impact the resources discussed in this RMP at similar spatial and temporal scales as the direct and indirect impacts.

The following reasonably foreseeable actions were identified that may contribute cumulative impacts to the project. Reasonably foreseeable actions are planned or proposed, not speculative or in the distant future. They also include continuation of recent trends in use. The following actions are identified as reasonably foreseeable:

- land and resource management planning in the CFO planning area and surrounding adjacent areas;
- continued expansion of mineral extraction activities, including oil, gas, and potash, within the planning area and surrounding adjacent areas along with state and private lands;
- utility corridor development;
- pipeline and transmission line development;
- increases in motorized and non-motorized recreation use of BLM-administered lands;
- federal, state, and local fire plan activities;
- continued implementation of the *New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management* (Standards and Guidelines), the BLM's 13 Western States Vegetation EIS, and Restore New Mexico;
- continued noxious weed infestations;
- continued wildfire management, including prescribed burning and natural ignitions;
- vegetation treatments and sagebrush restoration; and
- renewable energy development.

Specific reasonably foreseeable future actions for the CFO planning area are listed in Table 4-239.

Table 4-239. Reasonably Foreseeable Future Actions for Planning Area

Project Proponent	Brief Description	Footprint/Surface Disturbance
Intercontinental Potash Corporation (ICP) Ochoa Mine Project	The project includes 3,932 acres of surface disturbance for the processing plant, water well field, pipeline, and loadout facility. An estimated 1,842 acres of the processing plant is located within a lesser prairie-chicken management area.	3,932 acres
ICP	Same as above. The ROD was signed April 10, 2014. Total proposed new surface disturbance is expected to be 2,500 acres.	2,500 acres
Industrial Water Use	RFD projects include a number of wells that can also be used to make assumptions for water use. Water treatment facilities. EOG treatment facility all inclusive. Water use 38,943 acre-feet.	12,980 acres
Seismic projects	70 seismic projects.	32,500 acres[7] (short term); reclamation within 3 years
HB Amax Solution Mine Project	Potash production.	62 acres
Mosaic Tailings	Tailings storage.	1,405 acres
Fire and fuels treatments	Non-BLM agencies would treat up to 150,000 acres with prescribed fire, 20,000 acres with mechanical treatments, and 100,000 acres of herbicide over the next 20 years.	120,0000 acres
Land farms	27 land farms, including Maljamar land farm just west of Maljamar.	140 acres
Restore New Mexico	Vegetation restoration.	1 million acres treated and 1 million acres planned for the future
Frontier Energy Pipeline	A 200-mile (or 700 acres) crude oil gathering pipeline system.	700 acres
Amrad to Artesia Transmission Line	Transmission line.	787 acres
Xcel Transmission Grid	Based on corridor length of 251.4 miles at 30 feet wide. With 50-foot width it would be 1,524 acres.	915 acres
Enterprise Gas Pipeline	Gas pipeline.	267 acres
BOPCO Drill Islands Infrastructure	Drill islands infrastructure.	175 acres
Biofuel Project	Converting algae.	–
Hydraulic Fracturing sand projects	Rail line to deliver hydraulic fracturing sand to industry.	61 acres

[7] Average project area 6.500 acres and temporary disturbance for a year because of rolling of the equipment.

Project Proponent	Brief Description	Footprint/Surface Disturbance
Navitas	Midstream gas pipeline and plant.	420 acres
Xcel Energy	Hobbs to China Draw power line.	300 acres
Sunoco Pipeline	Oil pipeline.	175 acres
Xcel Energy	Substation feeder power line.	272 acres
RHEP Crude LLC	Oil pipeline.	77 acres
Plains All American Pipeline	Cotton Draw Expansion oil pipeline.	101 acres
Various Companies	Water use for mineral development.	12,980 acres 38,943 acre-feet
Lincoln National Forest Plan Revision	The Lincoln National Forest Plan is under revision. All resources and resource uses would be subject to changes in management.	Not known
Carlsbad Caverns and Guadalupe National Parks	Both national parks are managed for conservation.	Not known

Additional reasonably foreseeable future actions include the predicted number of oil and gas wells under each of the alternatives would disturb between 24,187 acres and 27,732 acres of soils and vegetation. Table 4-240 outlines the number of acres that would be disturbed for oil and gas development by alternative for BLM and non-BLM-administered lands.

Table 4-240. Predicted Surface Disturbance within CFO Planning Area

	No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Total predicted surface disturbance/acres on **BLM-administered lands only**	11,515	8,753	6,936	11,434	11,849
Total predicted surface disturbance/acres on **non-BLM-administered lands**[8]	14,115	14,115	14,115	14,115	14,115
Total predicted surface disturbance/acres on all lands after reclamation	22,751	20,680	19.317	22,690	23,002

Cumulative impacts from oil and gas development, including water use, would be greatest under Alternatives C and D as compared to the No Action Alternative. Alternatives A and B would contribute the least amount of surface disturbance reducing overall cumulative impacts. Cumulative impacts specific to each resource and resource use are discussed in the sections below.

[8] This number remains static and does not vary by alternative because BLM does not have jurisdiction over these lands and it is not known how many acres would be open or closed for development)

4.6.1 Soil and Water Resources

Past and present actions that affect and have affected soil and water resources include land use authorizations, livestock grazing, recreational uses (including OHVs, non-motorized recreation, etc.), mineral exploration and development, fire and fuels treatments, and other vegetation treatments, including noxious weeds management. Chapter 3, Section 3.2.2 provides greater details on the effect of past and present actions on soil and water resources, but in general these actions have all had cumulatively adverse impacts on soil and water resources by causing surface disturbance contributing to reduced soil productivity, alterations in water quality parameters, soil compaction, erosion, and increased sediment loading. They have also resulted in the introduction of invasive weeds, which can affect water resources through increased evapotranspiration rates, and soil resources through alterations to soil chemistry and productivity. Water withdrawals and impoundments have limited water availability and quality (see Chapter 3, Section 3.2.2).

Reasonably foreseeable future actions in the planning area that would affect soil and water resources include an expansion of mineral exploration, development, and production and energy development in general. All of these actions would have an adverse effect on soil and water resources from resulting surface disturbance and water use associated with these projects. Cumulative impacts, associated with decreased soil and water quality across the planning area, would be minimized through various management prescriptions and stipulations in place. 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. 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 Cumulative Impacts Analysis Area would increase the risk of spills and groundwater contamination. 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.

The Restore New Mexico program would contribute to beneficial cumulative impacts as additional acres are restored to historical, native vegetative communities annually.

Under all alternatives, soil and water resources would benefit from management, in accordance with the Standards and Guidelines. Adherence to these standards would reduce many of the cumulative adverse impacts from future actions. Under all action alternatives, recreational travel designation across the planning area would change from open to limited, thereby reducing negative cumulative impacts to soil and water resources. In general, Alternatives C and D would be the least protective of soil and water resources and would have the least mitigating effect on past impacts to soil and water resources in the planning area because they have the greatest percent of area open to surface disturbance. Alternative B would be the most protective and would provide the greatest reduction of cumulative impacts by excluding the most acres from grazing and predicting the least number of acres of surface disturbance.

4.6.2 Karst Resources

Past and present actions that affect and have affected karst resources include all surface- and subsurface-disturbing activities, particularly those occurring over high (including hydrologically important critical karst resource zones) and medium karst potential occurrence areas, including mineral exploration and development, livestock grazing, upland vegetation, including noxious weeds, management, fire management, and land use authorizations. Chapter 3, Section 3.2.3 provides greater details on the effect of past and present actions on karst resources. Cumulative impacts resulting from these past activities include an increased fragmentation of the overall karst landscape, as specific karst feature footprints are protected but do not consider a broader management view of whole-field and subsurface development. Other cumulative impacts include increased alterations to surface and subsurface drainage patterns, increased disruptions to subterranean environment, including changes in airflow patterns, requisite humidity levels for cave-adapted species and contamination.

Reasonably foreseeable actions that would impact karst resources include those future actions associated with mineral exploration and development, fire management, livestock grazing, and other ground-disturbing activities. Mineral exploration and development activities would contribute to greater fragmentation across the karst landscape within the planning area and increase the potential for groundwater contamination. Reasonably foreseeable future actions associated with fire and vegetation management would result in short-term adverse impacts to karst resources; however, long-term, indirect benefits would occur as the surface vegetative community recovers and moves I DPC (see Chapter 4, Section 0 for discussion on the importance of the surface vegetative community on karst resources).

Cumulative adverse impacts to karst resources would be minimized by the designation of the Cave Resources ACEC. Fragmentation across the karst landscape and disruptions within the subterranean environment would be reduced, as management prescriptions would minimize surface and subsurface disturbances within this ACEC. In general, Alternatives C and D would be the least protective of karst resources, as disturbance buffers are reduced under these alternatives compared to Alternatives A and B. Alternative B would be the most protective and would provide the greatest reduction of most cumulative impacts by excluding the most acres from grazing and predicting the least number of acres of surface disturbance, although the effect of fragmentation across karst landscapes would continue to increase.

4.6.3 Vegetative Communities

4.6.3.1 Upland Vegetation Including Noxious Weeds

Past and present actions that affect and have affected upland vegetation and noxious weeds management include land use authorizations, livestock grazing, recreational uses (including OHVs, non-motorized recreation, etc.), mineral exploration and development, fire and fuels treatments, and other vegetation treatments, including noxious weeds management. Chapter 3, Section 3.2.4 provides greater details on the effect of past and present actions on upland vegetation and noxious weeds management, but in general these actions have all had cumulatively adverse impacts by causing surface disturbance contributing to reduced plant cover and diversity, increased abundance of noxious weeds, greater habitat fragmentation, diminished habitat condition for monarch butterflies and other pollinators, and loss of pollinators. Previous vegetation treatments, both prescribed fire and mechanical/chemical means, have imparted long-term beneficial effects as a greater number of acres of plant communities are gradually returned to DPC.

Reasonably foreseeable actions that affect and have affected upland vegetation and noxious weed management include oil and gas development, which has occurred across the planning area in the past and would continue into the future. The spatial layout of oil and gas facilities disturbs a large proportion of vegetation (and also wildlife habitat) when considered across the region. Each disturbed area for a well pad increases the opportunity for weed invasions and disrupts the spatial continuity of vegetation communities, leading to increased fragmentation. Other activities such as road building and increased OHV use could increase human access and trampling of vegetation. Major contributors include OHV activities; habitat destruction from mineral development–related activities; some vegetation treatments, such as sagebrush removal; and possible livestock water developments resulting in redistribution of livestock into previously unused areas. The Restore New Mexico program would contribute to beneficial cumulative impacts as additional acres are restored to historical, native vegetative communities annually.

Under all alternatives, upland vegetation and noxious weeds management would benefit from management prescriptions, in accordance with the Standards and Guidelines. Adherence to these standards would reduce many of the cumulative adverse impacts from future actions. Under all action alternatives recreational travel designation across the planning area would change from open to limited, thereby reducing negative cumulative impacts to upland vegetation, including increased damage from trampling and bare ground, decreased plant diversity and increased presence of noxious weeds. In general, Alternatives C and D would be the least protective of upland vegetation and would have the least mitigating effect on past impacts to upland vegetation in the planning area. Alternative B would be the most protective and would provide the greatest reduction of cumulative impacts by excluding the most acres from grazing and predicting the least number of acres of surface disturbance.

4.6.3.2 Riparian and Wetland Vegetation

Past and present actions within the planning area that affect and have affected riparian areas include livestock grazing, recreational uses (including OHVs, non-motorized recreation, etc.), mineral exploration and development, and upstream water withdrawals and impoundments. In general, these actions have had some cumulatively adverse impacts on riparian health, such as decreased water quality in some systems, decreased riparian plant diversity, and greater loss of streambank stability. Livestock grazing, recreation, and mineral-related activities have led to surface disturbance, soil compaction, removal of riparian vegetation, bank trampling, and alteration of riparian areas' physical structure. They have also resulting in the widespread introduction of invasive weeds. Water withdrawals and impoundments have limited the health and extent of riparian zones by decreasing water availability and encouraged the introduction of invasive plants through the stabilization of formerly dynamic sediment deposits, such as bars and banks. Chapter 3, Section 3.2.4.2 provides greater details on the effect of past and present actions on riparian and wetland resources.

Reasonably foreseeable future actions that would affect riparian areas include an expansion of ongoing mineral exploration, development, and extraction. These actions could have a potential adverse effect on riparian areas. Under all of the alternatives, riparian resources would benefit from management for PFC, in accordance with the Standards and Guidelines. This would mitigate many of the adverse impacts from past, present, and future actions. In addition, continuing closure of several allotments to grazing with perennial streams and riparian vegetation would continue the restoration and enhancement of riparian resources in these areas.

In general, Alternatives C and D would be the least protective riparian and wetland resources, as proposed buffers around springs, seeps, and downstream riparian areas would be smaller than those proposed buffers in Alternatives A and B. Alternative B would be the most protective and would provide the greatest reduction of cumulative impacts by excluding the most riparian acres from grazing and predicting the least number of acres of surface disturbance, all of which would benefit riparian and wetland resources.

4.6.4 Fish and Wildlife

4.6.4.1 Fish

Past and present actions that have impacted non-special status fish include leasable mineral development on BLM-administered and non-BLM-administered lands in the planning area. Leasable mineral development is a surface-disturbing activity, which results in the off-site movement of soils and increase sediment loading and turbidity into nearby water bodies. In addition, such activities provide opportunities for invasive vegetation and noxious, non-native species to take hold in compromised water bodies. The development of oil and gas wells also require a large amount of water. The combined surface disturbance and water depletions resulting from leasable mineral development could be detrimental to fish, especially when the activities are located close to the Pecos, Delaware, and Black Rivers, which are the largest perennial rivers in the planning area.

Reasonably foreseeable future actions that could cumulatively impact fish include oil and gas on non-federal lands and potash development on both federal and non-federal lands. The RFD estimates 480 new wells per year would be drilled on non-federal lands over the next 20 years. Thus an estimated 9,600 wells on non-federal land are projected. Fresh water is required for hydraulic fracturing. The RFD estimates 4 million gallons of water or 6 acre-feet is needed per well. Approximately 30% of the water pumped to supply the oil and gas industry is from Eddy County, where direct connections to the Pecos, Delaware, and Black Rivers occur. The water wells to supply this water are under the jurisdiction of the New Mexico Office of the State Engineer (NMOSE). As new wells are drilled and existing wells are pumped at a higher rate, cumulative adverse impacts to fish species could occur if the pumping results in drawdown of the surface water levels. For example, the groundwater wells used to supply Intercontinental Potash's Ochoa Potash Mine is estimated to change the base flow of the Pecos River by approximately 28 acre-feet per year (BLM 2014a). The cumulative impacts of these uses could lead to a lower population of fish in the future.

Mineral development activities on that have a cumulative adverse impact to fish would be the same for all alternatives. Cumulative adverse impacts to fish, when ranked in order from the least adverse impacts to the greatest adverse impacts, would occur from Alternatives A, B, C, D, and then the No Action Alternative. The least amount of cumulative adverse impacts would occur under Alternative A because the fewest acres of special designations would be managed, the Delaware River and Black River would be recommended for WSR designation, and the greatest number of acres would be closed to leasable mineral development. Cumulative adverse impacts would be the greatest under the No Action Alternative because the Delaware and Black Rivers would not be managed as part of the NWSRS and the greatest number of acres would be open to leasable mineral development.

4.6.4.2 Wildlife

Oil and gas development has occurred and is expected to continue across this region on both BLM-administered and non-BLM-administered lands in the planning area. This development reduces habitat available to wildlife and contributes to habitat fragmentation through the clearing of roads and pads. Noise associated with this development may also reduce habitat used by wildlife. The removal of native vegetation and soil disturbance increases the opportunity for invasive weed infestation and disrupts the spatial continuity of vegetation communities that support wildlife in a semiarid environment. This development is accompanied by pipelines and gas plants, the former results in temporary habitat loss and displacement for wildlife, and the latter, permanent habitat loss. Regional wildlife populations have likely been negatively impacted by recent oil and gas development in the planning area.

Reasonably foreseeable actions include completion of additional oil and gas development on approximately 25,000 acres within the planning area for all the alternatives. Alternatives A and B would result in slightly less total surface acreage impacted. All alternative would result in additional surface disturbance that would remove valuable habitat for wildlife and create additional landscape fragmentation. The intensity of oil and gas development in the region is dictated primarily by the cost of the resource being extracted. With the fluctuation in gas prices it is expected that the pressure for future development would be cyclic. However, oil and gas development in years prior to 2015 outside BLM-administered lands in the planning area has been intensive. Recently gas prices have declined causing a slowdown in development. It can be expected that future prices would increase and stimulate a resurgence in oil and gas development within the planning area and on non-BLM-administered lands adjacent to the planning area. Potash and other mineral mining would further reduce wildlife habitat. The combination of disturbance associated with mining and oil and gas development would continue to put pressure on regional wildlife populations.

Use of prescribed fire and the efforts of Restore New Mexico would result in temporary disturbance to wildlife habitat and short-term displacement. However, these programs, if successful, would restore vast areas of valuable native grassland habitat and potentially offset long-term losses to development. Implementation of the three HMPs would improve habitat for a wide range of wildlife species and further mitigate for previous and future habitat loss from development.

4.6.5 Special Status Species

4.6.5.1 Plants

Surface disturbance associated with mineral and energy development, forage use by livestock and wildlife species, and OHV use in open areas would result in cumulative effects throughout the planning area.

Oil and gas development has occurred across this region on both BLM-administered and non-BLM-administered lands in the past and would continue into the future. The combined amount of surface disturbance of these past, present, and future actions could be detrimental to sensitive plants. The spatial layout of oil and gas facilities disturbs a large proportion of vegetation habitat when considered across the region. Each disturbed area for a well pad increases the opportunity for weed invasions and disrupts the spatial continuity of vegetation communities, and hence, habitat for sensitive plant species. Other activities such as road building and increased OHV use could increase human access to sensitive areas that special status species, vegetation, and wildlife are dependent upon for survival.

The overall cumulative impact of activities proposed on these resources could be detrimental at localized areas within the short term, with long-term improvements for (non-special status) vegetation habitat. Major contributors on both BLM and non-BLM-administered lands include OHV activities; habitat destruction from mineral development related activities; vegetation treatments such as sagebrush removal; and possible livestock water developments resulting in redistribution of livestock into previously unused areas that are sensitive to disturbance. Direct impacts would be due to loss of individual sensitive plants or animals from mineral, oil, and gas related development. Indirect impacts on both BLM and non-BLM-administered lands would also occur with habitat fragmentation due to development, changes in OHV use due to increased roads, and rock/fossil collection. These activities would concentrate grazing pressures and recreation use on habitat sites for some plant and wildlife species. The conversion of land use from agricultural lands to residential and commercial uses would increase the habitat values of undeveloped land. The change in land use could result in the loss of habitat for some wildlife species.

The cumulative impacts of all the uses discussed above on both BLM and non-BLM-administered lands could lead to lower populations of sensitive (and non-sensitive) plants in the future. However, protections provided by the Endangered Species Act would minimize the potential adverse cumulative impacts to listed species. Conversely, beneficial impacts would be obtained with BLM designation of proposed ACECs, WSRs, and management of land with wilderness characteristics, because numerous plant populations and habitats would be given special management protection within the boundaries of those areas. As a result of these proposed designations, the incremental contribution to the cumulative impacts on plants and their habitats would be the greatest under the No Action Alternative and Alternative D, the least amount under Alternatives A and B, and to a lesser extent Alternative C.

4.6.5.2 Fish

Past and present actions that have impacted special status fish include leasable mineral development on BLM and non-BLM-administered lands in the planning area. Leasable mineral development is a surface-disturbing activity, which results in the off-site movement of soils and increase sediment loading and turbidity into nearby water bodies. In addition, such activities provide opportunities for invasive vegetation and noxious, non-native species to take hold in compromised water bodies. The development of oil and gas wells also require a large amount of water. The combined surface disturbance and water depletions resulting from leasable mineral development could be detrimental to special status fish, especially when the activities are located close to the Pecos, Delaware, and Black Rivers, where known populations of special status species occur.

Reasonably foreseeable future actions that could cumulatively impact special status fish include oil and gas on non-federal lands and potash development on both federal and non-federal lands. The RFD estimates 480 new wells per year would be drilled on non-federal lands over the next 20 years. Thus an estimated 9,600 wells on non-federal land are projected. Fresh water is required for hydraulic fracturing. The RFD estimates 4 million gallons of water or 6 acre-feet is needed per well. Approximately 30% of the water pumped to supply the oil and gas industry is from Eddy County, where direct connections to the Pecos, Delaware, and Black Rivers occur. The water wells to supply this water are under the jurisdiction of the NMOSE. As new wells are drilled and existing wells are pumped at a higher rate, cumulative adverse impacts to special status fish species could occur if the pumping results in drawdown of the surface water levels. For example, the groundwater wells used to supply Intercontinental Potash's Ochoa Potash Mine is estimated to change the base flow of the Pecos River by approximately 28 acre-feet per year (BLM 2014a). The cumulative impacts of these uses could lead to a lower population of special status fish in the future. However, protections provided by the Endangered Species Act would minimize the potential adverse cumulative impacts to listed species.

Activities on non-federal lands that have a cumulative adverse impact to special status fish would be the same for all alternatives. Cumulative adverse impacts to special status fish, when ranked in order from the least adverse impacts to the greatest adverse impacts, would occur from Alternatives A, B, C, D, and then the No Action Alternative. The least amount of cumulative adverse impacts would occur under Alternative A because the Pecos Bluntnose Shiner ACEC would be designated, the Delaware River and Black River would be recommended for WSR designation, and the greatest number of acres would be closed to leasable mineral development. Cumulative adverse impacts would be the greatest under the No Action Alternative because the Delaware and Black Rivers would not be managed as part of the WSR system and the greatest number of acres would be open to leasable mineral development.

4.6.5.3 Wildlife

As with the impacts on wildlife, the extensive regional oil and gas development has likely reduced the amount of habitat available for special status species. Although some of these species are protected (LPC, DSL, aplomado falcon, several cactus species) by BLM practices, including conservation agreements, as well as the implementation of USFWS and NMDGF protection measures to protect or mitigate for impacts to species habitat, the intensive development has reduced areas that could have potentially been used to expand species populations. Roads and pads associated with oil and gas development contribute to habitat fragmentation and may inhibit special status species from colonizing other suitable habitat.

Reasonably foreseeable projects that could adversely impact special status species include developments that would result in habitat loss or fragmentation. Mineral developments, new road projects, transmission lines, renewable energy projects, and other surface-disturbance activities that occur on BLM-administered lands and on adjacent private lands could have a detrimental impact on these species. Completion of additional oil and gas development is expected on approximately 25,000 acres within the planning area for all the alternatives. Alternatives A and B would result in slightly less total surface acreage impacted. All alternative would result in additional surface disturbance that could remove potential habitat for special status species and create additional landscape fragmentation that might prevent these species from colonizing new areas. Recently gas prices have declined causing a slowdown in development, but it can be expected that prices would increase in the future and stimulate a resurgence in oil and gas development within the planning area and on non-BLM-administered lands adjacent to the planning area.

Use of prescribed fire and the efforts of Restore New Mexico would result in temporary disturbance to wildlife habitat and short-term displacement. However, these programs, if successfully targeted could restore vast areas of valuable native grassland habitat and roads that currently cause fragmentation. These actions could have a long-term benefit for special status species.

4.6.6 Wildland Fire and Fuels Management

Many fire prone areas within the planning area are at increased risk of uncharacteristic wildfire due to historic fire management practices. Past and present treatments on all jurisdictions to reduce fuel loads and restore woodlands, forests and grasslands I their natural range of variability, has contributed to reducing this risk within the planning area, and on a landscape scale, which is important due to the potential of fire spread from adjacent properties. In addition, past and present actions within the planning area that have increased the amount of urban development in the area have also impacted fire and fuels management through increasing the number of WUI acres adjacent to BLM-administered lands. Past surface-disturbing activities, such as the construction of oil and gas well pads, access roads, transmission lines, and other linear features, break up the continuity of fuels and potentially reduce fire spread; however, increased access roads have increased human-caused ignitions and existing oil and gas infrastructure may contribute to ignitions due to unintentional releases or explosions. The current fire environment and wildfire hazard and risk is described in detail in the affected environment section.

Reasonably foreseeable future actions that have the potential to impact fire and fuels management within the planning area include future planned prescribed fire and mechanical treatments by non-BLM agencies over the next 20 years, and Restore NM treatments that focus on restoration of overgrown woodlands and grassland. These actions would have beneficial cumulative impacts to fire management within the planning area by reducing fuel loading and breaking up the continuity of fuels reducing the risk and spread of catastrophic wildfire. These planned future treatments total over 5.2 million acres. Under the guidance of the 2004 Fire & Fuels RMP Amendment and the CFO FMP and other fire plans in adjacent BLM Field Offices and USFS Ranger Districts, including the revision of the Lincoln National Forest Plan, fuel load reductions, vegetation treatments, and salvage operations would reduce the risk of wildland fire in the planning area.

Additional impacts to fire management from reasonably foreseeable future actions include planned oil and gas infrastructure development, transmission lines, access roads, and other linear features. Those actions that result in the greatest permanent surface disturbance would, however, break up the continuity of wildland fuels reducing potential fire spread. Alternatives C and D would contribute the greatest amount of surface disturbance. Although the footprint of such development may break up surface fuels, such development would also provide additional access roads that increase potential for human-caused wildfire ignitions, as well as potential oil and gas ignited fires.

4.6.7 Cultural Resources

Past and present actions that have impacted cultural resources in the planning area include approximately 120,000 acres of surface-disturbing activities, such as past construction of oil and gas well pads, access roads, transmission lines, other linear features, and improved access. The impacts from these actions can be considered in five categories: 1) authorized physical disturbance of individual cultural resources, 2) unauthorized physical disturbance of individual cultural resources, 3) visual intrusion on individual cultural resources and cultural landscapes, 4) looting and vandalism due to increased access, and 5) incremental loss—from all sources—of resources comprising the broader cultural record of the area. Impacts under the first category—authorized disturbance—have occurred in situations where the resource or resources in question were either deemed not eligible for the NRHP or lacking religious or traditional significance or were deemed eligible for the NRHP and subject to mitigation measures to preserve important data prior to disturbance. Under the second category, cultural resources would have been damaged inadvertently through surface disturbance, OHV travel, etc. Impacts under the third category derive from placing aboveground structures or large-scale landscape alterations within the viewshed of individual cultural resources or areas of cultural resource concentration where setting and feeling stemming from the viewshed are important characteristics of those resources. Under the fourth category, increased access, as manifested in new transportation corridors to access project developments, has likely increased opportunities for looting and vandalism of sites not previously known or accessible to users of the area. The fifth category of impacts considers the broader archaeological and cultural record of the planning area, rather than individual sites or resources and the incremental loss of or damage to that record through the impacts under each of the other four categories. Data are not available to quantify the impacts under each category; however, it is important to note that impacts not accounted for through the Section 106 process and BLM cultural resource management policies are expected to have constituted a very small percentage of the total past impacts to cultural resources. That is, unauthorized impacts wherein consideration of the cultural, religious, or scientific importance of a given resource were not considered prior to impact are expected to represent a small proportion of impacts stemming from past and present actions.

Reasonably foreseeable actions with the potential to affect cultural resources include those actions with surface-disturbing components listed in Table 4-239 above. Together, these actions are anticipated to result in just less than 1.1 million acres of new surface disturbance over the life of the RMP. Of this, approximately 1 million acres would result from vegetation and habitat treatments. These treatments, as with all reasonably foreseeable future actions, would be subject to the requirements of the NHPA, its Section 106 process, and BLM policies for the consideration of cultural resources prior to implementation. As such, anticipated future loss of or damage to cultural resources of cultural, religious, or scientific value is expected to be limited to inadvertent and (rarely) unauthorized actions.

Many decisions related to VRM, special designations, and restrictions on surface disturbance—whether past, present, or reasonably foreseeable—have provided or would provide a net positive benefit to cultural resources within the planning area. These decisions reduce or control the frequency and extent of ground-disturbing activities that present the greatest threat to maintaining the use values of cultural resources.

The potential contributions to cumulative effects on cultural resources from the current array of alternatives would vary somewhat between them. On the whole, Alternative C would contribute the least potential risk and the most potential benefit to cumulative effects on cultural resources. This alternative generally includes the fewest acres open to surface-disturbing activities or open with limited constraints. It also generally includes the greatest number of acres closed or restricted to surface disturbances through such actions as special designations, VRM, etc. By contrast, the No Action Alternative and Alternative D would contribute the most potential risk to cultural resources among the alternatives; on the whole these two alternatives are roughly comparable. They include the least net benefit to cultural resources from avoidance, exclusion, withdrawn, closed, and VRM Class I and II lands wherein surface disturbance would be restricted. They also include the most acreage allocated to lands open to surface-disturbing activities with minimal restrictions. Alternatives A and C would contribute less potential benefit than Alternative B but more than Alternative D and the No Action Alternative and more potential risk to cultural resources than Alternative B but less than Alternative D and the No Action Alternative.

Although there are differences between the alternatives, the incremental contribution of any of the alternatives on the cumulative impacts to cultural resources is anticipated to be minimal since cultural resources are managed in compliance with federal laws, regulations, and policies designed to avoid, minimize, and mitigate adverse effects to resources of cultural, religious, or scientific importance.

4.6.8 Paleontological Resources

Past and present actions that have impacted paleontological resources include unauthorized OHV use, dispersed recreation, and vandalism. These impacts would be reduced under Alternatives A and B and to a lesser extent Alternative C because they provide more constraints on OHV use and dispersed recreation activities. There would also be impacts as a result of permitted surface-disturbing activities, such as mineral development in areas containing paleontological resources. The potential for inadvertent adverse impacts to paleontological resources from surface-disturbing activities would be greater under the No Action Alternative and Alternative D. However, existing laws, regulations, and policies provide for mitigation through avoidance or data recovery efforts. Although it is expected that some fossils would be destroyed in the course of legitimate uses of public lands, mitigation measures would likely bring paleontologists to areas where fossils had not been previously studied. Thus, some fossils that would otherwise have disintegrated over time due to weathering and erosion would be collected, placed in repositories, and protected in perpetuity. Cumulative impacts on paleontological resources could occur through incremental degradation of the resource base by a variety of sources, reducing the information and interpretive potential of the paleontological resources in the region. Activities on lands that are not protected by federal laws or policies protecting paleontological resources could decrease the regional resource base, increasing the scientific value of the paleontological resources within the entire planning area.

The incremental contribution to the overall cumulative impacts on paleontological resources would be greatest under the No Action Alternative and Alternative D. Alternatives A and B would have the least potential for adverse cumulative impacts followed to a lesser extent by Alternative C.

4.6.9 Lands with Wilderness Characteristics

Past and present actions that have impacted lands with wilderness characteristics include development of roads for access to lands, surface disturbance and infrastructure related to mineral and energy development, utility corridors, and OHV use. Within the planning area, a total of 57,359 acres (eight areas) was found to have wilderness characteristics. Under the No Action Alternative, no lands would be managed for wilderness characteristics. Potential for adverse cumulative impacts to lands with wilderness characteristics would be the greatest under this alternative. For Alternative A, all eight areas would be managed to protect the wilderness characteristics of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. These areas would be retained for wilderness character despite any past, present, and reasonably foreseeable future actions. For Alternative B, six areas would be managed to protect the wilderness characteristics of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. These areas would be retained for wilderness character despite any past, present, and reasonably foreseeable future actions. In the two remaining areas not managed under this alternative, if developed, wilderness qualities would not be retained on those parcels. For Alternative C, five areas would be managed to protect the wilderness characteristics of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. These areas would be retained for wilderness character despite any past, present, and reasonably foreseeable future actions. In the three remaining areas not managed under this alternative, if developed, wilderness qualities would not be retained on those parcels. For Alternative D, two areas would be managed to protect the wilderness characteristics of size, naturalness, and opportunities for solitude or primitive and unconfined recreation. These areas would be retained for wilderness character despite any past, present, and reasonably foreseeable future actions. In the six remaining areas not managed under this alternative, if developed, wilderness qualities would not be retained on those parcels.

Other resource and resource use decisions for the RMP could contribute to cumulative impacts on lands with wilderness characteristics. For example, under Alternatives A and B the Birds of Prey ACEC would be designated and where this designation overlaps lands with wilderness characteristics beneficial cumulative impacts would occur even if the area is not managed for wilderness characteristics. The VRM Class II management prescriptions for the Guadalupe Escarpment Scenic Area under all alternatives would also have a beneficial cumulative impact on lands with wilderness characteristics where they occur.

4.6.10 Visual Resources

Past and present actions that have impacted visual resources include oil and gas exploration and development, industrial development, agriculture, potash mining, OHV recreation designations, and utility corridor development. Oil and gas surface disturbances from well pad construction and infrastructure construction (e.g., drilling structures, access roads, pump jacks, pipelines), industry-related roads and buildings, potash mining waste dumps, power transmission lines, and surface disturbances from off-trail OHV use have cumulatively contributed to an adverse loss of scenic quality. These impacts are described in detail in Chapter 3, Section 3.2.11, and have, in general, created visually intrusive forms, lines, colors, and textures on the natural landscape.

Any reasonably foreseeable future actions that would create surface disturbances or visual contrasts on the landscape would have an effect on visual resources. Within the planning area, these actions would be pipeline laying for collection or distribution of oil and gas fluid minerals, gas plant construction, potash mining expansion, power transmission line construction, industrial water well drilling, and continuing oil and gas exploration and development. All of these projects would create surface disturbances and visual contrasts with the surrounding landscape and adversely contribute to the existing scenic quality impacts on the planning area’s landscapes. When comparing the proposed action alternatives to the cumulative impacts on visual resources, Alternative B would have the most beneficial impacts on visual resources and scenic quality because actions under this alternative would protect more acreage within the planning area under VRM Class I and II objectives than the other alternatives. The VRM Class I and II resource objectives would prohibit or limit long-term surface disturbances caused by the reasonably foreseeable future projects discussed above.

Under the proposed RMP, the actions under the other proposed alternatives would have varying effects on visual resources and scenic quality when compared with the cumulative effects of past, present, and foreseeable future actions. Alternative A would protect scenic quality by preserving or limiting surface disturbances within the landscape under VRM Class I and II objectives to a slightly lesser degree than Alternative B. Alternative D would have the least beneficial effects on visual resources by designating the fewest planning area acreage under VRM Class I and II, while Alternative C would have similar VRM designations and actions (but slightly more beneficial to scenic quality protection).

4.6.11 Air Resources

The cumulative impacts of mineral actions on air quality were evaluated over a 20-year time frame and over the 4-km modeling domain for the far-field modeling analyses. A 2008 emission inventory was developed to portray 2008 U.S. emissions at various temporal and spatial scales.

Two 2028 RFD emission inventories for BLM-administered lands in the planning area were developed for the planning area. These inventories included emissions related to oil and gas development, and fugitive dust from construction activity and land development and vehicle traffic associated with the oil and gas development. Emissions were also included for mining activity on BLM-administered lands in the planning area.

The final emission inventory included RFD sources on non-BLM-administered and other reasonable foreseeable future actions. The RFD sources included oil and gas and other resource development. Reasonable foreseeable future action sources included estimates for the entire U.S., and included large power generation and industrial sources, livestock management, farming, on-road mobile, off-road construction, biogenic, and wildfire.

The air quality modeling was performed for 2028 to evaluate cumulative impacts from the sources on BLM-administered lands and sources on non-BLM-administered lands.

Table 4-241 summarizes the cumulative air quality impacts from the projected emissions for 2028 for each of the alternatives. Significant cumulative impacts were predicted for $PM_{2.5}$, SO_2, visibility, nitrogen deposition, sulfur deposition, and acid neutralizing capacity. As described above, project only impacts are minimal. Almost all of the predicted impacts are attributable to non-project sources (i.e., No Action Alternative).

Table 4-241. Summary of Cumulative Impacts of Mineral Actions on Air Quality

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Far-Field Modeling Analyses				
Carbon Monoxide				
1-hour and 8-hour impacts below NAAQS/ NMAAQS	Cumulative 1-hour and 8-hour impacts below NAAQS/ NMAAQS.	Cumulative 1-hour and 8-hour impacts below NAAQS/ NMAAQS.	Cumulative 1-hour and 8-hour impacts below NAAQS/ NMAAQS.	Cumulative 1-hour and 8-hour impacts below NAAQS/ NMAAQS.
Nitrogen Oxides				
1-hour and annual impacts below NAAQS.	Cumulative 1-hour and annual impacts below NAAQS.	Cumulative 1-hour and annual impacts below NAAQS.	Cumulative 1-hour and annual impacts below NAAQS.	Cumulative 1-hour and annual impacts below NAAQS.
Ozone				
10 of 31 monitors had 8-hour design values above NAAQS (maximum 79 ppb in the Four Corners area vs. 75 ppb standard).	Cumulative impacts showed 10 of 31 monitors had 8-hour design values above NAAQS (maximum 79 ppb in the Four Corners area vs. 75 ppb standard).	Cumulative impacts showed 10 of 31 monitors had 8-hour design values above NAAQS (maximum 79 ppb in the Four Corners area vs. 75 ppb standard).	Cumulative impacts showed 10 of 31 monitors had 8-hour design values above NAAQS (maximum 79 ppb in the Four Corners area vs. 75 ppb standard).	Cumulative impacts showed 10 of 31 monitors had 8-hour design values above NAAQS (maximum 79 ppb in the Four Corners area vs. 75 ppb standard).
PM_{10}				
24-hour impacts below NAAQS.	Cumulative 24-hour impacts below NAAQS.	Cumulative 24-hour impacts below NAAQS.	Cumulative 24-hour impacts below NAAQS.	Cumulative 24-hour impacts below NAAQS.
$PM_{2.5}$				
2 of 11 monitors had 24-hour design values above the NAAQS (maximum 43 µg/m^3 in Odessa, TX, vs. 35 µg/m^3 standard). 4 of 11 monitors had annual design values above the NAAQS (maximum 17 µg/m^3 in Odessa, TX, vs. 12 µg/m^3 standard).	2 of 11 monitors had 24-hour design values above the NAAQS (maximum 43 µg/m^3 in Odessa, TX, vs. 35 µg/m^3 standard). 4 of 11 monitors had annual design values above the NAAQS (maximum 17 µg/m^3 in Odessa, TX, vs. 12 µg/m^3 standard).	2 of 11 monitors had 24-hour design values above the NAAQS (maximum 43 µg/m^3 in Odessa, TX, vs. 35 µg/m^3 standard). 4 of 11 monitors had annual design values above the NAAQS (maximum 17 µg/m^3 in Odessa, TX, vs. 12 µg/m^3 standard).	2 of 11 monitors had 24-hour design values above the NAAQS (maximum 43 µg/m^3 in Odessa, TX, vs. 35 µg/m^3 standard). 4 of 11 monitors had annual design values above the NAAQS (maximum 17 µg/m^3 in Odessa, TX, vs. 12 µg/m^3 standard).	2 of 11 monitors had 24-hour design values above the NAAQS (maximum 43 µg/m^3 in Odessa, TX, vs. 35 µg/m^3 standard). 4 of 11 monitors had annual design values above the NAAQS (maximum 17 µg/m^3 in Odessa, TX, vs. 12 µg/m^3 standard).

No Action Alternative	Alternative A	Alternative B	Alternative C	Alternative D
Sulfur Dioxide				
1-hour impacts above the NAAQS (maximum 16 times the 196 µg/m^3 standard in Amarillo, TX). 3-hour, 24-hour, and annual impacts below NAAQS.	Cumulative 1-hour impacts above the NAAQS. 3-hour, 24-hour, and annual impacts below NAAQS (maximum 16 times the 196 µg/m^3 standard in Amarillo, TX).	Cumulative 1-hour impacts above the NAAQS. 3-hour, 24-hour, and annual impacts below NAAQS (maximum 16 times the 196 µg/m^3 standard in Amarillo, TX).	Cumulative 1-hour impacts above the NAAQS. 3-hour, 24-hour, and annual impacts below NAAQS (maximum 16 times the 196 µg/m^3 standard in Amarillo, TX).	Cumulative 1-hour impacts above the NAAQS. 3-hour, 24-hour, and annual impacts below NAAQS (maximum 16 times the 196 µg/m^3 standard in Amarillo, TX).
Visibility at Class I Areas				
366 days (leap year) of significant visibility change.	For cumulative impacts, 366 days of significant visibility change.	For cumulative impacts, 366 days of significant visibility change.	For cumulative impacts, 366 days of significant visibility change.	For cumulative impacts, 366 days of significant visibility change.
Visibility at Sensitive Class II Areas				
366 days of significant visibility change.	For cumulative impacts, 366 days of significant visibility change.	For cumulative impacts, 366 days of significant visibility change.	For cumulative impacts, 366 days of significant visibility change.	For cumulative impacts, 366 days of significant visibility change.
Nitrogen Deposition				
Above the LOC at all receptors (maximum impact a factor of 11.2 times the LOC).	Above the LOC at all receptors (maximum impact a factor of 11.2 times the LOC).	Above the LOC at all receptors (maximum impact a factor of 11.2 times the LOC).	Above the LOC at all receptors (maximum impact a factor of 11.2 times the LOC).	Above the LOC at all receptors (maximum impact a factor of 11.2 times the LOC).
Sulfur Deposition				
Predicted impacts above the LOC at most receptors (maximum impact approximately 8.6 times the LOC).	Predicted impacts above the LOC at most receptors (maximum impact approximately 8.6 times the LOC).	Predicted impacts above the LOC at most receptors (maximum impact approximately 8.6 times the LOC).	Predicted impacts above the LOC at most receptors (maximum impact approximately 8.6 times the LOC).	Predicted impacts above the LOC at most receptors (maximum impact approximately 8.6 times the LOC).
Lake Acid Neutralizing Capacity				
Above the LAC for all lakes (maximum impact approximately 174 times the LAC).	Cumulative impacts above the LACs for all lakes (maximum impact approximately 174 times the LAC).	Cumulative impacts above the LACs for all lakes (maximum impact approximately 174 times the LAC).	Cumulative impacts above the LACs for all lakes (maximum impact approximately 174 times the LAC).	Cumulative impacts above the LACs for all lakes (maximum impact approximately 174 times the LAC).

4.6.12 Minerals

4.6.12.1 Leasable Minerals

Past and present actions that have impacted leasable minerals include other mineral development decisions and projects that have occurred in the planning area. The RFD estimates 61% of the wells drilled within the planning area have occurred (and would continue to occur) on non-federal lands, meaning state or private lands (Engler and Cather 2014). Mineral leasing on State of New Mexico mineral estate is administered by the Commissioner of Public Lands through the New Mexico State Land Office. The state leases minerals to generate revenue for the benefit of the state land trust (New Mexico State Land Office 2015). Overall, the approval of mineral leasing activities within the planning area has a beneficial impact to leasable mineral development and results in the generation of royalties. Adverse impacts to leasable mineral development would occur as a result of restrictions on mineral leasing on state lands beyond the standard lease terms may be applied through special federal lease stipulations attached to the state lease (New Mexico State Land Office 2013). Where mineral estate is owned by private entities, those entities may place restrictions or constraints on mineral leasing; however, the type and extent of those restrictions are unknown.

Constraints placed on mineral leasing on non-federal lands could lead to increased costs and time required to fully develop leasable minerals and could influence an operator's investment decision to conduct exploration. Impacts to mineral development include the relocation of drilling operations, the use of other drilling methods, such as directional drilling and timing delays. In many cases, these would be considered typical costs of doing business.

Reasonably foreseeable future actions that would impact leasable minerals include new oil, gas, and potash development projects. The RFD estimates 480 new wells per year would be drilled on non-federal lands over the next 20 years. Thus an estimated 9,600 wells on non-federal land are projected. An estimated 7,000 acres of new potash development is also projected (see Table 4-239 above). The new leasable mineral development would necessitate supporting infrastructure, such as roads, pipelines, aboveground facilities, and transmissions lines. As infrastructure is constructed, additional coordination and planning by operators would be required to avoid conflicts in the field. Therefore, routing and location constraints may be placed on leasable mineral operators as a result of future development.

As discussed under the direct and indirect impacts section for leasable minerals, Alternative B would place the highest amount of constraints on leasable minerals through lease stipulations, COAs, and BMPs. Alternative D would result in the least amount of constraints on leasable minerals. Cumulative adverse impacts to leasable mineral development would occur from administrative constraints placed on leasable mineral development on non-federal lands and from location constraints caused by future development activities in the planning area.

4.6.12.2 Locatable Minerals

Based on historical data and only one producing mine, the development potential for locatable mineral deposits is low across the entire planning area. This analysis assumes locatable mineral development is expected to occur at levels similar to the past. One mining claim and one locatable mineral mine is projected for the next 20 years. The potential for development activity for mineral specimen gypsum and gemstones is moderate in southwestern Eddy County and low throughout the rest of the planning area for all other locatable minerals (e.g., gypsum, metallurgical-grade limestone, and many metals and non-metals) during the planning period. Considering this level of activity, it is anticipated that there would be no cumulative impacts to locatable minerals because the demand for access to minerals within the planning area is less than the areas designated as open to mineral entry under each alternative.

4.6.12.3 Salable Minerals

Past and present actions that have impacted salable minerals include leasable and salable mineral development projects that have occurred in the planning area. Overall, the approval of both mineral leasing activities and salable mineral development within the planning area have beneficially impacted salable minerals due to the increase in demand for salable minerals and approval of new salable mineral operations. An estimated 61% of the wells drilled within the planning area have occurred (and would continue to occur) on non-federal lands, meaning state or private lands (Engler and Cather 2014). Leasable mineral development relies upon salable minerals, such as caliche, sand, and gravel; therefore, leasable mineral development increases the demand for salable minerals on both federal and non-federal lands. Salable mineral development on State of New Mexico lands is administered by the Commissioner of Public Lands through the New Mexico State Land Office. The state leases industrial minerals to generate revenue for the benefit of the state land trust (New Mexico State Land Office 2015). Salable minerals can also be obtained on privately owned lands within the planning area.

Reasonably foreseeable future actions that would cumulatively impact salable minerals include new oil, gas, and potash development projects. The cumulative impacts would be both adverse and beneficial. Beneficial impacts would include the increased demand for salable minerals to support leasable mineral development. Adverse impacts would include the potential conflict of the locations of leasable mineral operations with the location of salable mineral deposits. The RFD estimates 480 new wells per year would be drilled on non-federal lands over the next 20 years. Thus an estimated 9,600 wells on non-federal land are projected. An estimated 7,000 acres of new potash development is also projected (see Table 4-239 above). The new leasable mineral infrastructure would remove surface lands needed to access salable mineral deposits. Location constraints may be placed on salable mineral operators as a result of future leasable development. However, given the large land base and widely available salable mineral deposits in the planning area, these conflicts are not expected to be severe.

As discussed under the direct and indirect impacts section for salable minerals, Alternative B would close or avoid the greatest number of acres to salable mineral development on BLM-administered lands. Therefore, cumulative impacts from location constraints placed on salable minerals on non-federal lands would be the greatest under Alternative B. The No Action Alternative would result in the least amount of acres closed or avoided for salable mineral development. Therefore, cumulative impacts resulting from location constraints placed on salable minerals on non-federal lands would be the least under the No Action Alternative.

4.6.13 Renewable Energy

Past and present actions that have impacted renewable energy include construction of the 345-kilovolt (kV) Roadrunner electric transmission line. Its completion provides an initial option for transmission of any future renewable energy projects. Completion in 2012 of the *Solar Energy Development Programmatic Environmental Impact Statement* identified only a single suitable solar energy zone (SEZ) in New Mexico, the Afton site located southwest of Las Cruces. Under the RFD scenario, the *Solar Energy Development Programmatic Environmental Impact Statement* predicted 833 megawatts (MW) generated on BLM-administered lands in New Mexico by 2030. The Afton SEZ contains nearly 30,000 developable acres, which would easily cover the RFD scenario estimate even if not completely built out. No suitable SEZs were designated in the planning area.

In September 2014, the BLM published a proposed rule to amend its regulations governing solar and wind ROWs. That proposed rule, expected to become final before the end of 2015, would create "designated leasing areas" where more favorable terms for development would be established. To date, developers have demonstrated a reluctance to pursue renewable energy projects on BLM-administered lands. However, should a streamlined compliance process be established with more favorable economic terms, developers might reconsider if sufficient transmission became available.

At present, no commercial solar or geothermal development has occurred on BLM-administered lands in the planning area. One wind project, Wildcat Wind (27 MW) has been constructed on non-BLM-administered lands within the planning area. A second 15-MW wind project occurs just outside the planning area in Chaves County (American Wind Energy Association 2015). Currently, a 100-MW solar project is being proposed in nearby Chaves County and at least one additional wind project of approximately 25 MW is being considered in Lea County on non-BLM-administered lands in the planning area. The solar energy developer is currently looking for additional private land development opportunities in the planning area (Eddy or Lea Counties) for up to another 200 MW of photovoltaic solar. It appears that there would be little difference among the various alternatives in regard to cumulative impacts of renewable energy. The No Action Alternative and Alternative D would result in more acres of surface disturbance associated with oil and gas development that when combined with any future renewable energy development would result in greater cumulative impacts.

Reasonably foreseeable actions include completion of transmission lines that would encourage additional wind and solar development. Current route plans for the SunZia and Southline transmission lines are located far enough away from the planning area that they would not appear to encourage new large-scale commercial renewable energy development. Other transmission corridors, if proposed by the Renewable

Energy Transmission Authority, within the planning area could also increase the demand for land to develop renewable energy projects. Additional proposed 345-kV lines such as the Excel Energy Tuco-Yoakum-Hobbs line could also encourage further energy development, with an appropriate market and pending approvals from the New Mexico Public Regulation Commission.

4.6.14 Livestock Grazing

Past and present actions within the planning area that affect and have affected livestock grazing are the result of activities and actions within the planning area that affect available forage. Surface-disturbing activities such as mineral development, ROW development, spread of noxious weeds and OHV use have reduced the amount of forage available for livestock grazing. Chapter 3, Section 3.3.3 provides greater details on the effect of past and present actions on livestock grazing.

Reasonably foreseeable actions that affect and have affected livestock grazing include oil and gas development, which has occurred across the planning area in the past and would continue into the future. Other surface-disturbing activities, such as ROW development and OHV use, could contribute to greater loss of available forage and, therefore, an increase in the number of AUMs lost, as would other surface-disturbing activities listed under reasonably foreseeable future actions. Table 4-239 provides a look at the reasonable foreseeable future actions for the planning area. These projects, excluding those for vegetation restoration, would result in a cumulative loss of forage equating to approximately 24,862 AUMs (prior to reclamation) across the planning area.

Approximately 270,000 acres of vegetation treatments and fire rehabilitation projects are planned in the reasonably foreseeable future actions (Table 4-239), and though may result in short-term adverse impacts, would ultimately contribute to cumulatively long-term beneficial impacts as additional forage for livestock grazing is made available. Additionally, the Restore New Mexico program would contribute to beneficial cumulative impacts as one million acres have been restored to historical, native vegetative communities (and another million planned for restoration), thereby increasing the number of acres of forage available to livestock and also the number of available AUMs.

Under all alternatives, livestock grazing would benefit from management prescriptions, in accordance with the Standards and Guidelines. Adherence to these standards would reduce many of the cumulative adverse impacts to livestock grazing from future actions. Under all action alternatives scheduled rangeland improvements in accordance with established priorities would be implemented, thereby increasing beneficial cumulative impacts to livestock grazing, including healthier rangelands absent of noxious weeds and increased forage availability.

In general, Alternatives A and B would be the most beneficial to livestock grazing, as it would close a substantially greater number of acres to grazing compared to Alternatives C and D. Alternatives A and B would also result in the least number of AUMs lost. Alternative D would be the least beneficial to livestock grazing and would result in the greatest increase of adverse cumulative impacts by excluding the least number of acres from grazing and also contributing to the greatest number of AUMs lost.

4.6.15 Travel and Transportation Management

Past and present actions that have impacted travel include opening new routes and areas to OHV use in response to an increasing demand for recreational OHV access, new minerals exploration and development routes, and land tenure and land authorizations access routes. Cumulative impacts to travel would occur primarily from actions that permit, limit, or restrict travel access or travel opportunities: permitted travel within the planning area would be beneficial; restrictions or limitations on travel would be adverse. Route expansion for OHV recreational use has been beneficial, but has also generated adverse impacts from over-crowding and use conflicts in some areas, as discussed in detail in Chapter 3, Section 3.3.4. Minerals exploration and development, and land tenure and authorization actions have been beneficial for travel by opening new routes for planning area travel access.

The reasonably foreseeable future actions that would affect travel management include oil and gas exploration and development of wells and access routes, oil and gas pipeline construction, and power line and utility corridor development. Hydraulic fracturing has opened new opportunities for oil and gas production in areas previously considered inaccessible or too costly. The impacts of these future projects on travel management, when considered with past and present actions, would be beneficial in the long term by incrementally increasing travel access and opportunities within the planning area. Alternative D would allow the highest degree of minerals development and would permit the least limitations on OHV travel access. When considered with past, present, and foreseeable future actions, this alternative would have the most beneficial impacts on travel management.

Under the proposed RMP, the other action alternatives (Alternatives A, B, and C) would have varying impacts on travel management when considered with past, present, and future actions. Alternatives A, B, and C would have roughly similar OHV travel designations for open, limited, and closed; however, Alternative C would allow more planning area acreage to be open to leasable, salable, and locatable minerals development, with more beneficial impacts to travel because of increased accessibility to OHV users. Thus, Alternatives A and B, when considered within the context of past, present, and future actions, would have the least beneficial impacts on travel management.

4.6.16 Recreation and Visitor Services

Past and present actions that have impacted recreation resources and recreational opportunities are oil and gas exploration and development and mining. Both of these types of activities have and are currently adversely affecting the quality of backcountry recreational opportunities and experiences by degrading scenic quality and by encroaching on popular backcountry recreation areas. These impacts are discussed in Chapter 3, Section 3.3.5.

Actions that affect scenic quality (a component of the recreational experience) and affect the expectations that recreation users have when they visit an area (e.g., solitude, naturalness, challenging or interesting OHV trails) would have an effect on recreation. Reasonably foreseeable future actions on recreation include pipeline construction, continuing oil and gas exploration and development, utility line construction, and mining. All of these actions would create surface disturbances and, along with past and current actions, adversely affect recreation resources by degrading scenic quality. The future expansion of construction of oil and gas infrastructure, utility corridors, and mining, along with past and existing actions, would adversely affect recreation resources within the planning area ERMAs by reducing the likelihood for naturalness, quiet, and solitude. Under the proposed RMP, Alternative B actions would have the least adverse effect on recreation from oil, gas, and other minerals development because foreseeable total oil and gas disturbances would be the least, and the highest acreage would be recommended for withdrawal from locatable and salable minerals development (see Section 4.3.1).

When considering the other action alternatives in the context of past, present, and future actions on recreation, Alternative A would have a lesser degree of adverse impacts on recreation because there would be fewer acres predicted for oil and gas development and more acreage proposed for withdrawal from locatable and salable minerals development. Alternative D would have the most adverse impacts on recreation because the predicted acreage available for future oil and gas development would be the greatest under this alternative and because the fewest acres would be proposed for withdrawal from locatable and salable minerals development. Alternative C would be similar to Alternative D.

4.6.17 Land Use Authorizations

Because land use authorizations are based on programmatic decisions, past and present actions that have impacted such authorizations are limited to past resource management planning wherein areas of avoidance, exclusion, or withdrawal from ROWs were designated. Individual past and present projects do not contribute to these impacts. As such, the cumulative effects of past actions on land use authorizations are reflected in the No Action Alternative currently under consideration.

Reasonably foreseeable actions such as those listed in Table 4-239 above would all require issuance of land use authorizations. Future development of lands surrounding the planning area is likely to also prompt requests for ROW authorizations across BLM-administered lands to serve and access those developments.

Under the current alternatives, the designation of ROW avoidance and exclusion areas on BLM-administered lands, along with similar restrictions on ROW development on adjacent lands would have a cumulative impact of reducing routing options for ROW facilities such as utilities and roads. Among the alternatives, the No Action Alternative would result in the least change from existing conditions and would place the fewest overall restrictions on issuance of such authorizations through exclusion, avoidance, and withdrawal of ROWs. As a result, this alternative would place the greatest demand on the CFO Lands and Realty program for processing ROW applications and permits. Among the action alternatives, Alternative D would implement the fewest restrictions on ROWs (i.e., would include the fewest acres excluded, avoided, or withdrawn from ROWs). Alternative B would result in the biggest net change to land use authorizations and reduce the demand on the program for processing of applications and permits by implementing ROW exclusion, avoidance, and withdrawal designations on the highest acreage of land in the planning area.

4.6.18 Land Tenure

Past and present actions that have impacted land tenure adjustments include land sales, purchases, and exchanges. Because land tenure adjustments are based largely on programmatic decisions, past and present actions that have impacted such adjustments were governed by past resource management planning wherein areas of disposal and retention were designated. Individual past and present projects generally do not contribute to these impacts. As such, the cumulative effects of past actions on land tenure adjustments are reflected in the No Action Alternative currently under consideration. Since 1988, land tenure adjustments have resulted in a net loss of approximately 59,900 acres of federal land in the planning area.

Of the reasonably foreseeable actions listed in Table 4-239 above, only one—the Carlsbad Municipal Schools project—would effect a land tenure adjustment. Under this action, 82 acres of BLM-administered land would be transferred out of BLM ownership under the R&PP.

The designation of ROW avoidance and exclusion areas on BLM-administered lands, along with similar restrictions on ROW development on adjacent lands, particularly National Forest lands, would have a cumulative impact of reducing routing options for ROW facilities such as utilities and roads.

The current alternatives would not, in general, add cumulatively to effects on land tenure but would change the management approach to tenure adjustments by varying the amount of land specifically designated for disposal or retention. By comparison to the No Action Alternative, all of the action alternatives would reduce the acres of land designated for disposal and increase the acres of land designated for retention. Among the action alternatives, Alternative D would designate the most lands for disposal and the most land for retention. Alternative A would designate the least land for disposal and the second most land for retention. As such, this alternative would result in the least amount of change in land ownership among the action alternatives, though the net differences between the action alternatives are relatively small.

4.6.19 Special Designations

Past and present actions that have impacted and reasonably foreseeable future actions that can affect special designation include surface disturbance related to mineral development, utility corridors, OHV use, fire suppression, and geophysical exploration. Under the No Action Alternative, existing special designations as ACECs, SMAs, RNAs, and ONAs would continue to be managed to protect the relevant and important values. Any past, present, or reasonably foreseeable future actions would not contribute any adverse cumulative effects under this alternative.

For Alternative A, the BLM would manage nine ACECs to protect the relevant and important values despite any past, present, and reasonably foreseeable future actions. For the six remaining areas not designated under this alternative, if developed, many of these areas would not retain their relevant and important values. For Alternative A, the BLM would manage two WSR corridors as suitable for WSR designation. These areas would be managed to maintain their outstandingly remarkable values despite any past, present, and reasonably foreseeable future actions.

For Alternative B, the BLM would manage 15 areas as ACECs to protect the relevant and important values despite any past, present, and reasonably foreseeable future actions. Under this alternative, the BLM would manage one WSR corridor as suitable for WSR designation. This area would be managed to maintain its outstandingly remarkable values despite any past, present, and reasonably foreseeable future actions. For the remaining river corridor not managed as suitable for WSR status, if developed, it would not retain its outstandingly remarkable values.

For Alternative C, the BLM would manage eight areas as ACECs to protect the relevant and important values despite any past, present, and reasonably foreseeable future actions. For the seven remaining areas not designated under this alternative, if developed, many of these areas would not retain their relevant and important values. Under Alternative C, the BLM would manage one WSR corridor as suitable for WSR designation. This area would be managed to maintain its outstandingly remarkable values despite any past, present, and reasonably foreseeable future actions. For the remaining river corridor not managed as suitable for WSR status, if developed, it would not retain its outstandingly remarkable values.

For Alternative D, the BLM would manage five areas as ACECs to protect the relevant and important values despite any past, present, and reasonably foreseeable future actions. For the 10 remaining areas not designated under this alternative, if developed, many of these areas would not retain their relevant and important values. Under Alternative D, the BLM would manage the Black River as suitable for WSR designation. If developed, these river corridors would not retain its outstandingly remarkable values. Potential for adverse cumulative impacts to eligible specially designated areas would be the greatest under this alternative.

All alternatives would contribute no adverse cumulative impacts to WSAs because they are protected by law, regulation, and policy, and all alternatives would continue existing management of the Guadalupe Backcountry Byway.

4.6.20 Tribal Rights and Interests

The BLM CFO has limited information about the specific areas of significance to tribes within the planning area. Therefore, it is difficult to identify specific past, present, and reasonably foreseeable future actions that could result in cumulative impacts to tribal rights and interests.

Management decisions by other agencies and private entities that result in the degradation or removal of access to lands with tribal significance, including sacred site and TCPs would cumulatively impact tribal rights and interests. Degradation can include the disturbance of native land conditions considered significant to tribes, which can reduce the amount of land on which tribes can exercise their rights to hunt, gather, fish, and conduct ceremonies on non-federal land. Native plant communities, wildlife habitats, and cultural resource sites are more likely to be impacted from surface disturbance compared to areas left undisturbed. Therefore, mineral development, energy transmission, and transportation projects that result in surface disturbance have the potential to adversely impact tribal rights and interests, depending on the location of the projects in relation to tribally significant sites. Together, these activities could produce cumulative impacts to tribal rights and interest through incrementally impacting the condition of tribally important natural resources and the integrity and setting of sacred sites and TCPs. However, it is important to note that many of the projects listed in Table 4-239 above must comply with state and federal laws, EOs, and regulatory policies, as well as undergo government-to-government consultation with tribes prior to project implementation. As applicable during environmental review for these actions, tribal consultation would be conducted early in the planning process and input from tribes would be considered and incorporated into project planning and decision making, as appropriate. This implementation-level planning would address potential adverse impacts to tribal rights and interests at the project level.

Actions that conserve or restore those lands considered significant to tribes, such as the protection of high-value wildlife habitat and native vegetation restoration programs, could result in cumulative, beneficial impacts to tribal rights and interests. Projects listed in Table 4-239 above that could result in beneficial impacts to tribal rights and interests are Restore New Mexico and the various fire and fuel treatment projects. These projects would work to restore previously disturbed areas or areas with non-native vegetation to encourage native vegetation growth. Depending on the location of the specific treatments, especially if they occur near TCPs or other sacred sites, tribal rights and interests would be beneficially impacted by restoration activities.

4.6.21 Social and Economic Conditions

Past and present projects and activities have largely defined the socioeconomic setting described in Chapter 3. Ranching was the primary activity leading to the initial development of the current communities in the analysis area. The construction of irrigation systems in the late 1800s fostered crop production in the area and the discovery of oil in the Hobbs oilfield in 1928 was a major factor in the growth and development of communities in the eastern portion of the SESA. The declaration of Carlsbad Caverns as a National Monument, and then a National Park, fostered the development of the area's tourism industry.

Among the categories of reasonably foreseeable future actions identified at the outset of this chapter, the following appear likely to have the largest and longest-term effects on social and economic conditions in the SESA:

- ongoing increases in motorized and non-motorized uses of BLM-administered lands;
- renewable energy development and development of utility corridors, pipelines and transmission lines; and
- continued expansion of mineral extraction activities, including oil and gas and potash development, including development on lands not administered by the CFO.

Demand for recreational uses of BLM-administered lands is expected to continue to grow in the future. This cumulative effect was considered in developing the projections of future recreation-related economic activity described earlier in this section. Increases in recreational use, coupled with increases in energy-related development activity discussed below, has the potential to create more opportunities for conflict between different user groups and individuals holding different values concerning the use and management of public lands.

Development of additional energy-related infrastructure, such as utility corridors, pipelines, and transmission lines, is likely to help foster development of renewable and conventional energy resources in the SESA and would continue to support the key role of energy-related activity in the regional economy.

According to the CFO's RFD, approximately 9,600 oil and gas wells are projected to be developed over the next 20 years on lands within the study area that are not managed by the CFO. This estimate is approximately 2.4 times the number of wells projected to be developed on CFO-managed lands under Alternative B (which has the fewest number of projected wells among the alternative) and about 1.6 times the number of wells projected for CFO-managed lands under Alternative D (which has the largest number of projected wells). Since the socioeconomic effects of well development and operation are essentially the same regardless of whether the well is on federal, state, or private lands, the cumulative economic and social effects from this level of energy development would be more than twice as large as the direct and indirect effects quantified in the socioeconomic section of this chapter. Cumulative effects would be largest under Alternative D (which involves the most projected wells on CFO-managed lands) and smallest under Alternative A. The cumulative extent of potential energy-related activity in the SESA would likely be welcomed by individuals that prioritize natural resource uses for economic development and would likely be a source of concern among individuals who prioritize resource protection.

Other factors outside the control of the residents and institutions within the SESA would also affect social and economic conditions in the future. For example, national and international supply and demand for energy would determine prices for oil, natural gas and other energy products. Variations in price levels, in turn, would affect both the rate of development of new wells and the level of energy-related employment and economic activity in the SESA. Given the SESA's economic dependence on energy-related activity, variability in energy prices and activity over time has the potential to create periods of economic instability throughout the study area.

4.6.22 Health and Safety

Cumulative impacts would be the same under all of the alternatives. The potential impacts would be due to management actions and planning within those lands surrounding the planning area, including the BLM Roswell, Las Cruces, and Oklahoma and Amarillo Field Offices, the Lincoln National Forest, and Carlsbad Caverns and Guadalupe National Parks. Minerals development within surrounding areas would increase the use, generation, and transportation of hazardous materials. City and county use plans for surrounding communities could have cumulative effects, whereby mineral resources are developed adjacent to BLM-administered lands. State lands that are surrounded by BLM-administered land could have impacts from inholding development. Hazardous materials are regulated by the EPA and administered by state agencies regardless of land status. The incremental contribution of the proposed RMP and the alternatives on the cumulative impacts to health and safety is anticipated to be minimal if all applicable laws, regulations, safeguards, and procedures are followed.

4.6.23 Land Use Impacts to Resource Resiliency in the Context of Climate Change

Climate change is affecting the southwestern United States with temperature increases of almost 2°F in the last century and further increases of 3.5°F to 9.5°F anticipated by the end of this century (Globalchange.gov 2016). Drought conditions are already common in the Southwest and drought periods are expected to become more frequent, intense, and longer. Drought will affect important water sources, including the Colorado River Basin. The Southwest Regional Climate Assessment has issued five key messages with respect to natural resource projections in the context of climate change in the southwestern United States (Globalchange.gov 2016):

1. Snowpack and streamflow amounts are projected to decline in parts of the Southwest, decreasing surface water supply reliability for cities, agriculture, and ecosystems.

2. The Southwest produces more than half of the nation’s high-value specialty crops, which are irrigation-dependent and particularly vulnerable to extremes of moisture, cold, and heat. Reduced yields from increasing temperatures and increasing competition for scarce water supplies will displace jobs in some rural communities.

3. Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, have increased wildfires and impacts to people and ecosystems in the Southwest. Fire models project more wildfire and increased risks to communities across extensive areas.

4. Flooding and erosion in coastal areas are already occurring even at existing sea levels and damaging some California coastal areas during storms and extreme high tides. Sea level rise is projected to increase as Earth continues to warm, resulting in major damage as wind-driven waves ride upon higher seas and reach farther inland. (Note: this key message is not applicable to the CFO).

5. Projected regional temperature increases, combined with the way cities amplify heat, will pose increased threats and costs to public health in southwestern cities, which are home to more than 90% of the region’s population. Disruptions to urban electricity and water supplies will exacerbate these problems (Globalchange.gov 2016).

Water, vegetation, wildlife, cultural, air, and karst resources are identified as the resources most susceptible to climate change impacts in the planning area. Many CFO land uses will likely stress these resources even further and impact their resiliency. Resilience can be generally defined as the capacity of a resource to absorb stresses (e.g., land uses, climate change, etc.) and maintain function in the face of external stresses imposed upon it by (Wikipedia 2016). Common land uses in the planning area include those associated with leasable, salable, and locatable minerals (such as oil well pads, potash mines, and caliche pits), as well as land uses associated with land use authorizations (such as ROW power lines and pipelines). Other common land uses include grazing, OHV use, and other recreation uses. Resources identified as possessing a resiliency attribute include water, vegetation, soils, wildlife, riparian areas, and karst resources, and discussion of their resiliency to land use impacts in the context of a changing climate follows.

Given that cultural resources do not possess properties with the ability to recover once impacted, this resource class will not be further discussed in this section. For air resources, only ozone will be addressed; yet, resiliency of air quality is not fully understood and, for that reason, other air contaminants will not be discussed further in this section.

Table 4-242 represents anticipated land use impacts to each of these resources' resiliency in the context of a changing climate scenario as described above. In this table, an estimate of whether anticipated land uses will increase or decrease resource properties'/attributes' resiliency is made. Justification of these estimates of increase or decrease in resiliency is provided in some of the most current peer-reviewed science literature and is provided for each resource following the table.

Table 4-242. Anticipated Land Use Impacts to Resource Resiliency in the Context of Climate Change

	Groundwater	Soils	Vegetation	Karst	Wildlife	Riparian	Air
Leasable minerals	↓	↓	↓	↓	↓	↓	↓
Locatable minerals	↓	↓	↓	↓	↓	↓	↓
Salable minerals	↓	↓	↓	↓	↓	↓	↓
Land use authorizations	↓	↓	↓	↓	↓	↓	–
Renewable energy	↓	↓	↓	–	↓	↓	↑
Grazing	↓	↓	↓	↓	↓	↓	↓
OHV use	↓	↓	↓	↓	↓	↓	↓

↑ = increase in resource resiliency due to land use.
↓ = decrease in resource resiliency due to land use.

4.6.23.1 Groundwater/Surface Water

Water use and groundwater draw are primary issues of concern in the Southwest. Direct climate change impacts on groundwater quantity are anticipated to be minimal when compared to groundwater use (Friggens et al. 2013). On the other hand, riparian areas are expected to be impacted significantly by predicted warming and reduced precipitation trends. Warming trends will cause seasonal peak flows to occur earlier and snow packs to be reduced (Hurd and Coonrod 2008; Friggens et al. 2013). Given that the Pecos River receives a portion of its water from springs issuing from the Capitan Aquifer, decreased precipitation would result in a decrease in Pecos River flow. This change in surface flows likely will result in a greater reliance on groundwater by surface water users, thereby impacting aquifers beyond what is being observed currently (Friggens et al. 2013). Evaporation and lower flows may also result in increased salinity concentrations in waterways such as the Pecos River (Yuan and Miyamoto 2005, 2008).

In sum, increased demand on water resources "due to human population growth and increased municipal, agricultural, and industrial use can exacerbate climate-driven scarcity" (Nelson et al. 2013). Counties found to be "most at risk for water sustainability are found in the West, Southwest, and Great Plains (Roy et al. 2012). Moreover, water resources in southeast New Mexico, including Eddy, Lea, and Chaves Counties, are predicted to be severely impacted by climate change (Roy et al. 2012). For example, the amount of estimated freshwater withdrawal as a percentage of available precipitation is expected to be greater than 500% by 2050 (Roy et al. 2012). And, in a climate change scenario, Eddy, Lea and Chaves Counties are categorized as "Extreme" and "High" in the authors' Water Supply Sustainability Risk Index (2050) map for a climate change scenario (Roy et al. 2012).

It should be noted that the amount of withdrawal used in the Roy et al. (2012) study only accounts for domestic use, agricultural irrigation use, and thermoelectric cooling and does not include water extraction for hydraulic fracturing or potash operations. Projections from the RFD scenario has water used for hydraulic fracturing increasing from 5.4% to 17% of the total mining waters used in the state of New Mexico (total mining waters comprise 1% of the total waters available in New Mexico) (Engler and Cather 2014). Additional land uses such as hydraulic fracturing could create impacts that would make groundwater recharge volumes less resilient under an already extreme climate change scenario. However, 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. Potash mining operations would continue to stress the Ogallala Aquifer. For glacially recharged aquifers such as the Dewey Lake/Santa Rosa hydrostratigraphic aquifer, less precipitation would exacerbate the net loss of water volume in the aquifer from industrial, agricultural, and domestic use.

4.6.23.2 Vegetation

Climate change is expected to cause shifts in distribution of plant species and cause changes in spring phenology (Brandt et al. 2013; Brusca et al. 2013; Harsch et al. 2016; Ishioka et al. 2013; Krause et al. 2015). These changes are expected in vegetation communities and for single species, such as rare endemic plants. With these shifts, physical properties (e.g., soil type) could limit vegetation movement or adaptation and ultimately further reduce resilience.

Land uses pertaining to energy development, potash mining, grazing, etc., could reduce the resilience of vegetation and rare plants in the face of climate change. These resource uses may increase disturbance across the landscape by impacting pollinator habitat, increasing non-native species invasion, and reducing community connectivity, which in-turn amplifies the impacts of climate change and reduces resiliency. More research is needed to determine how specific uses might cumulatively impact vegetation communities and rare plants.

4.6.23.3 Soil

One predicted consequence of climate change in the Southwest is a decrease in vegetation production, which would result in increased erosion (Friggens et al. 2013). Additionally, a hotter and dryer climate would result in a higher frequency of severe disturbance such as wildfires. Burned areas devoid of vegetation would increase the likelihood of erosion from wind and water (Enquist and Gori 2008). Wildfires may also trigger “abrupt ecosystem transitions” that result in alterations to vegetation and “geomorphic, soil, hydrological, and biogeochemical systems” (Friggens et al. 2013 pg. 35).

Common land uses in the field office, such as grazing, oil and gas development, potash mining, and OHV use result in the de-stabilization of soils. Continuing these land uses will exacerbate the erosion predicted from climate change.

4.6.23.4 Wildlife

The Southwest, including the CFO planning area in southeastern New Mexico, is an area of high biodiversity and includes a number of endemic species. With climate change, major changes in the structure and species composition of southwestern plant communities are anticipated due to increasing temperatures and altered precipitation patterns. Seasonal and interannual variations in climate also influence many phenological events (e.g., flowering, migration, emergence, reproduction) in floral and faunal species. Therefore, climate influences species distribution and abundance through changes in resource availability, fecundity, and survivorship. It is currently unknown which species will have the capacity to adapt to a changing climate. For example, whether or not a species can migrate under an altered climate will be strongly influenced by its dispersal abilities and land use and habitats. Wildlife and plant responses to regional climate change will be highly dependent on feedbacks among weather, land cover, hydrology, fire, and invasive species.

4.6.23.4.1 Distribution

Many species' distributions will shift poleward due to increasing temperatures from climate change (Rosenzweig et al. 2007). Other studies, however, indicate that distributional shifts are likely to be multi-directional due to complex interactions among temperature, precipitation, and species-specific physiological tolerances (VanDerWal et al. 2013). Some species will experience a range expansion, others a reduction or a shift into less hospitable habitat. Some species may have nowhere to go because they are already at the northern limit of their habitat (EPA 2016b).

Other species may not have the adaptive capacity to keep up with a large magnitude and/or rapid rate of climate change, leading to severe range contractions and an increase in extinction risk (Hoegh-Guldberg et al. 2008). For some ecosystems, shifts in distribution will have far greater impacts than just the addition or subtraction of a species. Some range shifts are anticipated to have cascading effects on community structure and the functioning/stability of ecosystems (Lawler et al. 2009).

4.6.23.4.2 Habitat Quality

Climate change may produce a number of physical impacts to ecosystems, which may in turn affect the quality of plant and animal habitat. This may occur through a decrease in available water or other hydrological changes, or changes in vegetation type through severe drought or fire. Large areas of Chihuahuan grassland that were once suitable habitat for many species may no longer be suitable, potentially leading to significant changes in species composition due to loss of significant habitat components (Baez and Collins 2008). These communities may also experience a reduction in stability, which may have far-reaching consequences for biodiversity and ecosystem functioning (Baez and Collins 2008).

4.6.23.4.3 Phenological Events

Climate change has led to shifts in phenological events (the timing of natural, biological events) in many species distributed widely across taxonomic groups. Phenological events include fruit ripening, leaf coloring, bird migration, amphibian chorusing, and insect emergence (Rosenzweig et al. 2007).

In reptiles and amphibians, climate change may affect reproduction and dispersal (Blaustein et al. 2010). Trends toward earlier breeding have been observed in multiple species of amphibians across the globe, and these appear to be linked to changes in temperature and precipitation (Blaustein et al. 2010). Because the date and abundance of flower blooms are highly correlated with winter snowpack, projected declines in snowpack will decrease flower abundance and advance the date of flowering. Earlier flower blooms could have substantial impacts on plant and animal communities in southwestern deserts, especially on shrubs and migratory hummingbirds. Impacts are also possible to the migration and dispersal routes of many species, including migratory birds and bats (Skirp 2015).

4.6.23.4.4 Fragmentation and Isolation

Fragmentation and climate change are two human-influenced impacts considered to be the main threats to biodiversity globally (Klapwijk and Lewis 2012). Fragmentation can change the structure and function of ecological communities by altering the demography of populations, as well as individual behavior and genetics. Climate change further fragments habitat and creates barriers to migration, which can result in a decrease in a species' total range or a shift in range. Range shifts will alter the composition and structure of ecological food webs. Attempts to redistribute to more favorable habitats may be hampered by fragmentation, which can prevent species movements, potentially contributing to species extinction (Rosenzweig et al. 2007).

Indirect effects on species' interactions may also be harsh, impacting the structure and function of ecological communities. Disruption of feeding interactions (between predators and prey, herbivores and plants, and hosts and parasites) will lead to changes in the outcome of competitive interactions and altered probabilities of persistence for individual species. Both range shifts in response to climate change and habitat fragmentation will alter the composition and structure of ecological food webs, although predicting the consequences of such changes is problematic (Klapwijk and Lewis 2012).

Climate change induced variation in temperature and precipitation will directly affect rangeland plant production and wildlife habitat. Changes in climate may affect the vitality, productivity, and structure of rangeland plants, resulting in a decrease in overall conditions of both wildlife habitat and range condition. Higher temperatures and decreased precipitation will also decrease forage production and lengthen the growing and grazing season for ranching, resulting in increased competition with livestock for accessible natural vegetation and increasing the risk of disease.

Land uses such as grazing, recreation and OHV use, oil and gas development, land use authorizations, and renewable energy will reduce the resilience of wildlife in the face of climate change by increasing habitat fragmentation, habitat loss and alteration, barriers to migration, and human-wildlife conflict, potentially resulting in a decrease in biodiversity. Much habitat is lost to oil and gas development and infrastructure (Riley et al. 2012). Associated construction processes can cause erosion of dirt, minerals, and other harmful pollutants into nearby water sources, thereby degrading the clean water that wildlife depend upon for survival. Unconventional oil and gas development also poses contamination risks to surface waters through spills and leaks of chemicals, diesel fuel, and wastewater, putting surface water and wildlife at risk. Roads can alter the hydrology of a site, and OHV activity can compact soils, crush plants, and provide a means for non-native plant species to invade otherwise remote, intact habitats. Construction, mine operation, improvements and use of transportation routes, and installation of power lines have contributed to the loss of habitat due to mining activities and disturbance. As outdoor recreation increases due to higher temperatures, opportunities for impacts to individuals and wildlife habitat increase as well. The utility-scale development of renewable energy sources and related transmission facilities on can threaten wildlife, habitats and associated ecosystems. For example, wind farms produce electricity with wind, but the blades that generate electricity can kill large numbers of bats and birds, potentially leading to population declines (Cohn 2008). The turbulence and barometric air pressure changes caused by the moving blades also can cause serious injury and death to bats (Maupin et al. 2014). Impacts also include habitat loss and fragmentation due to development of the site and the road system, vegetation removal, and installation of supporting structures. ROWs may destroy, fragment, and degrade wildlife habitat, and present barriers to migration. A loss of key species may result in negative cascading effects on community structure and ecosystem function, with an associated loss in ecosystem services. The combined impacts from climate change and land uses will result in a decrease in overall conditions of wildlife habitat, forage production, and water availability and quality, thereby also decreasing the resiliency of many wildlife.

4.6.23.5 Riparian Areas

Riparian areas are expected to be significantly impacted by warming and a decrease in average annual precipitation, which will cause seasonal peak flows to occur earlier and snowpack to be reduced (Hurd and Coonrod 2008; Friggens et al. 2013). Given that the Pecos River is recharged, in part, by the Capitan Aquifer (Uliana 2001), decreased precipitation and subsequent pumping for irrigation, domestic use, etc., reduces the water table, which then results in decreased Pecos River flow. The problem is exacerbated when farmers and ranchers with supplemental wells sell their well water for commercial use, a practice that may be unsustainable (Romm 2013). Areas of significant aridity such as the Chihuahuan Desert may present particular challenges if water use draws down groundwater below the roots of desert riparian vegetation. To protect riparian ecosystems, land managers and water users will need to collaborate to ensure that riparian ecosystems maintain adequate flows.

Fish, insects, and other aquatic species all have a preferred temperature range (Coutant 1999). Climate change is projected to result in higher surface water temperatures, which, in combination with anticipated land use changes, may create problems in streams (Nelson and Palmer 2007). Temperature increase alone could induce profound species community transformations (Nelson and Palmer 2007). Climate change can significantly modify (disrupt) the distribution and population of aquatic organisms as water temperatures in some streams are already reaching the lethal limit fish (Eaton et al. 1995).

Riparian ecosystems contribute to ecological resilience for the region because they are naturally resilient, provide linear habitat corridors, and create thermal refugia (Seavy et al. 2009). Riparian habitats become more important to wildlife and riverine functions as the climate dries and warms. As the riparian ecosystem is impacted by the loss of precipitation and recharge from the aquifers, the ecosystem loses resiliency and the ability to extend that resiliency to surrounding areas. Anticipated land uses that affect groundwater draw or occur within riparian areas will have a detrimental effect on riparian areas.

4.6.23.6 Sand Shinnery Ecosystem

Sand shinnery is a peculiar subset of short grass prairie, which is co-dominated by grasses and a species of oak (shinnery oak) that grows predominantly under the surface of the sands. Sand shinnery communities extend across the southern Great Plains occupying sandy soils in portions of north and west Texas, west Oklahoma, and southeast New Mexico. Most of Eddy, Lea, and portions of Chaves Counties are dominated by sand shinnery habitat and are intermixed to a lesser degree with mesquite. Although the sand shinnery may be one of the nation's largest stands of oak with 5 to 7 million acres in the southern Great Plains (Peterson and Boyd 1998), the ecosystem is at risk.

Precipitation varies within the range of sand shinnery with an annual average of 12.4 inches occurring in Eddy County (Peterson and Boyd 1998). In southern New Mexico, April through June are generally dry and July through September relatively wet, with many grasses not beginning their growth until July. Snowfall in the southern shinnery averages less than 6 inches per year and none falls in some winters. Because water availability is a limiting factor for plant growth in this community, decreased precipitation from climate change may have major impacts to shinnery vegetation.

Shinnery oak grows leaves and flowers in April–May, typically 2 weeks before neighboring grasses and forbs, giving it a competitive edge. It also is able to store water, another competitive advantage over grasses and forbs. With increased temperatures and less precipitation, shinnery oak's phenology could be impacted, reducing its competitive advantage over other vegetation. During drought conditions, shinnery oak may not leaf out in the spring or may lose its leaves; however, shinnery oak can leaf out later in the growing season if water becomes available. Drought can modify or transform the community; therefore, prolonged periods of increased temperatures and/or decreased precipitation due to climate change may negatively impact shinnery oak.

Wildlife of the sand shinnery include dunes sagebrush lizard, which is endemic, and lesser prairie-chicken, which is restricted to shinnery and similar sagebrush, shortgrass- and mixed-grass prairie grasslands (Elmore et al. 2009). Despite moderate changes, compared to other estimates, Grisham et al. (2013) expected that clutch size would increase, but ultimately and with high certainty the nest survival would decrease to a level below the threshold for population persistence by 2050. Being at the drier edge of the range, shinnery oak may be displaced by desert as the climate becomes drier and the overall range of the species could diminish.

Shinnery ecology is robust when disturbed by grazing but is limited by the availability of precipitation (Peterson and Boyd 1998). Habitat fragmentation and loss from activities such as oil and gas development may make the ecosystem more brittle when added to the impacts associated with climate change.

4.6.23.7 Karst Resources

The CFO manages approximately 2.5 million acres of federal lands, of which over 1 million acres is karst terrain. Karst terrain is a landscape formed in soluble rock types such as limestone, dolomite, gypsum, and salt. In karst terrains there are few if any surface streams because the water moves rapidly underground through fractures and open conduits that are solutionally widened. Other features commonly found in karst landscapes are closed depressions (sinkholes), swallets, sinking streams, karst resurgences, and caves. Aquifer recharge is primarily from meteoric water.

There are three primary karst aquifers in the planning area. Possibly the most important is the Capitan Reef aquifer. It provides 98% of the drinking water for the city of Carlsbad and 100% of the water for Whites City (City of Carlsbad Water Department 2016).

Other important karst aquifers are the Rustler and the Castile Formations. The Rustler Formation is composed of interbedded gypsums and dolomites. It extends over a large portion of the planning area and provides primary water sources for the communities of Otis and Loving, along with several ranching communities. The Castile Formation is located southeast of the Guadalupe Mountains in the Delaware Basin and is composed of Permian-age gypsum. The formation gives rise to several springs that support riparian habitat and is the water source for the ranching community there.

The general effect of climate change on the southwestern United States will be a drier and warmer climate. The impact of that effect on the cave and karst environments could be multi-fold. With the increased desertification of the karst landscape there would be less recharge of the aquifers. This would then result in decreasing water levels in the karst aquifers, which would in turn result in decreased outflow from karst springs and a diminishing of the riparian habitat associated with those springs. For the cave ecosystems, the result would manifest in decreased moisture in the system. Drier cave ecosystems would stress the troglobitic wildlife. Continued depletion of karst aquifers would jeopardize any troglobitic aquatic species. There have been two new species of troglobitic aquatic species discovered in the Rustler karst aquifer and more may exist as biologic inventories continue (Mace and Wade 2007; Veni 2014). Drier climates would also slow the infiltration of meteoric water from the surface into the cave systems. This would slow the growth of the speleothems.

As climate change progresses there will still be a domestic and industrial demand for water resources. The primary uses form karst aquifers would be for domestic city use. A second high demand would come from industrial use, which includes the oil and gas industry and the potash industry. Water use associated with the oil and gas industry for drilling and hydraulic fracturing is from 3.5 to 4.5 million gallons per well. With hundreds of wells proposed for drilling in karst areas in the planning area, there is a potential for depletion of aquifer drawdown with volumetric resilience being low. However, 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. Most of agricultural use comes from the Pecos River with only a small amount coming from supplemental wells drawing from karst aquifers. The potash industry gets most of its water for processing ore from the Ogallala Aquifer. One of the new recovery techniques is solution mining that requires 3.77 million gallons of water per day but drawn from the Rustler Formation (BLM 2012f).

Sustained or increased domestic and industrial/agricultural use of water from karst aquifers would add to the strain of already stressed cave and karst ecosystems.

4.6.23.8 Air Resources

Ozone in the atmosphere warms the climate and particulate matter can have either have either a warming or cooling effect (EPA 2016b).

Conversely, climate changes can impact air quality. A warming climate associated with climate change can potentially increase ground-level ozone concentrations on a regional basis. This could present future problems for compliance of ozone standards and cause ozone concentration exceedances. Without accounting for climate change effects, models indicate that, by 2021, areas may be in exceedance of the new ozone standard of 70 ppb due to foreseeable development (see Chapter 4, Section 4.2.11.8.3, Impacts from the Alternatives). Combined with climate change, even greater exceedances leading to non-attainment are likely to occur.

The impact of climate change on other air pollutants is less certain (EPA 2016b). Research is ongoing to better understand the influence of climate change on fine particulate matter and other air pollutions, as well as the interactions between naturally emitted compounds and human-made pollutants in the atmosphere (EPA 2016b).

EXHIBIT 7

Rebuttal Testimony of Lori Marquez and Jeff Bennett

New Mexico EIB No. 20-21(A)

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

Draft Resource Management Plan and Environmental Impact Statement

Carlsbad Field Office, Pecos District, New Mexico

Estimated Lead Agency Total Costs Associated with Developing and Producing this EIS

$4,812,816

August 2018 ▪ Volume II

BLM/NM/PL-18-01-1610

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APPENDIX E

Air Resources Technical Background

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Air Resources Technical Support Document Supplement

Carlsbad Field Office

Oil and Gas Resource Management Plan

November 2015

This supplement to the final *Air Resources Technical Support Document (ARTSD) for the Carlsbad Field Office Oil and Gas Resource Management Plan* dated April 2013 was prepared because of the October 1, 2015 strengthening of the National Ambient Air Quality Standard (NAAQS) for ground-level ozone by the U.S. Environmental Protection Agency (EPA). Based on extensive scientific evidence about ozone's effects on public health and welfare, the primary standard was lowered from 75 parts per billion (ppb) to 70 ppb. The secondary standard was also lowered to 70 ppb. The Carlsbad Field Office planning area design value for the 3-year average from 2012 through 2014 is 71 ppb according to EPA data; however, according to informal communications with the New Mexico Environment Department, the estimated design value for the 3-year average from 2013 through 2015 is below 70 ppb. Because designations typically occur 2 to 3 years from the date a standard is finalized, counties in the Carlsbad Field Office planning area will likely be designated based in part on 2014 through 2016 monitoring data. It is unclear at this time whether any counties in southeastern New Mexico will be designated nonattainment. EPA is expected to issue new guidance on the designation process in early 2016. Although it is not yet known whether the counties within the Carlsbad Field Office planning area will attain the new standard, the Carlsbad Field Office can still supplement the ARTSD by providing information on how this change to the ozone NAAQS affects the air quality analysis completed for the Resource Management Plan (RMP) and the conclusions of the analysis.

The new standard does not affect the scope, goals, and study area outlined in the ARTSD; and, because no other standards or values have changed except the ozone NAAQS, comparison of other modeling results to thresholds and standards remains the same as documented in the ARTSD. The air quality modeling protocol and procedures used to guide the analysis are still valid for all pollutants analyzed because the EPA has not issued any guidance that would invalidate the analysis approach in the ARTSD. The ARTSD notes (p. 4-23) that the 2008 ozone primary and secondary NAAQS were being reconsidered at the time the ARTSD was drafted and finalized. The future design values modeled for monitors in the Carlsbad Field Office areas (Carlsbad, Carlsbad Caverns National Park and Hobbs-Jefferson) all show expected exceedance of the new ozone NAAQS. Under the previous standard, the Hobbs-Jefferson monitor predicted design value would have been less than the 75 ppb ozone NAAQS (72 ppb under both scenarios). As noted in the ARTSD, predicted absolute ozone concentrations should be interpreted carefully because an absolute ozone concentration above 70 ppb at a specific grid cell on an individual day does not indicate that the area would be classified as nonattainment; designations are based on a 3-year average of the 4th highest daily maximum 8-hour average monitored concentration. As well, photochemical grid model predictions are not exact due to uncertainties in meteorological, emissions inventory, and other model input data. The conclusion in the ARTSD on page 4-41 remains valid despite the change in the ozone standard: the modeling analysis found that ozone impacts attributable to the Carlsbad Field Office RMP and cumulative emissions are not predicted to cause or contribute to violations of the ozone NAAQS. The projected design values for reasonably foreseeable development with controls required by current regulations and reasonably foreseeable development with controls beyond what is currently required show little change from the future year-base case. The ARTSD conclusions do not change as a result of the new ozone NAAQS.

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EXHIBIT 8

Rebuttal Testimony of Lori Marquez and Jeff Bennett

New Mexico EIB No. 20-21(A)

3-hr Avg.	Max Daily 8-hr Avg.									NMED Raw Data	
2015-01-01	0.012	2016-01-01	0.038	2017-01-01	0.037	2018-01-01	0.031	2019-01-01	0.024	2020-01-01	0.036
2015-01-02	0.01	2016-01-02	0.03	2017-01-02	0.038	2018-01-02	0.03	2019-01-02	0.023	2020-01-02	0.033
2015-01-03	0.022	2016-01-03	0.04	2017-01-03	0.036	2018-01-03	0.043	2019-01-03	0.043	2020-01-03	0.032
2015-01-04	0.017	2016-01-04	ND	2017-01-04	0.03	2018-01-04	0.031	2019-01-04	0.04	2020-01-04	0.036
2015-01-05	0.017	2016-01-05	0.022	2017-01-05	0.027	2018-01-05	0.039	2019-01-05	0.038	2020-01-05	0.037
2015-01-06	0.019	2016-01-06	0.028	2017-01-06	0.032	2018-01-06	0.04	2019-01-06	0.037	2020-01-06	0.039
2015-01-07	0.023	2016-01-07	0.038	2017-01-07	0.036	2018-01-07	0.039	2019-01-07	0.041	2020-01-07	0.038
2015-01-08	0.015	2016-01-08	0.038	2017-01-08	0.035	2018-01-08	0.041	2019-01-08	0.039	2020-01-08	0.038
2015-01-09	0.02	2016-01-09	0.026	2017-01-09	0.027	2018-01-09	0.039	2019-01-09	0.041	2020-01-09	0.038
2015-01-10	0.015	2016-01-10	0.033	2017-01-10	0.036	2018-01-10	0.041	2019-01-10	0.035	2020-01-10	0.036
2015-01-11	0.017	2016-01-11	0.036	2017-01-11	0.037	2018-01-11	0.035	2019-01-11	0.033	2020-01-11	0.034
2015-01-12	0.013	2016-01-12	0.039	2017-01-12	0.039	2018-01-12	0.039	2019-01-12	0.038	2020-01-12	0.041
2015-01-13	ND	2016-01-13	0.037	2017-01-13	0.02	2018-01-13	0.037	2019-01-13	0.036	2020-01-13	0.036
2015-01-14	0.014	2016-01-14	0.04	2017-01-14	0.012	2018-01-14	0.04	2019-01-14	0.028	2020-01-14	0.035
2015-01-15	ND	2016-01-15	0.041	2017-01-15	0.011	2018-01-15	0.035	2019-01-15	0.028	2020-01-15	0.024
2015-01-16	0.022	2016-01-16	0.035	2017-01-16	0.031	2018-01-16	0.034	2019-01-16	0.033	2020-01-16	0.021
2015-01-17	0.026	2016-01-17	0.042	2017-01-17	0.033	2018-01-17	0.037	2019-01-17	0.04	2020-01-17	0.022
2015-01-18	0.027	2016-01-18	0.031	2017-01-18	0.035	2018-01-18	0.035	2019-01-18	0.043	2020-01-18	0.038
2015-01-19	0.024	2016-01-19	0.04	2017-01-19	0.037	2018-01-19	0.039	2019-01-19	0.043	2020-01-19	0.038
2015-01-20	0.025	2016-01-20	ND	2017-01-20	0.043	2018-01-20	0.047	2019-01-20	0.038	2020-01-20	0.036
2015-01-21	0.025	2016-01-21	0.041	2017-01-21	0.045	2018-01-21	0.047	2019-01-21	0.037	2020-01-21	0.033
2015-01-22	0.026	2016-01-22	0.039	2017-01-22	0.043	2018-01-22	0.041	2019-01-22	0.034	2020-01-22	0.031
2015-01-23	0.023	2016-01-23	0.039	2017-01-23	0.035	2018-01-23	0.042	2019-01-23	0.039	2020-01-23	0.038
2015-01-24	0.024	2016-01-24	0.044	2017-01-24	0.046	2018-01-24	0.044	2019-01-24	0.042	2020-01-24	0.04
2015-01-25	0.025	2016-01-25	0.043	2017-01-25	0.045	2018-01-25	0.045	2019-01-25	0.044	2020-01-25	0.037
2015-01-26	ND	2016-01-26	0.034	2017-01-26	0.045	2018-01-26	0.031	2019-01-26	0.048	2020-01-26	0.037
2015-01-27	ND	2016-01-27	0.038	2017-01-27	0.042	2018-01-27	0.043	2019-01-27	0.047	2020-01-27	0.036
2015-01-28	ND	2016-01-28	0.038	2017-01-28	0.045	2018-01-28	0.048	2019-01-28	0.038	2020-01-28	0.035
2015-01-29	ND	2016-01-29	0.041	2017-01-29	0.045	2018-01-29	0.044	2019-01-29	0.036	2020-01-29	0.04
2015-01-30	0.025	2016-01-30	0.042	2017-01-30	0.042	2018-01-30	0.047	2019-01-30	0.037	2020-01-30	0.029
2015-01-31	0.018	2016-01-31	0.042	2017-01-31	0.042	2018-01-31	0.045	2019-01-31	0.042	2020-01-31	0.038
2015-02-01	0.025	2016-02-01	0.043	2017-02-01	0.045	2018-02-01	0.044	2019-02-01	0.041	2020-02-01	0.038
2015-02-02	0.026	2016-02-02	0.04	2017-02-02	0.039	2018-02-02	0.042	2019-02-02	0.043	2020-02-02	0.036
2015-02-03	0.025	2016-02-03	0.041	2017-02-03	0.036	2018-02-03	0.042	2019-02-03	0.035	2020-02-03	0.035
2015-02-04	0.024	2016-02-04	0.042	2017-02-04	0.029	2018-02-04	0.046	2019-02-04	0.036	2020-02-04	0.028
2015-02-05	0.023	2016-02-05	0.042	2017-02-05	0.044	2018-02-05	0.038	2019-02-05	0.032	2020-02-05	0.033
2015-02-06	0.028	2016-02-06	0.043	2017-02-06	0.04	2018-02-06	0.027	2019-02-06	0.042	2020-02-06	0.035
2015-02-07	0.031	2016-02-07	0.043	2017-02-07	0.04	2018-02-07	0.039	2019-02-07	0.048	2020-02-07	0.032
2015-02-08	0.032	2016-02-08	0.043	2017-02-08	0.039	2018-02-08	0.05	2019-02-08	0.036	2020-02-08	0.039
2015-02-09	0.034	2016-02-09	0.046	2017-02-09	0.042	2018-02-09	0.046	2019-02-09	0.037	2020-02-09	0.035
2015-02-10	0.03	2016-02-10	0.042	2017-02-10	0.043	2018-02-10	0.036	2019-02-10	0.023	2020-02-10	0.026
2015-02-11	0.031	2016-02-11	0.045	2017-02-11	0.05	2018-02-11	0.035	2019-02-11	0.054	2020-02-11	0.029
2015-02-12	0.035	2016-02-12	0.053	2017-02-12	0.041	2018-02-12	0.043	2019-02-12	0.047	2020-02-12	0.033
2015-02-13	0.035	2016-02-13	0.052	2017-02-13	0.03	2018-02-13	0.039	2019-02-13	0.043	2020-02-13	0.037
2015-02-14	0.038	2016-02-14	0.044	2017-02-14	0.043	2018-02-14	0.034	2019-02-14	ND	2020-02-14	0.028
2015-02-15	0.029	2016-02-15	0.043	2017-02-15	0.05	2018-02-15	0.028	2019-02-15	0.037	2020-02-15	0.036
2015-02-16	0.031	2016-02-16	0.035	2017-02-16	0.046	2018-02-16	0.038	2019-02-16	0.051	2020-02-16	0.041
2015-02-17	0.029	2016-02-17	0.046	2017-02-17	0.043	2018-02-17	0.039	2019-02-17	0.053	2020-02-17	0.036
2015-02-18	0.027	2016-02-18	0.048	2017-02-18	0.044	2018-02-18	0.04	2019-02-18	0.034	2020-02-18	0.033
2015-02-19	0.031	2016-02-19	0.038	2017-02-19	0.048	2018-02-19	0.029	2019-02-19	0.033	2020-02-19	ND
2015-02-20	0.023	2016-02-20	0.044	2017-02-20	0.048	2018-02-20	0.043	2019-02-20	0.051	2020-02-20	0.03
2015-02-21	0.029	2016-02-21	0.042	2017-02-21	0.032	2018-02-21	0.033	2019-02-21	0.047	2020-02-21	0.034
2015-02-22	0.025	2016-02-22	0.034	2017-02-22	0.03	2018-02-22	0.029	2019-02-22	0.047	2020-02-22	0.029
2015-02-23	0.025	2016-02-23	0.037	2017-02-23	0.045	2018-02-23	0.047	2019-02-23	0.051	2020-02-23	0.042

2015-02-24	0.019	2016-02-24	0.044	2017-02-24	0.052	2018-02-24	0.051	2019-02-24	0.054	2020-02-24	0.039
2015-02-25	0.03	2016-02-25	0.04	2017-02-25	0.047	2018-02-25	0.053	2019-02-25	0.05	2020-02-25	ND
2015-02-26	0.027	2016-02-26	0.045	2017-02-26	0.047	2018-02-26	0.053	2019-02-26	0.05	2020-02-26	0.039
2015-02-27	0.026	2016-02-27	0.05	2017-02-27	0.045	2018-02-27	0.039	2019-02-27	0.04	2020-02-27	0.039
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2015-03-05	0.033	2016-03-04	0.046	2017-03-05	0.045	2018-03-05	0.059	2019-03-05	0.049	2020-03-04	0.038
2015-03-06	0.032	2016-03-05	0.057	2017-03-06	0.042	2018-03-06	0.048	2019-03-06	0.041	2020-03-05	0.041
2015-03-07	0.034	2016-03-06	0.043	2017-03-07	0.062	2018-03-07	0.052	2019-03-07	0.025	2020-03-06	0.049
2015-03-08	0.027	2016-03-07	0.041	2017-03-08	0.056	2018-03-08	0.054	2019-03-08	0.04	2020-03-07	0.047
2015-03-09	0.031	2016-03-08	0.047	2017-03-09	0.045	2018-03-09	0.046	2019-03-09	0.052	2020-03-08	0.031
2015-03-10	0.038	2016-03-09	0.043	2017-03-10	0.041	2018-03-10	0.049	2019-03-10	0.041	2020-03-09	0.039
2015-03-11	0.044	2016-03-10	0.045	2017-03-11	0.04	2018-03-11	0.046	2019-03-11	0.024	2020-03-10	0.034
2015-03-12	0.041	2016-03-11	0.053	2017-03-12	0.036	2018-03-12	0.052	2019-03-12	0.047	2020-03-11	0.035
2015-03-13	0.041	2016-03-12	0.051	2017-03-13	0.045	2018-03-13	0.055	2019-03-13	0.052	2020-03-12	0.028
2015-03-14	0.037	2016-03-13	0.048	2017-03-14	0.046	2018-03-14	0.059	2019-03-14	0.054	2020-03-13	0.022
2015-03-15	0.039	2016-03-14	0.045	2017-03-15	0.051	2018-03-15	0.045	2019-03-15	0.048	2020-03-14	0.044
2015-03-16	0.037	2016-03-15	0.05	2017-03-16	0.047	2018-03-16	0.054	2019-03-16	0.053	2020-03-15	0.015
2015-03-17	0.02	2016-03-16	0.052	2017-03-17	0.052	2018-03-17	0.048	2019-03-17	0.058	2020-03-16	0.029
2015-03-18	0.025	2016-03-17	0.049	2017-03-18	0.05	2018-03-18	0.053	2019-03-18	0.06	2020-03-17	0.026
2015-03-19	0.03	2016-03-18	0.042	2017-03-19	0.051	2018-03-19	0.053	2019-03-19	0.058	2020-03-18	0.032
2015-03-20	0.027	2016-03-19	0.042	2017-03-20	0.053	2018-03-20	0.057	2019-03-20	0.05	2020-03-19	0.05
2015-03-21	0.025	2016-03-20	0.048	2017-03-21	0.048	2018-03-21	0.063	2019-03-21	0.051	2020-03-20	0.03
2015-03-22	0.035	2016-03-21	0.045	2017-03-22	0.052	2018-03-22	0.049	2019-03-22	0.044	2020-03-21	0.024
2015-03-23	0.039	2016-03-22	0.051	2017-03-23	0.054	2018-03-23	0.042	2019-03-23	0.056	2020-03-22	0.045
2015-03-24	0.037	2016-03-23	0.05	2017-03-24	0.046	2018-03-24	0.048	2019-03-24	0.055	2020-03-23	0.054
2015-03-25	0.037	2016-03-24	0.043	2017-03-25	0.051	2018-03-25	0.037	2019-03-25	0.055	2020-03-24	0.051
2015-03-26	0.032	2016-03-25	0.052	2017-03-26	0.056	2018-03-26	0.045	2019-03-26	0.056	2020-03-25	0.049
2015-03-27	0.035	2016-03-26	0.051	2017-03-27	0.054	2018-03-27	0.033	2019-03-27	0.045	2020-03-26	0.035
2015-03-28	0.032	2016-03-27	0.045	2017-03-28	0.053	2018-03-28	0.051	2019-03-28	0.054	2020-03-27	0.044
2015-03-29	0.038	2016-03-28	0.047	2017-03-29	0.038	2018-03-29	0.051	2019-03-29	0.052	2020-03-28	0.049
2015-03-30	0.041	2016-03-29	0.051	2017-03-30	0.055	2018-03-30	0.057	2019-03-30	0.044	2020-03-29	0.052
2015-03-31	0.037	2016-03-30	0.045	2017-03-31	0.057	2018-03-31	0.051	2019-03-31	0.047	2020-03-30	0.05
2015-04-01	0.038	2016-03-31	0.049	2017-04-01	0.031	2018-04-01	0.045	2019-04-01	0.058	2020-03-31	0.047
2015-04-02	0.054	2016-04-01	0.038	2017-04-02	0.049	2018-04-02	0.056	2019-04-02	0.055	2020-04-01	0.043
2015-04-03	0.043	2016-04-02	0.04	2017-04-03	0.049	2018-04-03	0.052	2019-04-03	0.054	2020-04-02	0.044
2015-04-04	0.044	2016-04-03	0.044	2017-04-04	0.06	2018-04-04	0.055	2019-04-04	0.059	2020-04-03	0.03
2015-04-05	0.045	2016-04-04	0.045	2017-04-05	0.05	2018-04-05	0.057	2019-04-05	0.057	2020-04-04	0.03
2015-04-06	0.044	2016-04-05	0.051	2017-04-06	0.058	2018-04-06	0.055	2019-04-06	0.051	2020-04-05	0.038
2015-04-07	0.042	2016-04-06	0.049	2017-04-07	0.055	2018-04-07	0.044	2019-04-07	0.051	2020-04-06	0.037
2015-04-08	0.03	2016-04-07	0.049	2017-04-08	0.053	2018-04-08	0.044	2019-04-08	0.059	2020-04-07	0.046
2015-04-09	0.057	2016-04-08	0.048	2017-04-09	0.055	2018-04-09	0.052	2019-04-09	0.053	2020-04-08	0.044
2015-04-10	0.046	2016-04-09	0.055	2017-04-10	0.055	2018-04-10	0.062	2019-04-10	0.06	2020-04-09	0.04
2015-04-11	0.04	2016-04-10	0.047	2017-04-11	0.053	2018-04-11	0.061	2019-04-11	0.042	2020-04-10	0.044
2015-04-12	0.037	2016-04-11	0.043	2017-04-12	0.047	2018-04-12	0.055	2019-04-12	0.054	2020-04-11	0.051
2015-04-13	0.048	2016-04-12	0.028	2017-04-13	0.054	2018-04-13	0.066	2019-04-13	0.04	2020-04-12	0.038
2015-04-14	0.05	2016-04-13	0.048	2017-04-14	0.041	2018-04-14	0.05	2019-04-14	0.057	2020-04-13	0.041
2015-04-15	0.048	2016-04-14	0.051	2017-04-15	0.056	2018-04-15	0.061	2019-04-15	0.062	2020-04-14	0.034
2015-04-16	0.051	2016-04-15	0.051	2017-04-16	0.058	2018-04-16	0.068	2019-04-16	0.056	2020-04-15	0.044
2015-04-17	0.057	2016-04-16	0.059	2017-04-17	0.061	2018-04-17	0.065	2019-04-17	0.052	2020-04-16	0.05
2015-04-18	0.06	2016-04-17	0.047	2017-04-18	0.058	2018-04-18	0.058	2019-04-18	0.048	2020-04-17	0.034
2015-04-19	0.054	2016-04-18	0.046	2017-04-19	0.059	2018-04-19	0.061	2019-04-19	0.057	2020-04-18	0.042

2015-04-20	0.053	2016-04-19	0.047	2017-04-20	0.051	2018-04-20	0.056	2019-04-20	0.055	2020-04-19	0.045
2015-04-21	0.057	2016-04-20	0.053	2017-04-21	0.063	2018-04-21	0.056	2019-04-21	0.051	2020-04-20	0.046
2015-04-22	0.055	2016-04-21	0.057	2017-04-22	0.053	2018-04-22	0.058	2019-04-22	0.041	2020-04-21	0.051
2015-04-23	0.047	2016-04-22	0.06	2017-04-23	0.057	2018-04-23	0.067	2019-04-23	0.039	2020-04-22	0.048
2015-04-24	0.051	2016-04-23	0.057	2017-04-24	0.061	2018-04-24	0.066	2019-04-24	0.05	2020-04-23	0.048
2015-04-25	0.057	2016-04-24	0.052	2017-04-25	0.053	2018-04-25	0.049	2019-04-25	0.059	2020-04-24	0.043
2015-04-26	0.054	2016-04-25	0.057	2017-04-26	0.047	2018-04-26	0.059	2019-04-26	0.059	2020-04-25	0.042
2015-04-27	0.047	2016-04-26	0.059	2017-04-27	0.053	2018-04-27	0.063	2019-04-27	0.058	2020-04-26	0.046
2015-04-28	0.058	2016-04-27	0.059	2017-04-28	0.052	2018-04-28	0.065	2019-04-28	0.065	2020-04-27	0.046
2015-04-29	0.064	2016-04-28	0.056	2017-04-29	0.043	2018-04-29	0.059	2019-04-29	0.044	2020-04-28	0.049
2015-04-30	0.062	2016-04-29	0.062	2017-04-30	0.055	2018-04-30	0.06	2019-04-30	0.05	2020-04-29	0.049
2015-05-01	0.062	2016-04-30	0.056	2017-05-01	0.054	2018-05-01	0.06	2019-05-01	0.059	2020-04-30	0.049
2015-05-02	0.059	2016-05-01	0.035	2017-05-02	0.065	2018-05-02	0.044	2019-05-02	0.039	2020-05-01	0.049
2015-05-03	0.055	2016-05-02	0.047	2017-05-03	0.055	2018-05-03	0.057	2019-05-03	0.057	2020-05-02	0.048
2015-05-04	0.043	2016-05-03	0.054	2017-05-04	0.054	2018-05-04	0.055	2019-05-04	0.063	2020-05-03	0.046
2015-05-05	0.054	2016-05-04	0.059	2017-05-05	0.06	2018-05-05	0.07	2019-05-05	0.058	2020-05-04	0.052
2015-05-06	0.054	2016-05-05	0.058	2017-05-06	0.057	2018-05-06	0.067	2019-05-06	0.062	2020-05-05	0.046
2015-05-07	0.058	2016-05-06	0.057	2017-05-07	0.054	2018-05-07	0.066	2019-05-07 ND		2020-05-06	0.054
2015-05-08	0.056	2016-05-07	0.049	2017-05-08	0.051	2018-05-08	0.061	2019-05-08	0.052	2020-05-07	0.055
2015-05-09	0.066	2016-05-08	0.06	2017-05-09	0.049	2018-05-09	0.066	2019-05-09	0.037	2020-05-08	0.042
2015-05-10	0.063	2016-05-09	0.055	2017-05-10	0.06	2018-05-10	0.064	2019-05-10	0.035	2020-05-09	0.048
2015-05-11	0.048	2016-05-10	0.063	2017-05-11	0.064	2018-05-11	0.05	2019-05-11	0.046	2020-05-10	0.045
2015-05-12	0.043	2016-05-11	0.058	2017-05-12	0.058	2018-05-12	0.048	2019-05-12	0.056	2020-05-11	0.046
2015-05-13	0.048	2016-05-12	0.05	2017-05-13	0.063	2018-05-13	0.048	2019-05-13	0.049	2020-05-12	0.058
2015-05-14	0.047	2016-05-13	0.052	2017-05-14	0.065	2018-05-14	0.053	2019-05-14	0.068	2020-05-13	0.05
2015-05-15	0.04	2016-05-14	0.042	2017-05-15	0.06	2018-05-15	0.047	2019-05-15	0.055	2020-05-14	0.049
2015-05-16	0.053	2016-05-15	0.037	2017-05-16	0.055	2018-05-16	0.055	2019-05-16	0.051	2020-05-15	0.05
2015-05-17	0.054	2016-05-16	0.045	2017-05-17	0.062	2018-05-17	0.055	2019-05-17	0.059	2020-05-16	0.054
2015-05-18	0.053	2016-05-17	0.031	2017-05-18	0.053	2018-05-18	0.067	2019-05-18	0.064	2020-05-17	0.053
2015-05-19	0.048	2016-05-18	0.034	2017-05-19	0.055	2018-05-19	0.074	2019-05-19	0.075	2020-05-18	0.053
2015-05-20	0.027	2016-05-19	0.043	2017-05-20	0.049	2018-05-20	0.056	2019-05-20	0.061	2020-05-19	0.05
2015-05-21	0.031	2016-05-20	0.058	2017-05-21	0.045	2018-05-21	0.059	2019-05-21	0.058	2020-05-20	0.054
2015-05-22	0.033	2016-05-21	0.05	2017-05-22	0.061	2018-05-22	0.059	2019-05-22	0.063	2020-05-21	0.054
2015-05-23	0.037	2016-05-22	0.058	2017-05-23	0.057	2018-05-23	0.055	2019-05-23	0.049	2020-05-22	0.058
2015-05-24	0.058	2016-05-23	0.056	2017-05-24	0.061	2018-05-24	0.064	2019-05-24	0.058	2020-05-23	0.054
2015-05-25	0.062	2016-05-24	0.057	2017-05-25	0.053	2018-05-25	0.07	2019-05-25	0.04	2020-05-24	0.049
2015-05-26	0.058	2016-05-25	0.049	2017-05-26	0.046	2018-05-26	0.069	2019-05-26	0.031	2020-05-25	0.038
2015-05-27	0.049	2016-05-26	0.053	2017-05-27	0.052	2018-05-27	0.064	2019-05-27	0.059	2020-05-26	0.051
2015-05-28	0.043	2016-05-27	0.061	2017-05-28	0.058	2018-05-28	0.063	2019-05-28	0.057	2020-05-27	0.051
2015-05-29	0.052	2016-05-28	0.069	2017-05-29	0.059	2018-05-29	0.068	2019-05-29	0.061	2020-05-28	0.047
2015-05-30	0.049	2016-05-29	0.048	2017-05-30	0.063	2018-05-30	0.061	2019-05-30	0.055	2020-05-29	0.048
2015-05-31	0.056	2016-05-30	0.042	2017-05-31	0.06	2018-05-31	0.062	2019-05-31	0.049	2020-05-30	0.049
2015-06-01	0.059	2016-05-31	0.052	2017-06-01	0.063	2018-06-01	0.056	2019-06-01	0.048	2020-05-31	0.049
2015-06-02	0.049	2016-06-01	0.051	2017-06-02	0.053	2018-06-02	0.062	2019-06-02	0.04	2020-06-01	0.044
2015-06-03	0.055	2016-06-02	0.05	2017-06-03	0.058	2018-06-03	0.057	2019-06-03	0.049	2020-06-02	0.042
2015-06-04	0.045	2016-06-03	0.055	2017-06-04	0.062	2018-06-04	0.083	2019-06-04	0.05	2020-06-03 ND	
2015-06-05	0.045	2016-06-04	0.05	2017-06-05	0.065	2018-06-05	0.078	2019-06-05	0.07	2020-06-04	0.045
2015-06-06	0.039	2016-06-05	0.055	2017-06-06	0.059	2018-06-06	0.057	2019-06-06	0.063	2020-06-05	0.044
2015-06-07	0.044	2016-06-06	0.063	2017-06-07	0.067	2018-06-07	0.058	2019-06-07	0.082	2020-06-06	0.036
2015-06-08	0.045	2016-06-07	0.064	2017-06-08	0.064	2018-06-08	0.048	2019-06-08	0.07	2020-06-07	0.039
2015-06-09	0.044	2016-06-08	0.066	2017-06-09	0.074	2018-06-09	0.049	2019-06-09	0.04	2020-06-08	0.044
2015-06-10	0.053	2016-06-09	0.056	2017-06-10	0.062	2018-06-10	0.06	2019-06-10	0.046	2020-06-09	0.056
2015-06-11	0.054	2016-06-10	0.049	2017-06-11	0.063	2018-06-11	0.059	2019-06-11	0.059	2020-06-10	0.056
2015-06-12	0.048	2016-06-11	0.051	2017-06-12	0.057	2018-06-12	0.058	2019-06-12	0.049	2020-06-11	0.044
2015-06-13	0.048	2016-06-12	0.058	2017-06-13	0.053	2018-06-13	0.049	2019-06-13	0.053	2020-06-12	0.051

2015-06-14	0.054	2016-06-13	0.065	2017-06-14	0.057	2018-06-14	0.046	2019-06-14	0.066	2020-06-13	0.051
2015-06-15	0.062	2016-06-14	ND	2017-06-15	0.059	2018-06-15	0.042	2019-06-15	0.059	2020-06-14	0.052
2015-06-16	0.051	2016-06-15	0.055	2017-06-16	0.068	2018-06-16	0.032	2019-06-16	0.063	2020-06-15	ND
2015-06-17	0.053	2016-06-16	0.065	2017-06-17	0.065	2018-06-17	0.042	2019-06-17	0.057	2020-06-16	0.041
2015-06-18	0.057	2016-06-17	0.059	2017-06-18	0.045	2018-06-18	0.06	2019-06-18	0.061	2020-06-17	0.042
2015-06-19	0.046	2016-06-18	0.061	2017-06-19	ND	2018-06-19	0.063	2019-06-19	0.057	2020-06-18	ND
2015-06-20	0.04	2016-06-19	0.053	2017-06-20	0.053	2018-06-20	0.039	2019-06-20	0.064	2020-06-19	ND
2015-06-21	0.042	2016-06-20	0.052	2017-06-21	0.057	2018-06-21	0.063	2019-06-21	0.058	2020-06-20	0.043
2015-06-22	0.036	2016-06-21	0.033	2017-06-22	0.072	2018-06-22	0.053	2019-06-22	0.065	2020-06-21	ND
2015-06-23	0.028	2016-06-22	0.043	2017-06-23	0.06	2018-06-23	0.067	2019-06-23	0.056	2020-06-22	ND
2015-06-24	0.033	2016-06-23	0.048	2017-06-24	0.059	2018-06-24	0.069	2019-06-24	0.063	2020-06-23	ND
2015-06-25	0.037	2016-06-24	0.053	2017-06-25	0.06	2018-06-25	0.052	2019-06-25	0.063	2020-06-24	ND
2015-06-26	0.05	2016-06-25	0.043	2017-06-26	0.065	2018-06-26	0.046	2019-06-26	0.054	2020-06-25	ND
2015-06-27	0.057	2016-06-26	0.052	2017-06-27	0.062	2018-06-27	0.052	2019-06-27	0.044	2020-06-26	ND
2015-06-28	0.064	2016-06-27	0.04	2017-06-28	0.063	2018-06-28	0.042	2019-06-28	0.044	2020-06-27	0.041
2015-06-29	0.062	2016-06-28	0.04	2017-06-29	0.061	2018-06-29	0.058	2019-06-29	0.049	2020-06-28	0.06
2015-06-30	0.065	2016-06-29	0.052	2017-06-30	0.063	2018-06-30	0.063	2019-06-30	0.063	2020-06-29	0.045
2015-07-01	0.042	2016-06-30	0.057	2017-07-01	0.047	2018-07-01	0.062	2019-07-01	0.056	2020-06-30	0.039
2015-07-02	0.048	2016-07-01	0.053	2017-07-02	0.056	2018-07-02	0.054	2019-07-02	0.051	2020-07-01	0.048
2015-07-03	0.046	2016-07-02	0.052	2017-07-03	0.051	2018-07-03	0.06	2019-07-03	0.052	2020-07-02	0.044
2015-07-04	0.042	2016-07-03	0.058	2017-07-04	0.051	2018-07-04	0.054	2019-07-04	0.062	2020-07-03	0.04
2015-07-05	0.049	2016-07-04	0.058	2017-07-05	0.065	2018-07-05	0.046	2019-07-05	0.055	2020-07-04	0.041
2015-07-06	0.057	2016-07-05	0.059	2017-07-06	0.061	2018-07-06	0.048	2019-07-06	0.047	2020-07-05	0.043
2015-07-07	0.041	2016-07-06	0.052	2017-07-07	0.043	2018-07-07	0.051	2019-07-07	0.053	2020-07-06	0.06
2015-07-08	0.057	2016-07-07	0.053	2017-07-08	0.049	2018-07-08	0.06	2019-07-08	0.057	2020-07-07	0.056
2015-07-09	0.045	2016-07-08	0.063	2017-07-09	0.047	2018-07-09	0.06	2019-07-09	0.054	2020-07-08	0.051
2015-07-10	0.041	2016-07-09	0.055	2017-07-10	0.048	2018-07-10	0.042	2019-07-10	0.069	2020-07-09	0.052
2015-07-11	0.044	2016-07-10	0.053	2017-07-11	0.036	2018-07-11	0.047	2019-07-11	0.059	2020-07-10	0.047
2015-07-12	0.049	2016-07-11	0.054	2017-07-12	0.037	2018-07-12	0.041	2019-07-12	0.058	2020-07-11	0.045
2015-07-13	0.053	2016-07-12	0.049	2017-07-13	0.038	2018-07-13	0.044	2019-07-13	0.058	2020-07-12	0.043
2015-07-14	0.05	2016-07-13	0.053	2017-07-14	0.037	2018-07-14	0.044	2019-07-14	0.061	2020-07-13	0.047
2015-07-15	0.054	2016-07-14	0.047	2017-07-15	0.04	2018-07-15	0.044	2019-07-15	0.054	2020-07-14	0.047
2015-07-16	0.059	2016-07-15	0.057	2017-07-16	0.046	2018-07-16	0.049	2019-07-16	0.053	2020-07-15	0.049
2015-07-17	0.058	2016-07-16	0.048	2017-07-17	0.055	2018-07-17	0.051	2019-07-17	0.046	2020-07-16	0.045
2015-07-18	0.052	2016-07-17	0.044	2017-07-18	0.064	2018-07-18	0.062	2019-07-18	0.067	2020-07-17	0.038
2015-07-19	0.049	2016-07-18	0.044	2017-07-19	0.041	2018-07-19	0.056	2019-07-19	0.057	2020-07-18	0.039
2015-07-20	0.051	2016-07-19	0.047	2017-07-20	0.038	2018-07-20	0.057	2019-07-20	0.061	2020-07-19	0.039
2015-07-21	0.064	2016-07-20	0.042	2017-07-21	0.045	2018-07-21	0.057	2019-07-21	0.053	2020-07-20	0.037
2015-07-22	0.057	2016-07-21	0.048	2017-07-22	0.053	2018-07-22	0.055	2019-07-22	0.048	2020-07-21	0.036
2015-07-23	0.048	2016-07-22	0.051	2017-07-23	0.058	2018-07-23	0.064	2019-07-23	0.057	2020-07-22	0.042
2015-07-24	0.052	2016-07-23	0.046	2017-07-24	0.045	2018-07-24	0.065	2019-07-24	0.066	2020-07-23	0.037
2015-07-25	0.049	2016-07-24	0.048	2017-07-25	0.046	2018-07-25	0.077	2019-07-25	0.069	2020-07-24	0.04
2015-07-26	0.057	2016-07-25	0.05	2017-07-26	ND	2018-07-26	0.059	2019-07-26	0.073	2020-07-25	0.043
2015-07-27	0.052	2016-07-26	0.054	2017-07-27	0.048	2018-07-27	0.065	2019-07-27	0.068	2020-07-26	0.04
2015-07-28	0.05	2016-07-27	0.061	2017-07-28	0.046	2018-07-28	0.065	2019-07-28	0.053	2020-07-27	0.035
2015-07-29	0.047	2016-07-28	0.062	2017-07-29	0.048	2018-07-29	0.062	2019-07-29	0.057	2020-07-28	0.039
2015-07-30	0.048	2016-07-29	0.05	2017-07-30	0.047	2018-07-30	0.057	2019-07-30	0.05	2020-07-29	0.041
2015-07-31	0.046	2016-07-30	0.045	2017-07-31	0.05	2018-07-31	0.07	2019-07-31	0.05	2020-07-30	0.047
2015-08-01	0.062	2016-07-31	0.047	2017-08-01	0.052	2018-08-01	0.076	2019-08-01	0.048	2020-07-31	0.054
2015-08-02	0.062	2016-08-01	0.05	2017-08-02	0.058	2018-08-02	0.076	2019-08-02	0.056	2020-08-01	0.057
2015-08-03	0.066	2016-08-02	0.051	2017-08-03	0.06	2018-08-03	0.066	2019-08-03	0.054	2020-08-02	0.054
2015-08-04	0.069	2016-08-03	0.047	2017-08-04	0.061	2018-08-04	0.063	2019-08-04	0.064	2020-08-03	0.056
2015-08-05	0.061	2016-08-04	0.055	2017-08-05	0.055	2018-08-05	0.05	2019-08-05	0.064	2020-08-04	0.049
2015-08-06	0.053	2016-08-05	0.052	2017-08-06	0.057	2018-08-06	0.041	2019-08-06	0.062	2020-08-05	ND
2015-08-07	0.052	2016-08-06	0.05	2017-08-07	0.049	2018-08-07	0.044	2019-08-07	0.058	2020-08-06	0.044

2015-08-08	0.055	2016-08-07	0.038	2017-08-08	0.046	2018-08-08	0.049	2019-08-08	0.056	2020-08-07	0.039
2015-08-09	0.06	2016-08-08	0.044	2017-08-09	0.054	2018-08-09	0.063	2019-08-09	0.055	2020-08-08	0.039
2015-08-10	0.05	2016-08-09	0.049	2017-08-10	0.051	2018-08-10	0.059	2019-08-10	0.051	2020-08-09	0.037
2015-08-11	0.048	2016-08-10	0.048	2017-08-11	0.039	2018-08-11	0.058	2019-08-11	0.051	2020-08-10	0.035
2015-08-12	0.054	2016-08-11	0.052	2017-08-12	0.05	2018-08-12	0.056	2019-08-12	0.055	2020-08-11	0.043
2015-08-13	0.062	2016-08-12	0.054	2017-08-13	0.055	2018-08-13	0.062	2019-08-13	0.051	2020-08-12	0.044
2015-08-14	0.063	2016-08-13	0.058	2017-08-14	0.056	2018-08-14	0.06	2019-08-14	0.056	2020-08-13	0.052
2015-08-15	0.069	2016-08-14	0.045	2017-08-15	0.054	2018-08-15	0.06	2019-08-15	0.052	2020-08-14	0.047
2015-08-16	0.061	2016-08-15	0.052	2017-08-16	0.049	2018-08-16	0.059	2019-08-16	0.061	2020-08-15	0.045
2015-08-17	0.064	2016-08-16	0.057	2017-08-17	0.055	2018-08-17	0.055	2019-08-17	0.062	2020-08-16	0.042
2015-08-18	0.061	2016-08-17	0.05	2017-08-18	0.041	2018-08-18	0.052	2019-08-18	0.058	2020-08-17	0.043
2015-08-19	0.039	2016-08-18	0.038	2017-08-19	0.042	2018-08-19	0.064	2019-08-19	0.049	2020-08-18	0.057
2015-08-20	0.056	2016-08-19	0.042	2017-08-20	0.034	2018-08-20	0.065	2019-08-20	0.049	2020-08-19	0.056
2015-08-21	0.067	2016-08-20	0.045	2017-08-21	0.037	2018-08-21	0.056	2019-08-21	0.043	2020-08-20	0.053
2015-08-22	0.07	2016-08-21	0.051	2017-08-22	0.04	2018-08-22	0.049	2019-08-22	0.04	2020-08-21	0.054
2015-08-23	0.052	2016-08-22	0.04	2017-08-23	0.044	2018-08-23	0.055	2019-08-23	0.052	2020-08-22	0.055
2015-08-24	0.047	2016-08-23	0.041	2017-08-24	0.037	2018-08-24	0.065	2019-08-24	0.066	2020-08-23	0.053
2015-08-25	0.043	2016-08-24	0.039	2017-08-25	0.045	2018-08-25	0.054	2019-08-25	0.053	2020-08-24	0.051
2015-08-26	0.056	2016-08-25	0.041	2017-08-26	0.044	2018-08-26	0.05	2019-08-26	0.051	2020-08-25	0.048
2015-08-27	0.058	2016-08-26	0.044	2017-08-27	0.042	2018-08-27	0.064	2019-08-27	0.047	2020-08-26	0.052
2015-08-28	0.056	2016-08-27	0.045	2017-08-28	0.047	2018-08-28	0.069	2019-08-28	0.053	2020-08-27	0.051
2015-08-29	0.055	2016-08-28	0.046	2017-08-29	0.055	2018-08-29	ND	2019-08-29	0.057	2020-08-28	0.051
2015-08-30	0.066	2016-08-29	0.038	2017-08-30	0.054	2018-08-30	ND	2019-08-30	0.06	2020-08-29	0.043
2015-08-31	0.059	2016-08-30	0.032	2017-08-31	0.052	2018-08-31	0.054	2019-08-31	0.049	2020-08-30	0.037
2015-09-01	0.053	2016-08-31	0.034	2017-09-01	0.055	2018-09-01	0.048	2019-09-01	0.048	2020-08-31	0.042
2015-09-02	0.05	2016-09-01	0.042	2017-09-02	0.056	2018-09-02	0.066	2019-09-02	0.056	2020-09-01	0.043
2015-09-03	0.054	2016-09-02	0.051	2017-09-03	0.06	2018-09-03	0.054	2019-09-03	0.059	2020-09-02	
2015-09-04	0.051	2016-09-03	0.046	2017-09-04	0.058	2018-09-04	0.059	2019-09-04	0.061	2020-09-03	
2015-09-05	0.046	2016-09-04	0.041	2017-09-05	0.047	2018-09-05	0.054	2019-09-05	0.053	2020-09-04	
2015-09-06	0.042	2016-09-05	0.034	2017-09-06	0.055	2018-09-06	0.044	2019-09-06	0.049	2020-09-05	
2015-09-07	0.042	2016-09-06	0.03	2017-09-07	0.057	2018-09-07	0.04	2019-09-07	0.043	2020-09-06	
2015-09-08	0.043	2016-09-07	0.032	2017-09-08	0.067	2018-09-08	ND	2019-09-08	0.043	2020-09-07	
2015-09-09	0.045	2016-09-08	0.034	2017-09-09	0.066	2018-09-09	0.048	2019-09-09	ND	2020-09-08	
2015-09-10	0.051	2016-09-09	0.048	2017-09-10	0.059	2018-09-10	0.05	2019-09-10	0.04	2020-09-09	
2015-09-11	0.053	2016-09-10	0.037	2017-09-11	0.058	2018-09-11	0.059	2019-09-11	0.04	2020-09-10	
2015-09-12	0.058	2016-09-11	0.036	2017-09-12	0.069	2018-09-12	0.05	2019-09-12	0.045	2020-09-11	
2015-09-13	0.055	2016-09-12	0.039	2017-09-13	0.08	2018-09-13	0.046	2019-09-13	0.046	2020-09-12	
2015-09-14	0.052	2016-09-13	0.045	2017-09-14	0.051	2018-09-14	0.053	2019-09-14	0.052	2020-09-13	
2015-09-15	0.051	2016-09-14	0.042	2017-09-15	0.047	2018-09-15	0.04	2019-09-15	0.06	2020-09-14	
2015-09-16	ND	2016-09-15	0.035	2017-09-16	0.053	2018-09-16	0.041	2019-09-16	0.051	2020-09-15	
2015-09-17	0.041	2016-09-16	ND	2017-09-17	0.049	2018-09-17	0.036	2019-09-17	0.051	2020-09-16	
2015-09-18	0.043	2016-09-17	ND	2017-09-18	0.048	2018-09-18	0.032	2019-09-18	0.052	2020-09-17	
2015-09-19	0.035	2016-09-18	ND	2017-09-19	0.043	2018-09-19	0.035	2019-09-19	0.054	2020-09-18	
2015-09-20	0.035	2016-09-19	0.045	2017-09-20	0.041	2018-09-20	0.031	2019-09-20	0.047	2020-09-19	
2015-09-21	0.04	2016-09-20	0.034	2017-09-21	0.05	2018-09-21	0.039	2019-09-21	0.031	2020-09-20	
2015-09-22	0.038	2016-09-21	ND	2017-09-22	0.038	2018-09-22	0.051	2019-09-22	0.045	2020-09-21	
2015-09-23	0.043	2016-09-22	0.042	2017-09-23	0.03	2018-09-23	0.051	2019-09-23	0.039	2020-09-22	
2015-09-24	0.048	2016-09-23	0.044	2017-09-24	0.032	2018-09-24	0.055	2019-09-24	0.049	2020-09-23	
2015-09-25	0.055	2016-09-24	0.044	2017-09-25	0.035	2018-09-25	0.055	2019-09-25	0.047	2020-09-24	
2015-09-26	0.057	2016-09-25	0.034	2017-09-26	0.022	2018-09-26	0.038	2019-09-26	0.05	2020-09-25	
2015-09-27	0.059	2016-09-26	0.037	2017-09-27	0.023	2018-09-27	0.049	2019-09-27	0.05	2020-09-26	
2015-09-28	0.062	2016-09-27	0.055	2017-09-28	0.022	2018-09-28	0.056	2019-09-28	0.037	2020-09-27	
2015-09-29	0.061	2016-09-28	0.053	2017-09-29	0.024	2018-09-29	0.044	2019-09-29	0.03	2020-09-28	
2015-09-30	0.066	2016-09-29	0.043	2017-09-30	0.037	2018-09-30	0.039	2019-09-30	0.024	2020-09-29	
2015-10-01	0.054	2016-09-30	0.045	2017-10-01	0.037	2018-10-01	0.034	2019-10-01	0.025	2020-09-30	

2015-10-02	0.06	2016-10-01	0.042	2017-10-02	0.039	2018-10-02	0.032	2019-10-02	0.041	2020-10-01
2015-10-03	0.046	2016-10-02	0.047	2017-10-03	0.032	2018-10-03	0.04	2019-10-03	0.034	2020-10-02
2015-10-04	0.039	2016-10-03	0.037	2017-10-04	0.021	2018-10-04	0.039	2019-10-04	0.046	2020-10-03
2015-10-05	0.044	2016-10-04	0.045	2017-10-05	0.029	2018-10-05	ND	2019-10-05	0.04	2020-10-04
2015-10-06	0.054	2016-10-05	0.046	2017-10-06	0.039	2018-10-06	0.034	2019-10-06	0.047	2020-10-05
2015-10-07	0.054	2016-10-06	0.041	2017-10-07	0.054	2018-10-07	0.041	2019-10-07	0.042	2020-10-06
2015-10-08	0.041	2016-10-07	0.036	2017-10-08	0.053	2018-10-08	0.043	2019-10-08	0.049	2020-10-07
2015-10-09	0.04	2016-10-08	0.035	2017-10-09	0.036	2018-10-09	ND	2019-10-09	0.04	2020-10-08
2015-10-10	0.043	2016-10-09	0.04	2017-10-10	0.038	2018-10-10	0.044	2019-10-10	0.044	2020-10-09
2015-10-11	0.041	2016-10-10	0.037	2017-10-11	0.042	2018-10-11	0.033	2019-10-11	0.033	2020-10-10
2015-10-12	0.045	2016-10-11	0.038	2017-10-12	0.037	2018-10-12	0.036	2019-10-12	0.042	2020-10-11
2015-10-13	0.048	2016-10-12	0.033	2017-10-13	0.035	2018-10-13	0.035	2019-10-13	0.042	2020-10-12
2015-10-14	0.05	2016-10-13	0.029	2017-10-14	0.039	2018-10-14	0.028	2019-10-14	0.036	2020-10-13
2015-10-15	0.046	2016-10-14	0.041	2017-10-15	0.045	2018-10-15	0.038	2019-10-15	0.043	2020-10-14
2015-10-16	0.041	2016-10-15	0.042	2017-10-16	0.052	2018-10-16	0.04	2019-10-16	0.043	2020-10-15
2015-10-17	0.058	2016-10-16	0.047	2017-10-17	0.048	2018-10-17	0.044	2019-10-17	0.055	2020-10-16
2015-10-18	0.056	2016-10-17	0.046	2017-10-18	0.044	2018-10-18	0.037	2019-10-18	0.038	2020-10-17
2015-10-19	0.045	2016-10-18	0.043	2017-10-19	0.042	2018-10-19	0.029	2019-10-19	0.047	2020-10-18
2015-10-20	0.044	2016-10-19	ND	2017-10-20	0.047	2018-10-20	0.04	2019-10-20	0.047	2020-10-19
2015-10-21	0.032	2016-10-20	0.046	2017-10-21	0.033	2018-10-21	0.049	2019-10-21	0.047	2020-10-20
2015-10-22	0.036	2016-10-21	0.049	2017-10-22	0.045	2018-10-22	0.04	2019-10-22	0.042	2020-10-21
2015-10-23	0.043	2016-10-22	0.044	2017-10-23	0.042	2018-10-23	0.036	2019-10-23	0.045	2020-10-22
2015-10-24	0.036	2016-10-23	0.05	2017-10-24	0.043	2018-10-24	0.037	2019-10-24	0.03	2020-10-23
2015-10-25	0.042	2016-10-24	0.046	2017-10-25	0.051	2018-10-25	0.039	2019-10-25	0.034	2020-10-24
2015-10-26	0.044	2016-10-25	0.042	2017-10-26	0.046	2018-10-26	0.045	2019-10-26	0.046	2020-10-25
2015-10-27	0.043	2016-10-26	0.043	2017-10-27	0.033	2018-10-27	0.046	2019-10-27	0.036	2020-10-26
2015-10-28	0.04	2016-10-27	0.043	2017-10-28	0.043	2018-10-28	0.035	2019-10-28	0.027	2020-10-27
2015-10-29	0.041	2016-10-28	0.039	2017-10-29	0.046	2018-10-29	0.054	2019-10-29	0.021	2020-10-28
2015-10-30	0.039	2016-10-29	0.041	2017-10-30	0.034	2018-10-30	0.035	2019-10-30	0.024	2020-10-29
2015-10-31	0.042	2016-10-30	0.041	2017-10-31	0.04	2018-10-31	0.028	2019-10-31	0.034	2020-10-30
2015-11-01	0.044	2016-10-31	0.04	2017-11-01	0.043	2018-11-01	0.036	2019-11-01	0.042	2020-10-31
2015-11-02	0.044	2016-11-01	0.038	2017-11-02	0.04	2018-11-02	0.045	2019-11-02	0.038	2020-11-01
2015-11-03	0.041	2016-11-02	ND	2017-11-03	0.035	2018-11-03	0.042	2019-11-03	0.049	2020-11-02
2015-11-04	0.037	2016-11-03	0.033	2017-11-04	0.038	2018-11-04	0.041	2019-11-04	0.04	2020-11-03
2015-11-05	0.044	2016-11-04	0.038	2017-11-05	0.031	2018-11-05	0.04	2019-11-05	0.049	2020-11-04
2015-11-06	0.043	2016-11-05	0.029	2017-11-06	0.033	2018-11-06	0.045	2019-11-06	0.022	2020-11-05
2015-11-07	0.038	2016-11-06	0.032	2017-11-07	0.028	2018-11-07	0.033	2019-11-07	0.019	2020-11-06
2015-11-08	0.04	2016-11-07	0.034	2017-11-08	0.022	2018-11-08	0.021	2019-11-08	0.02	2020-11-07
2015-11-09	0.039	2016-11-08	0.04	2017-11-09	0.024	2018-11-09	0.036	2019-11-09	0.04	2020-11-08
2015-11-10	0.032	2016-11-09	0.028	2017-11-10	0.021	2018-11-10	0.035	2019-11-10	0.035	2020-11-09
2015-11-11	0.046	2016-11-10	0.029	2017-11-11	0.025	2018-11-11	0.036	2019-11-11	0.025	2020-11-10
2015-11-12	0.045	2016-11-11	0.029	2017-11-12	0.027	2018-11-12	0.038	2019-11-12	ND	2020-11-11
2015-11-13	0.047	2016-11-12	0.036	2017-11-13	0.015	2018-11-13	0.042	2019-11-13	0.027	2020-11-12
2015-11-14	0.035	2016-11-13	0.04	2017-11-14	0.031	2018-11-14	0.042	2019-11-14	0.038	2020-11-13
2015-11-15	0.022	2016-11-14	0.043	2017-11-15	0.04	2018-11-15	0.04	2019-11-15	0.041	2020-11-14
2015-11-16	0.04	2016-11-15	0.041	2017-11-16	0.034	2018-11-16	0.041	2019-11-16	0.041	2020-11-15
2015-11-17	0.037	2016-11-16	0.046	2017-11-17	0.034	2018-11-17	0.032	2019-11-17	0.038	2020-11-16
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2015-11-19	0.036	2016-11-18	0.035	2017-11-19	0.042	2018-11-19	0.04	2019-11-19	0.042	2020-11-18
2015-11-20	0.04	2016-11-19	0.041	2017-11-20	0.04	2018-11-20	0.044	2019-11-20	0.03	2020-11-19
2015-11-21	0.038	2016-11-20	0.039	2017-11-21	0.042	2018-11-21	0.037	2019-11-21	0.013	2020-11-20
2015-11-22	0.042	2016-11-21	0.03	2017-11-22	0.038	2018-11-22	0.04	2019-11-22	0.024	2020-11-21
2015-11-23	0.032	2016-11-22	0.04	2017-11-23	0.037	2018-11-23	0.043	2019-11-23	0.039	2020-11-22
2015-11-24	0.041	2016-11-23	0.038	2017-11-24	0.043	2018-11-24	0.041	2019-11-24	0.039	2020-11-23
2015-11-25	0.033	2016-11-24	0.042	2017-11-25	0.043	2018-11-25	0.04	2019-11-25	0.034	2020-11-24

2015-11-26	0.025	2016-11-25	0.033	2017-11-26	0.05	2018-11-26	0.039	2019-11-26	0.04	2020-11-25			
2015-11-27	0.027	2016-11-26	0.026	2017-11-27	0.045	2018-11-27	0.045	2019-11-27	0.031	2020-11-26			
2015-11-28	0.025	2016-11-27	0.039	2017-11-28	0.037	2018-11-28	0.045	2019-11-28	0.024	2020-11-27			
2015-11-29	0.014	2016-11-28	0.044	2017-11-29	0.038	2018-11-29	0.047	2019-11-29	0.034	2020-11-28			
2015-11-30	0.035	2016-11-29	0.038	2017-11-30	0.042	2018-11-30	0.042	2019-11-30	0.042	2020-11-29			
2015-12-01	0.039	2016-11-30	0.039	2017-12-01	0.044	2018-12-01	0.043	2019-12-01	0.041	2020-11-30			
2015-12-02	0.041	2016-12-01	0.041	2017-12-02	0.035	2018-12-02	0.039	2019-12-02	0.037	2020-12-01			
2015-12-03	0.041	2016-12-02	0.025	2017-12-03	0.046	2018-12-03	0.045	2019-12-03	0.036	2020-12-02			
2015-12-04	0.043	2016-12-03	0.029	2017-12-04	0.041	2018-12-04	0.041	2019-12-04	0.035	2020-12-03			
2015-12-05	0.035	2016-12-04	0.029	2017-12-05	0.031	2018-12-05	0.039	2019-12-05	0.031	2020-12-04			
2015-12-06	0.04	2016-12-05	0.037	2017-12-06	0.027	2018-12-06	0.028	2019-12-06	0.037	2020-12-05			
2015-12-07	0.038	2016-12-06	0.038	2017-12-07	0.035	2018-12-07	0.02	2019-12-07	0.041	2020-12-06			
2015-12-08	0.035	2016-12-07	0.022	2017-12-08	0.042	2018-12-08	0.028	2019-12-08	0.031	2020-12-07			
2015-12-09	0.032	2016-12-08	0.027	2017-12-09	0.044	2018-12-09	0.026	2019-12-09	0.022	2020-12-08			
2015-12-10	0.038	2016-12-09	0.021	2017-12-10	0.041	2018-12-10	0.034	2019-12-10	0.029	2020-12-09			
2015-12-11	0.036	2016-12-10	0.027	2017-12-11	0.036	2018-12-11	0.025	2019-12-11	0.02	2020-12-10			
2015-12-12	0.037	2016-12-11	0.035	2017-12-12	0.04	2018-12-12	0.034	2019-12-12	0.031	2020-12-11			
2015-12-13	0.035	2016-12-12	0.029	2017-12-13	0.039	2018-12-13	0.038	2019-12-13	0.031	2020-12-12			
2015-12-14	0.038	2016-12-13	0.031	2017-12-14	0.041	2018-12-14	0.041	2019-12-14	0.03	2020-12-13			
2015-12-15	0.04	2016-12-14	0.029	2017-12-15	0.043	2018-12-15	0.038	2019-12-15	0.034	2020-12-14			
2015-12-16	0.036	2016-12-15	ND	2017-12-16	0.039	2018-12-16	0.029	2019-12-16	0.034	2020-12-15			
2015-12-17	ND	2016-12-16	0.028	2017-12-17	0.04	2018-12-17	0.026	2019-12-17	0.04	2020-12-16			
2015-12-18	0.035	2016-12-17	0.031	2017-12-18	0.034	2018-12-18	0.032	2019-12-18	0.04	2020-12-17			
2015-12-19	0.039	2016-12-18	0.033	2017-12-19	0.042	2018-12-19	0.04	2019-12-19	0.034	2020-12-18			
2015-12-20	0.039	2016-12-19	0.032	2017-12-20	0.043	2018-12-20	0.042	2019-12-20	0.039	2020-12-19			
2015-12-21	0.039	2016-12-20	0.029	2017-12-21	0.041	2018-12-21	0.039	2019-12-21	0.036	2020-12-20			
2015-12-22	0.038	2016-12-21	0.031	2017-12-22	0.029	2018-12-22	0.04	2019-12-22	0.035	2020-12-21			
2015-12-23	0.035	2016-12-22	0.038	2017-12-23	0.043	2018-12-23	0.038	2019-12-23	0.035	2020-12-22			
2015-12-24	0.039	2016-12-23	0.035	2017-12-24	0.028	2018-12-24	0.039	2019-12-24	0.032	2020-12-23			
2015-12-25	0.035	2016-12-24	0.035	2017-12-25	0.029	2018-12-25	0.044	2019-12-25	0.038	2020-12-24			
2015-12-26	0.03	2016-12-25	0.046	2017-12-26	0.029	2018-12-26	0.04	2019-12-26	0.037	2020-12-25			
2015-12-27	0.036	2016-12-26	0.044	2017-12-27	0.019	2018-12-27	0.038	2019-12-27	0.029	2020-12-26			
2015-12-28	0.042	2016-12-27	0.035	2017-12-28	0.027	2018-12-28	0.03	2019-12-28	0.041	2020-12-27			
2015-12-29	0.045	2016-12-28	0.035	2017-12-29	0.035	2018-12-29	0.027	2019-12-29	0.035	2020-12-28			
2015-12-30	0.037	2016-12-29	0.039	2017-12-30	0.019	2018-12-30	0.033	2019-12-30	0.039	2020-12-29			
2015-12-31	0.04	2016-12-30	0.032	2017-12-31	0.025	2018-12-31	0.04	2019-12-31	0.041	2020-12-30			
		2016-12-31	0.031							2020-12-31			
1 1st high	0.07		0.069		0.08		0.083		0.082		0.06		
2 2nd high	0.069		0.066		0.074		0.078		0.075		0.06		
3 3rd high	0.069		0.065		0.072		0.077		0.073		0.058		
4 4th high	0.067		0.065		0.069		0.076		0.07		0.058	0.066	2020 Target Design Value
5 5th high	0.066		0.064		0.068		0.076		0.07		0.057		
6 6th high	0.066		0.063		0.067		0.074		0.069		0.057		
7 7th high	0.066		0.063		0.067		0.07		0.069		0.056		
Design Value Average of 4th highest Daily 8-hour maxima					0.067 ppm		0.07 ppm		0.071 ppm		0.068 ppm	0.07	
					2015-17		2016-18		2017-19		2018-20	2018-20	
											Through 9/1/2020		
Valid Days	356		356		363		360		361		232		
Exceedances	0		0		3		6		3		0		
											Through 9/1/2020		