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

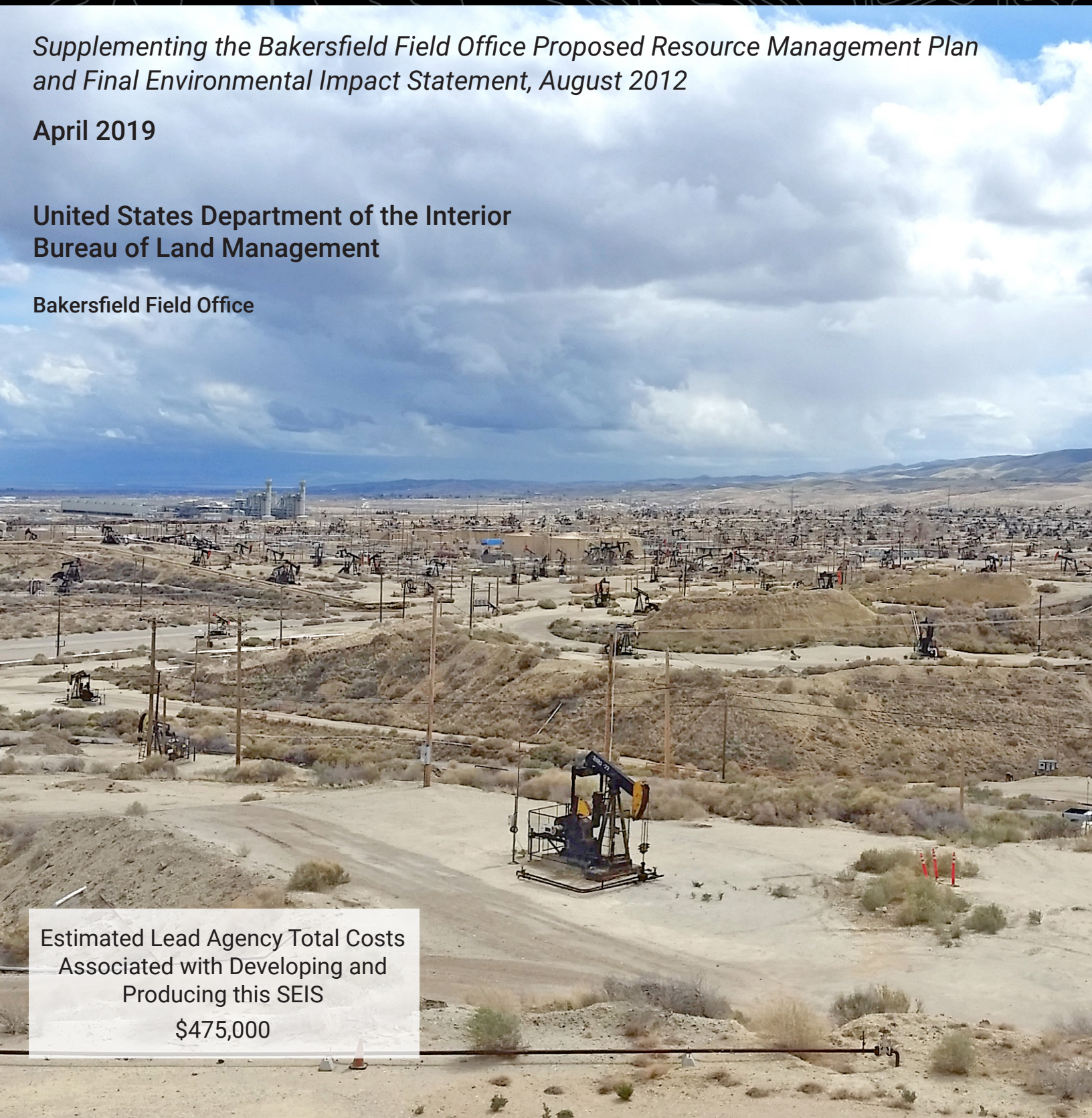
Bakersfield Field Office Hydraulic Fracturing Draft Supplemental Environmental Impact Statement

Supplementing the Bakersfield Field Office Proposed Resource Management Plan and Final Environmental Impact Statement, August 2012

April 2019

United States Department of the Interior
Bureau of Land Management

Bakersfield Field Office



Estimated Lead Agency Total Costs Associated with Developing and Producing this SEIS

$475,000

The BLM manages more than 245 million acres of public land located primarily in 12 Western states, including Alaska. The BLM also administers 700 million acres of sub-surface mineral estate throughout the nation. The agency's mission is to sustain the health, diversity, and productivity of America's public lands for the use and enjoyment of present and future generations. Diverse activities authorized on these lands generated $96 billion in sales of goods and services throughout the American economy in fiscal year 2017. These activities supported more than 468,000 jobs.

DOI Control Number and ePlanning Number

DOI-BLM-CA-C060-2018-0082-EIS

Abstract

Bakersfield Field Office Hydraulic Fracturing
Draft Supplemental Environmental Impact Statement

1. **Lead Agency:** U.S. Department of the Interior (DOI), Bureau of Land Management (BLM)

2. **Type of Action:** Administrative

3. **Document Name:** Bakersfield Field Office Hydraulic Fracturing Draft Supplemental Environmental Impact Statement, *Supplementing the Bakersfield Proposed Resource Management Plan and Final Environmental Impact Statement*

4. **Document Status:** Draft (X) Final ( )

5. **Jurisdiction:** eastern Fresno, western Kern, Kings, Madera, San Luis Obispo, Santa Barbara, Tulare, and Ventura Counties, California.

6. **Abstract:** This Bakersfield Field Office Hydraulic Fracturing Draft Supplemental Environmental Impact Statement (Draft Supplemental EIS) supplements BLM's previous environmental analyses in the 2012 Bakersfield Proposed Resource Management Plan (PRMP) and 2012 Bakersfield Final Environmental Impact Statement EIS (2012 Final EIS). This supplemental analysis was conducted in response to an issue identified in the PRMP and 2012 Final EIS by the U.S. District Court of California; that is, to take a "hard look" at the impacts of hydraulic fracturing that could occur as a result of implementation of leasable fluid mineral management decisions consistent with the PRMP.

   This Draft Supplemental EIS analyzes the five alternative fluid mineral management plan decisions from the 2012 Final EIS. The supplemental analysis incorporates new information. Results of the analysis were intended to inform BLM's consideration of whether to amend the existing 2014 RMP.

   Major issues addressed in this supplemental analysis include impacts to Air and Atmospheric Values; Biological Resources; Cultural Resources; Native American Values; Paleontological Resources; Soil Resources; Visual Resources; Water Resources; Livestock Grazing; Minerals Management; Areas of Critical Environmental Concern; Social and Economic Resources; Seismicity; and Special Status Species.

7. **Date Comments Must Be Received:** BLM will accept written comments on this Draft Supplemental EIS that are postmarked or received within 45 days following the notice of its availability in the Federal Register. The close of the comment period will be announced on the project website at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=renderDefaultPlanOrProjectSite&projectId=100601&dctmId=0b0003e8810ab8e2, or may be obtained by contacting BLM at the address or telephone number below.

8. **For Further Information Contact:**
   Carly Summers, Project Manager Telephone: 661-391-6000
   BLM Bakersfield Field Office
   3801 Pegasus Drive
   Bakersfield, CA 93308

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Bakersfield Field Office Hydraulic Fracturing

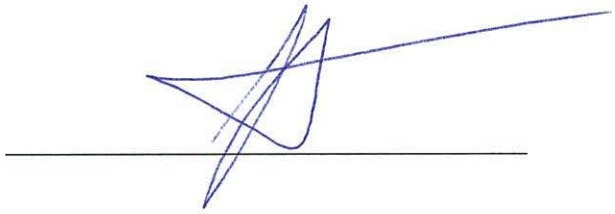
Draft Supplemental Environmental Impact Statement

Supplementing Bakersfield Proposed Resource Management Plan and Final Environmental Impact Statement, August 2012

Prepared by

U.S. Department of the Interior Bureau of Land Management
Bakersfield Field Office

April 2019



Joseph Stout
Acting California State Director

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United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Bakersfield Field Office
3801 Pegasus Drive
Bakersfield, CA 93308
www.blm.gov/california

April 5, 2019

Dear Reader:

Enclosed is the Bureau of Land Management (BLM) Bakersfield Field Office Hydraulic Fracturing Draft Supplemental Environmental Impact Statement (Draft Supplemental EIS). This supplemental analysis discloses potential environmental impacts associated with hydraulic fracturing at the planning level - *not at the site or project-specific level.*

Resource Management Plans (RMPs) are planning documents, typically prepared or updated by BLM Field Offices approximately every ten years. RMPs determine future management direction and appropriate use of public lands under Field Office jurisdiction. Amending the 2014 Bakersfield Field Office Resource Management Plan was considered, but found to be not warranted for this hydraulic fracturing assessment. The impact analysis in this Supplemental EIS is specifically intended to address a May 2017, U.S. District Court Order.

This Draft Supplemental EIS has been developed in accordance with the National Environmental Policy Act of 1969, as amended, the Federal Land Policy and Management Act of 1976, Land Use Planning Handbook (H-1601-1), and other applicable policy and law. Additionally, the BLM has prepared this Draft Supplemental EIS taking into account public comments received during the public scoping period prior to the release of the document.

Any person who wishes to comment on this draft document will need to do so within 45 days from the date the Environmental Protection Agency publishes the Notice of Availability of this draft document in the *Federal Register*. You may submit comments on the Draft Supplemental EIS in writing to the BLM at the project website: https://go.usa.gov/xE3Nw; via hand-delivery; or by mail to the Bakersfield Field Office, Attn: Bakersfield Hydraulic Fracturing Analysis, 3801 Pegasus Drive, Bakersfield, CA 93308. Please make your comments as specific as possible and reference a section or page number where applicable. Please note that comments that contain only opinions and preferences will not receive a formal response in the Final Supplemental EIS. Before including addresses, phone numbers, email addresses, or other personal identifying information in a comment, be aware that the entire comment—including personal identifying information—may be made publicly available at any time. While someone may ask the BLM to withhold personal identifying information from public review, the BLM cannot guarantee that it will be able to do so.

The BLM will announce public meetings at least 15 days in advance through public notices, media releases, and/or mailings. Thank you for your interest in the Bakersfield Draft Supplemental EIS. We appreciate your contributions to this planning process.

Sincerely,

GABRIEL GARCIA

Digitally signed by GABRIEL GARCIA
Date: 2019.03.21 16:11:04 -07'00'

Gabriel Garcia,
BLM Bakersfield Field Office Manager

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Executive Summary

Introduction

The U.S. Department of the Interior, Bureau of Land Management's (BLM) Bakersfield Field Office is supplementing the 2012 Bakersfield Final Environmental Impact Statement (referred to hereafter as the "2012 Final EIS"), associated with the 2012 Bakersfield Proposed Resource Management Plan (PRMP) (BLM 2012). The Approved Resource Management Plan (ARMP) and Record of Decision (ROD) was published in 2014 (BLM 2014) and is hereafter referred to as the "2014 RMP." This Bakersfield Field Office Draft Supplemental Environmental Impact Statement (hereafter referred to as the "Draft Supplemental EIS") evaluates the environmental consequences of hydraulic fracturing as a result of future leasing and development decisions consistent with the 2014 RMP fluid mineral management decisions.

The Center for Biological Diversity and Los Padres ForestWatch challenged BLM's 2014 ROD approving the 2014 RMP (Civ. No. 2:15-cv-04378-MWF/JEM [June 10, 2015]). The plaintiffs argued that BLM violated the National Environmental Policy Act (NEPA) because the 2012 Final EIS had failed to analyze adequately the impacts of hydraulic fracturing within the Planning Area, among other issues.

The U.S. District Court, Central District of California, issued summary judgment finding that BLM failed to take a "hard look" at the environmental impact of hydraulic fracturing in the 2012 Final EIS (September 6, 2016). The Court upheld the range of alternatives analyzed in the 2012 Final EIS and found that the Reasonably Foreseeable Development Scenario was acceptable. The Court held that BLM was obligated to analyze the environmental consequences resulting from the use of hydraulic fracturing (Court Order).

On May 3, 2017, the Court approved a Settlement Agreement (Case No. 2:15-cv-04378–MWF/JEM0) (Settlement Agreement) in which the parties agreed to partial remand without setting aside the ROD for the 2014 RMP. Therefore, a Notice of Intent to prepare a Draft Supplemental EIS and potential RMP Amendment (RMPA) was issued by the Department of the Interior on August 7, 2018, and published in the Federal Register on August 8, 2018. The Notice of Intent was styled to prepare a potential resource management plan amendment, because at the time, BLM was considering whether or not the integration of the information regarding hydraulic fracturing would warrant amendment of the 2014 RMP, or whether BLM should propose a resource management plan to supersede the 2014 RMP. For reasons discussed in this Draft Supplemental EIS, no amendment to the 2014 RMP is warranted. Therefore, the title of this document has been changed to reflect that it addresses the Court's decision, as well as the subsequent Settlement Agreement, wherein BLM agreed to consider amending or superseding the 2014 RMP.

Purpose and Need

The purpose of this Draft Supplemental EIS is to analyze the environmental effects of the use of hydraulic fracturing technology in oil and gas development on new leases within the Planning Area and to determine whether changes are needed to the fluid minerals decisions in the 2014 RMP.

The need to develop the Draft Supplemental EIS is established by the Settlement Agreement, filed with the U.S. District Court for the Central District of California on May 3, 2017.

Supplemental Analysis

The focus of this supplemental analysis addresses only the potential impacts of hydraulic fracturing as a result of future leasing and development decisions consistent with the 2014 RMP fluid mineral management decisions. This Draft Supplemental EIS therefore analyzes the impacts of hydraulic fracturing technology on BLM-administered public land and mineral estate in the Planning Area, exclusive of the California Coastal National Monument and the Carrizo Plain National Monument, which are addressed in Monument-specific RMPs. New wells on new leases that may be completed using hydraulic fracturing would be subject to all fluid mineral management decisions in the 2014 RMP.

For the purposes of this supplemental analysis, hydraulic fracturing is defined as a well completion process employed after drilling an oil or natural gas well. It involves injecting a mixture of highly pressurized fluids and proppant (usually sand) into a geologic formation to create and prop open fissures, or pathways, through which the produced fluids can more easily flow into the wellbore. When the hydraulic pressure is removed from the well, the small grains of sand remain in the fissures and hold the fractures open, allowing for higher production rates of the desired oil and gas resource than would otherwise be achieved.

It is important to note that this Draft Supplemental EIS, like the 2012 Final EIS it supplements, is prepared at the land use planning level of impact analysis. Oil and gas leasing and development on federal mineral estate requires multiple stages of BLM environmental analysis and authorization. Pursuant to NEPA, BLM review must address the direct, indirect, and cumulative effects of the specific action proposed at each of these stages. The 2014 RMP identifies areas as open or closed to fluid mineral leasing and establishes appropriate stipulations, and other mitigation measures and best management practices (BMPs) that could be applied to areas identified as open to leasing. The environmental review for leasing identifies parcels to be offered for leasing and the conditions under which leasing and eventual development may occur. The environmental review, including direct and indirect effects, for the development of leased parcels, including well completion techniques such as hydraulic fracturing, is a site-specific analysis of potential impacts from an identified proposed project. Applications for Permits to Drill (APDs) are required to be submitted by developers/operators, and typically include an initial on-the-ground, site-specific field evaluation by BLM resource specialists in addition to a site-specific NEPA analysis. This analysis allows site-specific information regarding local resource conditions to be evaluated and potential impacts disclosed. During this project-specific analysis, BLM will finalize project mitigation measures, BMPs, and stipulations from the 2014 RMP.

Scoping and Public Involvement

Preliminary issues for this Draft Supplemental EIS, concerning resources that may be impacted by hydraulic fracturing, were identified during internal scoping led by BLM personnel; federal, state, and local agencies; and other stakeholders. The issues identified included:

- Air and Atmospheric Values (including estimated Greenhouse Gas Emissions);
- Biological Resources;
- Cultural Resources;
- Native American Values;
- Paleontological Resources;
- Soil Resources;

- Visual Resources;
- Water Resources (quality and quantity);
- Livestock Grazing;
- Minerals Management;
- Areas of Critical Environmental Concern;
- Social and Economic Resources
- Seismicity; and
- Special Status Species.

The Notice of Intent initiated a 30-day public scoping period, which closed September 7, 2018. This notice included information on the various ways the public could submit scoping comments, as well as whom to contact for more information. A press release was also emailed to a database of tribal members, stakeholders, and interested parties. BLM also notified Congressional and State Legislature elected officials, and County representatives. Results of public scoping are summarized in the 2018 Public Scoping Summary Report and have been integrated into this Draft Supplemental EIS as appropriate.

Alternatives

The Court Order upheld the range of alternatives analyzed in the 2012 Final EIS. Therefore, per the Court Order to take a "hard look" at the environmental impact of hydraulic fracturing in the 2012 Final EIS, this supplemental analysis considers the alternative proposed fluid mineral management decisions previously analyzed in that document. The No Action Alternative reflects management under the previous land use plans, as carried-forward in the 2012 FEIS. Alternative B, the Proposed Plan, was adopted in the 2014 RMP.

- **Alternative A (No Action**) would continue current management practices as the No Action alternative required by NEPA, under the 1997 Caliente RMP and 1984 Hollister RMP, as amended.
- **Alternative B (Proposed Plan)** balances resource conservation and ecosystem health with the production of commodities and public use of the land. This alternative reflects changes made after the publication of the Draft RMP/Draft Environmental Impact Statement as a result of public comment and internal analysis (September 2011).
- **Alternative C** emphasizes conserving cultural and natural resources, maintaining functioning natural systems, and restoring natural systems that are degraded.
- **Alternative D** tracks Alternative C in all aspects except livestock grazing. This alternative eliminates livestock grazing for the life of the plan from the public lands where the 2014 RMP provides administrative direction for the livestock-grazing program.
- **Alternative E** emphasizes the production of natural resources commodities and public use opportunities. Resource uses such as recreation, livestock grazing, mining, and oil/gas leasing, consistent with BLM guidance and constraints, would be emphasized.

Environmental Consequences

Impacts of the alternative fluid mineral management decisions on relevant resources and programs are analyzed and categorized as direct and indirect, as well as cumulative. Impacts from hydraulic fracturing are quantified to the degree possible at the land use planning level of analysis, based on estimated areas of surface impacts, or other metrics, as appropriate by resource (Table ES.1). Areas most likely to undergo hydraulic fracturing have been identified as supplemental hydraulic fracturing analysis areas (Figure ES.1). These supplemental hydraulic fracturing analysis areas were determined through an analysis of historic hydraulic fracturing data, areas of high resource potential, and BLM-managed minerals available for leasing.

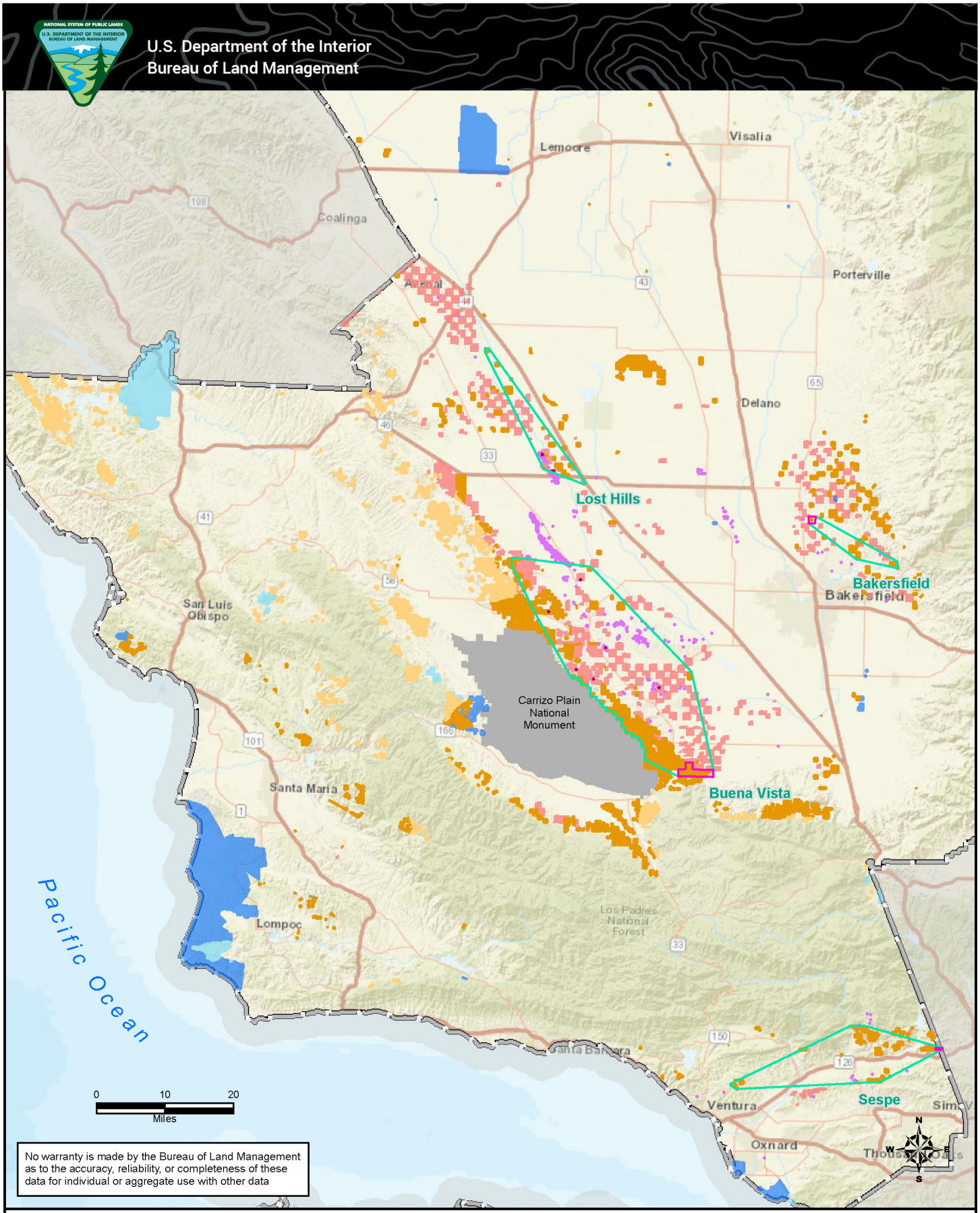
Table ES.1
Estimated Short- and Long-Term Surface Impacts of Wells Completed by Hydraulic Fracturing, on BLM and Non-BLM Surface

Disturbance Type	Short-term Disturbance BLM Surface[a] (acres)	Long-term Disturbance BLM Surface[a] (acres)	Short-term Disturbance Non-BLM Surface[a] (acres)	Long-term Disturbance Non-BLM Surface[a] (acres)	Total Estimated Disturbance[d] (acres)
New pads[b]	0–9.0	0–16.8	0–47.0	0–87.3	0–160.1
Roads	0–0.7	0–7.0	0–3.7	0–36.6	0–48
Pipelines	0–0.1	0	0-0.4	0	0–0.5
Distribution lines	Included above[c]	Included above[c]	Included above[c]	Included above[c]	Included above[c]
Total	**0–9.8**	**0–23.8**	**0–51.1**	**0–123.9**	**0–208.6**

Notes:
[a] Estimated for a range of 0 to 40 wells, possibly developed over the life of the 2014 RMP
[b] Assumes a single well/pad
[c] Included in pipeline area estimation
[d] Total assumes no overlap of short- and long-term disturbance areas

This supplemental impact analysis necessitated numerous assumptions for the required land use planning level of analysis. First, although potential impacts from possible hydraulic fracturing were conceptually included in the 2012 Final EIS analysis, this supplemental analysis will present them as additive to the 2012 Final EIS analysis, in order to show the work of taking a hard look at these potential impacts. Similarly, throughout this Draft Supplemental EIS, the most conservative impact assumptions were selected to integrate into the supplemental impact analyses. As a result, the actual maximum potential impacts will most likely be much smaller.

For all BLM surface, estimated environmental impacts incorporate positive effects of proposed special designations, mitigation measures, BMPs, standard operating procedures, and lease stipulations in the 2014 RMP. For potential impacts on non-BLM surface, constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulations. In addition, and as applicable, this analysis assumes that all hydraulic fracturing activities would be conducted in compliance with all other applicable federal, state, and local restrictions and regulations.



Legend

- Hydraulically Fractured Wells
- BLM Hydraulically Fractured Wells
- Carrizo Plain National Monument (Excluded from analysis)
- Bakersfield Field Office
- Expressed Interest in Leasing
- Existing BLM Oil & Gas Leases (2018)
- SHF Analysis Area - identified by associated oil fields

Available for Leasing:

- Moderate Resource Potential - BLM Surface
- High Resource Potential - BLM Surface
- Moderate Resource Potential - Non-BLM Surface
- High Resource Potential - Non-BLM Surface

Supplemental Hydraulic Fracturing Analysis Area
Bureau of Land Management
Bakersfield Field Office
DRAFT SEIS

Figure ES.1

The potential environmental impacts of integrating hydraulic fracturing, as a result of future leasing and development decisions consistent with the 2014 RMP Fluid Mineral management decisions, are summarized in Table ES.2. The results of this supplemental analysis calculating the impacts of limited hydraulic fracturing, additive to those identified in the 2012 Final EIS, did not show notable increase in total impacts. No conflicts were found between the estimated impacts of hydraulic fracturing and the resource or program management goals and objectives stated in the 2012 Proposed RMP. Therefore, an amendment to the 2014 RMP has been determined to be unnecessary, and this Draft Supplemental EIS documents that decision.

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
Air and Atmospheric Values	No change from 2012 Final EIS	See Section 4.1, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. Emissions from hydraulic fracturing well development are summarized in Table 4.1.1. These emission increases are minimal, with the largest being NO_X at 2.74 tons per year. Greenhouse gas emissions from hydraulic fracturing well development are summarized in Tables 4.1.5, 4.1.6, and 4.1.7.	See Section 4.1, Impacts Common to All Action Alternatives	See Section 4.1, Impacts Common to All Action Alternatives	See Section 4.1, Impacts Common to All Action Alternatives	See Section 4.1, Impacts Common to All Action Alternatives
Biological Resources	No change from 2012 Final EIS	See Section 4.2, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. On BLM surface, BMPs, SOPS, and lease stipulations, in Sections L3 and L.7, Appendix L in the 2014 RMP, would mitigate potential impacts. On non-BLM surface, constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or	See Section 4.2, Impacts Common to All Action Alternatives CSU for Compensation Lands ACEC, would further reduce potential surface impacts after mitigation	See Section 4.2, Impacts Common to All Action Alternatives	See Section 4.2, Impacts Common to All Action Alternatives	See Section 4.2, Impacts Common to All Action Alternatives CSU for Bitter Creek ACEC would prevent/reduce disturbance to current or future refuge resources from fluid mineral development

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulations. In addition, and as applicable, protective measures, mitigation, and BMPs from SB4, Chapter 313, as well as Kern County Zoning Ordinance, Chapter 19.98 (Oil and Gas Production) (Kern County 2015) would apply to mitigate potential impacts. Wells on non-BLM surface would likely be subject to additional environmental impact analysis under CEQA. Required surveys, mitigation, and monitoring from the Programmatic BO (USFWS 2017) would apply to all T&E species on BLM surface.				
Cultural Resources	No change from 2012 Final EIS	See Section 4.3, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. On both BLM and non-BLM surface: When issuing permits related to the extraction of subsurface federal minerals, federal agencies must follow National Historic Preservation Act (54 U.S.C. 306108) Section 106 guidelines and regulations and other related statutes	See Section 4.3, Impacts Common to All Action Alternatives	See Section 4.3, Impacts Common to All Action Alternatives	See Section 4.3, Impacts Common to All Action Alternatives	See Section 4.3, Impacts Common to All Action Alternatives

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		for cultural resource compliance. This includes projects that employ hydraulic fracturing technology. Federal agencies will also follow their internal cultural resource policies, guidance documents, agreements with the California Office of Historic Preservation, and tribal agreements. This process, the application of Bakersfield Field Office BMPs, SOPS, and stipulations, as well as a full avoidance lease stipulation for NRHP eligible historic properties located within new federal leases, as outlined in Section L.6 of Appendix L in the 2014 RMP, would avoid, minimize, and mitigate adverse effects to historic properties. Federal cultural resource compliance, according to the above process, is not required for projects located on private lands absent federal involvement. For non-federally permitted projects, protection of cultural resources on State of California Lands is regulated under the California Public Resources Code (PRC), CEQA (Sec. 21083.2 and 21084.1) and may require the evaluation of effects on any project undertaken, assisted, or permitted by the state or the state's political subdivisions.				
Native American Values	No change from Final 2012 EIS	See Section 4.4, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the	See Section 4.4, Impacts Common to All Action Alternatives	See Section 4.4, Impacts Common to All Action Alternatives	See Section 4.4, Impacts Common to All Action Alternatives	See Section 4.4, Impacts Common to All Action Alternatives

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		same for all Action Alternatives, summarized in Table 4.2. Potential Impacts to Native American values would be addressed through guidance and policies provided in the BLM Handbook 1780-1 *Improving and Sustaining BLM-Tribal Relations* (BLM 2016), which promote meaningful and effective tribal consultation. In addition, for federally permitted projects, implementation of Section 106 compliance, BMPs, SOPS, and stipulations as outlined in Section L.6 of Appendix L in the 2014 RMP would avoid, minimize, or mitigate potential adverse effects to historic properties with religious and cultural significance to tribes. On both BLM and non-BLM federal surface: when issuing permits related to the extraction of subsurface federal minerals, federal agencies must follow their specific agency guidance regarding consultation and coordination with Native peoples and at a minimum must include adherence to the National Historic Preservation Act (54 U.S.C. 306108) Section 106 guidelines and regulations, Executive Order (EO)13007, Indian Sacred Sites; American Indian Religious Freedom Act (42 U.S.C. 21.1 Sec. 1996 and 1996a); and the Religious Freedom Restoration Act of 1993 (42 U.S.C. 21B, Sec. 2000bb et seq.). Federal agencies will also follow any existing agreements with Tribes.				

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		This includes projects that employ hydraulic fracturing technology. For non-federally permitted projects, protection of Native American values on State of California Lands and political subdivisions is under PRC Sections 5097.91 – 5097.97 that establishes a Native American Heritage Commission (NAHC), governs state and local agency cooperation with the NAHC, and creates a process to identify and protect sacred places.				
Paleontological Resources	No change from 2012 Final EIS	See Section 4.5, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. On both BLM and non-BLM surface, potential impacts to paleontological values from permits issued in relation to extraction of subsurface federal minerals, would be addressed through guidance and policies provided in BLM Handbook H-8270-1, *General Procedural Guidance for Paleontological Resource Management* and the BLM Manual MS-8270, *Paleontological Resource Management.* These documents are supplemented by Instruction Memorandum 2009-011, Assessment and Mitigation of Potential Impacts to	See Section 4.5, Impacts Common to All Action Alternatives	See Section 4.5, Impacts Common to All Action Alternatives	See Section 4.5, Impacts Common to All Action Alternatives	See Section 4.5, Impacts Common to All Action Alternatives

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		Paleontological Resources (DOI 2009) and 2016-124, Potential Fossil Yield Classification System for Paleontological Resources on Public Lands (DOI 2016). Procedures in these guidance documents are meant to satisfy the requirements of the Omnibus Public Land Management Act of 2009, National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.), and other federal authorities. Potential impacts to paleontological values would also be addressed by guidance provided in the 2014 RMP and Record of Decision (BLM 2014). Paleontological Resources Decision 1 implements measures to protect paleontological resources from inadvertent damage or destruction through: • Avoidance • Fencing • Stabilization • Collection or excavation and deposit in museum repository • Interpretation, or • Administrative closure Paleontological Resources Decision 4 ensures that site-specific NEPA analysis, which may include field inventory and fossil specimen recovery, implements the Potential Fossil Yield Classification as a standard part of the				

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		review for all surface disturbing projects throughout the Decision Area. On non-federal lands, potential impacts to paleontological resources may be addressed through California Public Resources Code, CEQA Appendix G (Sec. 8.16.2.2) and regulations depending on the county.				
Soil Resources	No change from Final 2012 EIS	See Section 4.6, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. On BLM surface, BMPs, SOPS, and lease stipulations, in Section L.4 of Appendix L in the 2014 RMP, would mitigate potential impacts. On non-BLM surface, constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulation. In addition, and as applicable, protective measures, mitigation, and BMPs from SB4, Chapter 313,	See Section 4.6, Impacts Common to All Action Alternatives	See Section 4.6, Impacts Common to All Action Alternatives	See Section 4.6, Impacts Common to All Action Alternatives	See Section 4.6, Impacts Common to All Action Alternatives

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		as well as Kern County Zoning Ordinance, Chapter 19.98 (Oil and Gas Production) (Kern County 2015) would apply to mitigate potential impacts. Additionally, all wells on non-BLM surface would likely be subject to additional environmental impact analysis under CEQA.				
Visual Resources	No change from 2012 Final EIS	See Section 4.7, Impacts Common to All Action Alternatives Supplemental analysis indicated no substantive change from estimated impacts in the 2012 Final EIS.	See Section 4.7, Impacts Common to All Action Alternatives	See Section 4.7, Impacts Common to All Action Alternatives	See Section 4.7, Impacts Common to All Action Alternatives	See Section 4.7, Impacts Common to All Action Alternatives
Water Resources	No change from 2012 Final EIS	See Section 4.8, Impacts Common to All Action Alternatives Surface Water Use - negligible impacts due to lack of surface water in the supplemental hydraulic fracturing analysis areas. Groundwater Use – negligible impacts in context of regional agricultural consumption. Hydraulic fracturing constituent mixing and handling - Impacts to groundwater due to spills of fracturing fluids would be negligible. Injection of hydraulic fracturing fluids/flowback management and disposal – groundwater impacts from loss of well integrity or out-of-zone migration of fracturing fluids from an average of zero to four wells/year would be negligible. If	See Section 4.8, Impacts Common to All Action Alternatives	See Section 4.8, Impacts Common to All Action Alternatives	See Section 4.8, Impacts Common to All Action Alternatives	See Section 4.8, Impacts Common to All Action Alternatives

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		present trends continue, the drilling up to of 40 wells over the 10-year planning period would also have negligible impact.				
Livestock Grazing	No change from 2012 Final EIS	See Section 4.9, Impacts Common to All Action Alternatives Supplemental analysis indicated no substantive change from estimated impacts in the 2012 Final EIS.	See Section 4.9, Impacts Common to All Action Alternatives	See Section 4.9, Impacts Common to All Action Alternatives	See Section 4.9, Impacts Common to All Action Alternatives	See Section 4.9, Impacts Common to All Action Alternatives
Minerals Management	No change from 2012 Final EIS	See Section 4.10, Impacts Common to All Action Alternatives Access to fluid mineral reserves for leasing - supplemental analysis indicated no substantive change from estimated impacts in the 2012 Final EIS. Seismicity - negligible impacts related to hydraulic fracturing or wastewater disposal.	See Section 4.10, Impacts Common to All Action Alternatives	See Section 4.10, Impacts Common to All Action Alternatives	See Section 4.10, Impacts Common to All Action Alternatives	See Section 4.10, Impacts Common to All Action Alternatives
Areas of Critical Environmental Concern	No change from 2012 Final EIS	See Section 4.11, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. NSOs and CSUs would provide protection to ACECs from hydraulic fracturing operations, and there would be negligible impacts.	See Section 4.11, Impacts Common to All Action Alternatives CSU for Compensation Lands ACEC would further reduce potential surface impacts after mitigation.	See Section 4.11, Impacts Common to All Action Alternatives	See Section 4.11, Impacts Common to All Action Alternatives	See Section 4.11, Impacts Common to All Action Alternatives CSU for Bitter Creek ACEC would prevent/reduce disturbance to current or future refuge resources from

Table ES.2
Summary of Estimated Environmental Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
						fluid mineral development
Social and Economic Resources	No change from 2012 Final EIS	See Section 4.12, Impacts Common to All Action Alternatives Supplemental analysis indicated no substantive change from estimated impacts in the 2012 Final EIS.	See Section 4.12, Impacts Common to All Action Alternatives	See Section 4.12, Impacts Common to All Action Alternatives	See Section 4.12, Impacts Common to All Action Alternatives	See Section 4.12, Impacts Common to All Action Alternatives

Key:
2012 Final EIS = 2012 Bakersfield Final Environmental Impact Statement
ACEC = Area of Critical Environmental Concern
BLM = Bureau of Land Management
BMP= Best Management Practice
BO = Biological Opinion
CEQA = California Environmental Quality Act
CSU = Controlled Surface Use
NO_X =oxides of nitrogen
NRHP = National Register of Historic Places
NSO = No Surface Occupancy
RMP = Bakersfield Field Office Resource Management Plan
SB4 = California Senate Bill 4
SOP = standard operating procedure
T&E = Threatened or Endangered
U.S.C. = United States Code

Acronyms and Abbreviations

2012 Final EIS	2012 Bakersfield Final Environmental Impact Statement
2014 RMP	2014 Bakersfield Field Office Resource Management Plan
ACEC	Area of Critical Environmental Concern
ACPD	Air Pollution Control District
APD	Application for Permit to Drill
ARB	California Air Resources Board
ARMP	Approved Resource Management Plan
BLM	Bureau of Land Management
BMP	best management practice
CCR	California Code of Regulations
CCST	California Council on Science and Technology
Central Coast Field Office Draft RMPA/EIS	*Central Coast Oil and Gas Leasing and Development Draft Resource Management Plan Amendment/Environmental Impact Statement*
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CH_4	methane
CIAA	Cumulative Impact Assessment Area
COA	Conditions of Approval
CO	carbon monoxide
CO_2	carbon dioxide
Court Order	U.S. District Court, Central District of California order for BLM to analyze the environmental consequences resulting from the use of hydraulic fracturing.
CSU	Controlled Surface Use
DOGGR	California Division of Oil, Gas, and Geothermal Resources
DOI	Department of the Interior
EIR	Environmental Impact Report
EO	Executive Order
Draft Supplemental EIS	Draft Bakersfield Field Office Supplemental Environmental Impact Statement
FLPMA	Federal Land Policy and Management Act
GHG	greenhouse gas
GWP	global warming potential
IPCC	Intergovernmental Panel on Climate Change
MA	Management Area
MCF	thousand cubic feet
mg/L	milligrams per liter
$MTCO_2e$	metric tons of carbon dioxide equivalent
$MMTCO_2e$	million metric tons of carbon dioxide equivalent
N_2O	nitrous oxide
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act
NOI	Notice of Intent
NO_X	oxides of nitrogen

NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
OEHHA	California Environmental Protection Agency Office of Environmental Health Hazard Assessment
Permanent Regulations	Final Permanent Well Stimulation Treatment Regulations
Planning Area	Bakersfield Field Office Planning Area
PM	particulate matter
PM_{10}	particulate matter smaller than 10 microns in diameter
$PM_{2.5}$	particulate matter smaller than 2.5 microns in diameter
PRC	California Public Resources Code
PRMP	2012 Bakersfield Proposed Resource Management Plan
PSD	Prevention of Significant Deterioration
RFDS	Reasonably Foreseeable Development Scenario
RMP	Resource Management Plan
RMPA	Resource Management Plan Amendment
ROD	Record of Decision
ROG	reactive organic gasses
SB4 EIR	California Department of Conservation (2015) *Analysis of Oil and Gas Well Stimulation Treatment in California*
SB4	California Senate Bill 4
Supplemental EIS	Supplemental Environmental Impact Statement
Settlement Agreement	Case No. 2:15-cv-04378–MWF/JEM0
SIP	State Implementation Plan
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_X	sulfur oxides
T&E	Threatened or Endangered
TDS	total dissolved solids
U.S.C.	United States Code
UIC	Underground Injection Control
USDW	underground source of drinking water
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VRM	visual resource management
WST	well stimulation treatment

1 Chapter One

1.1 Introduction

This Bakersfield Field Office hydraulic fracturing Draft Supplemental Environmental Impact Statement (Draft Supplemental EIS) evaluates the environmental consequences of integrating hydraulic fracturing as a result of future leasing and development decisions consistent with fluid mineral management decisions in the U.S. Department of the Interior (DOI) Bureau of Land Management (BLM) Bakersfield Field Office 2014 Resource Management Plan (RMP), hereafter referred to as the "2014 RMP." This analysis supplements the 2012 Bakersfield Final Environmental Impact Statement (BLM 2012), hereafter referred to as the "2012 Final EIS," for the 2012 Bakersfield Proposed Resource Management Plan (PRMP), which did not specifically analyze the potential effects of hydraulic fracturing. The Approved Resource Management Plan (ARMP) and Record of Decision (ROD) were published two years later (BLM 2014).

Prior to publication of the ROD and ARMP, public lands within the Bakersfield Field Office Planning Area (Planning Area) were managed under the Caliente RMP, as amended (BLM 1997), the Hollister RMP (BLM 1984), and two RMPs covering public lands within the California Coastal National Monument (BLM 2005a) and the Carrizo Plain National Monument (BLM 2010). The Caliente RMP, completed in 1997, covers public lands in San Luis Obispo, Santa Barbara, Ventura, Kings, Tulare, and western Kern Counties. The Hollister RMP, completed in 1984 by the Hollister Field Office, covers lands in Madera and eastern Fresno Counties, which were administratively transferred to the Bakersfield Field Office in October 2000. (Note: The Hollister Field Office moved to Marina, California, in 2016 and is now referred to as the Central Coast Field Office.) The 2014 RMP does not address public land management within the California Coastal National Monument or the Carrizo Plain National Monument, except for livestock grazing management in a small portion of the California Coastal National Monument.

BLM develops RMPs for areas such as the Bakersfield Field Office for which no consolidated planning document exists. This is in accordance with the Federal Land Policy and Management Act (FLPMA) of 1976 (43 United States Code [U.S.C.], 1701 et seq.), which directs the development of RMPs to guide management of public lands within BLM's jurisdiction.

The 2014 RMP was prepared using BLM planning regulations and guidance issued under the authority of FLPMA and the BLM Land Use Planning Handbook, H-1601-1 (BLM 2005b). An Environmental Impact Statement (EIS) is incorporated into this document to meet the requirements of these planning authorities, and in accordance with the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations [CFR], 1500-1508) (CEQ 1978), and requirements of BLM's NEPA Handbook, H-1790-1 (BLM 2008).

In compliance with the Mineral Lands Leasing Act of 1920 (30 U.S.C. § 181 et seq.), as amended, BLM is responsible for administering the leasing of onshore federal mineral estate, including oil and gas. Such leasing is conducted consistent with the applicable BLM Field Office RMP. This responsibility does not include administering leases for offshore federal mineral estate.

The 2012 Final EIS analyzed approximately 1,015,350 acres of federal mineral estate as open to fluid mineral leasing, subject to restrictions and resource-protective measures contained in the 2014 RMP. A Reasonably Foreseeable Development Scenario (RFDS) was prepared as a foundation document for the

2014 RMP. The RFDS projected the exploration, drilling, and production activity that would likely occur in the next 10 years, the anticipated life of the 2014 RMP. This was predicted to be approximately 100 to 400 federal wells to be drilled on federal mineral estate per year during the life of the 2014 RMP. This includes 90 to 360 wells per year on existing leases issued and 10 to 40 wells per year on new leases issued subsequent to the 2014 RMP approval date. Some of these wells were expected to be hydraulically fractured.

On June 10, 2015, the Center for Biological Diversity and Los Padres Forest Watch challenged BLM's 2014 ROD approving the 2014 RMP (Civ. No. 2:15-cv-04378-MWF/JEM). The plaintiffs argued that BLM violated NEPA because the 2012 Final EIS had failed to analyze adequately the impacts of hydraulic fracturing within the Planning Area.

On September 6, 2016, the U.S. District Court, Central District of California, issued summary judgment finding that BLM failed to take a "hard look" at the environmental impact of hydraulic fracturing in the 2014 RMP. The Court upheld the range of alternatives analyzed in the 2012 Final EIS and found that the Reasonably Foreseeable Development Scenario was acceptable. The Court stated that BLM was obligated to analyze at the land use planning level the environmental consequences resulting from the use of hydraulic fracturing (herein referred to as the "Court Order").

On May 3, 2017, the Court approved a Settlement Agreement (Case No. 2:15-cv-04378–MWF/JEM0) (Settlement Agreement) in which the parties agreed to partial remand without vacatur of (setting aside) the ROD for the 2014 RMP. BLM agreed to prepare appropriate NEPA documentation to address the deficiencies identified by the Court and to issue a new decision document that would amend or supersede the existing 2014 RMP ROD if appropriate.

1.2 Purpose of the Action

The purpose of this Draft Supplemental EIS is to analyze the environmental effects of the use of hydraulic fracturing technology in oil and gas development on new leases within the Planning Area and to determine whether changes are needed to the fluid minerals decisions in the 2014 RMP.

1.3 Need for the Action

The need to develop a Supplemental EIS is established by the Settlement Agreement, filed with the U.S. District Court for the Central District of California on May 3, 2017.

1.4 Supplemental Environmental Impact Statement

This Draft Supplemental EIS addresses the information and alternatives analyzed in the 2012 Final EIS, supplemented with additional analyses in response to the Court Order and Settlement Agreement. This Draft Supplemental EIS therefore analyzes the impacts of the use of hydraulic fracturing technology on BLM-administered public land and mineral estate in the Planning Area, exclusive of the California Coastal National Monument and Carrizo Plain National Monument, which are addressed in Monument-specific RMPs. It should be noted the decisions generated in the proposed plan only apply to BLM-administered surface and mineral estate. No decisions generated by the 2014 RMP would change existing rights or authority of private land owners or other surface management agencies. New wells on new leases that may be completed using hydraulic fracturing would be subject to all fluid mineral management decisions in the 2014 RMP. The following link has been provided to direct the readers of

this Draft Supplemental EIS to the 2012 Final EIS; it may prove helpful to have both documents open simultaneously as associated information has been incorporated by reference.

https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=renderDefaultPlanOrProjectSite&projectId=70273&dctmId=0b0003e880de4801

It is important to note that this Draft Supplemental EIS, like the 2012 Final EIS it supplements, is conducted at the land use planning level of impact analysis. Oil and gas leasing and development on federal mineral estate requires multiple stages of BLM environmental analysis and authorization. Environmental review under NEPA is required for the specific action proposed at each of these stages. The 2014 RMP identifies areas as open or closed to fluid mineral leasing and establishes appropriate stipulations, and other mitigation measures and best management practices (BMPs) that could be applied to areas identified as open to leasing. The environmental review for leasing parcels identifies which parcels should be offered for leasing and the conditions under which leasing and eventual development should occur. The environmental review for the development of leased parcels, including well completion techniques such as hydraulic fracturing, is a site-specific analysis of potential impacts from an identified proposed project. APDs are required to be submitted by developers/ operators, and typically include an initial on-the-ground, site-specific field evaluation by BLM resource specialists in addition to a site-specific NEPA analysis. This analysis allows site-specific information regarding local resource conditions to be evaluated and potential impacts disclosed. During this project-specific analysis, BLM would finalize the set of design features, Conditions of Approval (COAs), BMPs, and stipulations from the 2014 RMP that would be applied to the project.

1.4.1 New Information

In accordance with BLM's NEPA Handbook H-1790-1 (BLM 2008a), BLM must address significant new circumstances or information relevant to environmental concerns and bearing on the proposed action, or its effects, in a Supplemental EIS analysis (40 CFR 1502.9(c)(1)(ii)). The following new circumstances and information, as well as changed regulatory status, are integrated into this Draft Supplemental EIS:

- New cultural resources survey results have been recorded since the 2012 Final EIS. This updated information is described in Section 3.3 of this Draft Supplemental EIS.
- A single new paleontological locality was recorded since the 2012 Final EIS. This updated information is described in Section 3.5 of this Draft Supplemental EIS.
- Native American values were not analyzed in the 2012 Final EIS, but are considered in this Draft Supplemental EIS. Therefore, the Affected Environment for these values is described in Section 3.4. of this Draft Supplemental EIS.
- The United States Fish and Wildlife Service (USFWS) published its Programmatic Biological Opinion on Oil and Gas Activities on Bureau of Land Management Lands in the San Joaquin Valley after the 2012 Final EIS, in December 2017 (USFWS 2017). The applicability of this Biological Opinion (BO) to this Draft Supplemental EIS analysis is described in Section 4.2.
- BLM commissioned a review of the state of the knowledge of well stimulation and completions technologies in California. This independent assessment was published by the California Council on Science and Technology (CCST). It was prepared by Lawrence Berkeley National Laboratories and the Pacific Institute. Titled *An Independent Review of Scientific and Technical Information on*

Advanced Well Stimulation Technologies in California, the assessment was published in 2014 (CCST 2014) and updated in 2016 (CCST 2016). Both reports are cited extensively throughout this Draft Supplemental EIS.

- An important assumption for the planning-level analysis in the 2012 Final EIS, as supplemented in this Draft Supplemental EIS, is the number of new wells expected to be drilled on new federal mineral leases over the course of the 2014 RMP's 10-year planning scenario. Apparent contradictions in the 2012 Final EIS regarding this value are clarified in Section 4.1 of this Draft Supplemental EIS.

1.5 Description of the Planning Area

The Planning Area is located in Fresno, Kern, Kings, Madera, San Luis Obispo, Santa Barbara, Tulare, and Ventura Counties in California and encompasses approximately 400,000 acres of public land and 1.2 million acres of federal mineral estate (Map 1.1). The Planning Area is completely described in Section 1.3.1 of the 2012 Final EIS.

As noted above, the CCST (2014) report documents an assessment of well stimulation technologies, including hydraulic fracturing, as they are applied and practiced in California, including within the Bakersfield Field Office. The following sections define hydraulic fracturing, and how it is practiced, as integrated into this Draft Supplemental EIS impact analysis.

1.5.1 Definition of Hydraulic Fracturing

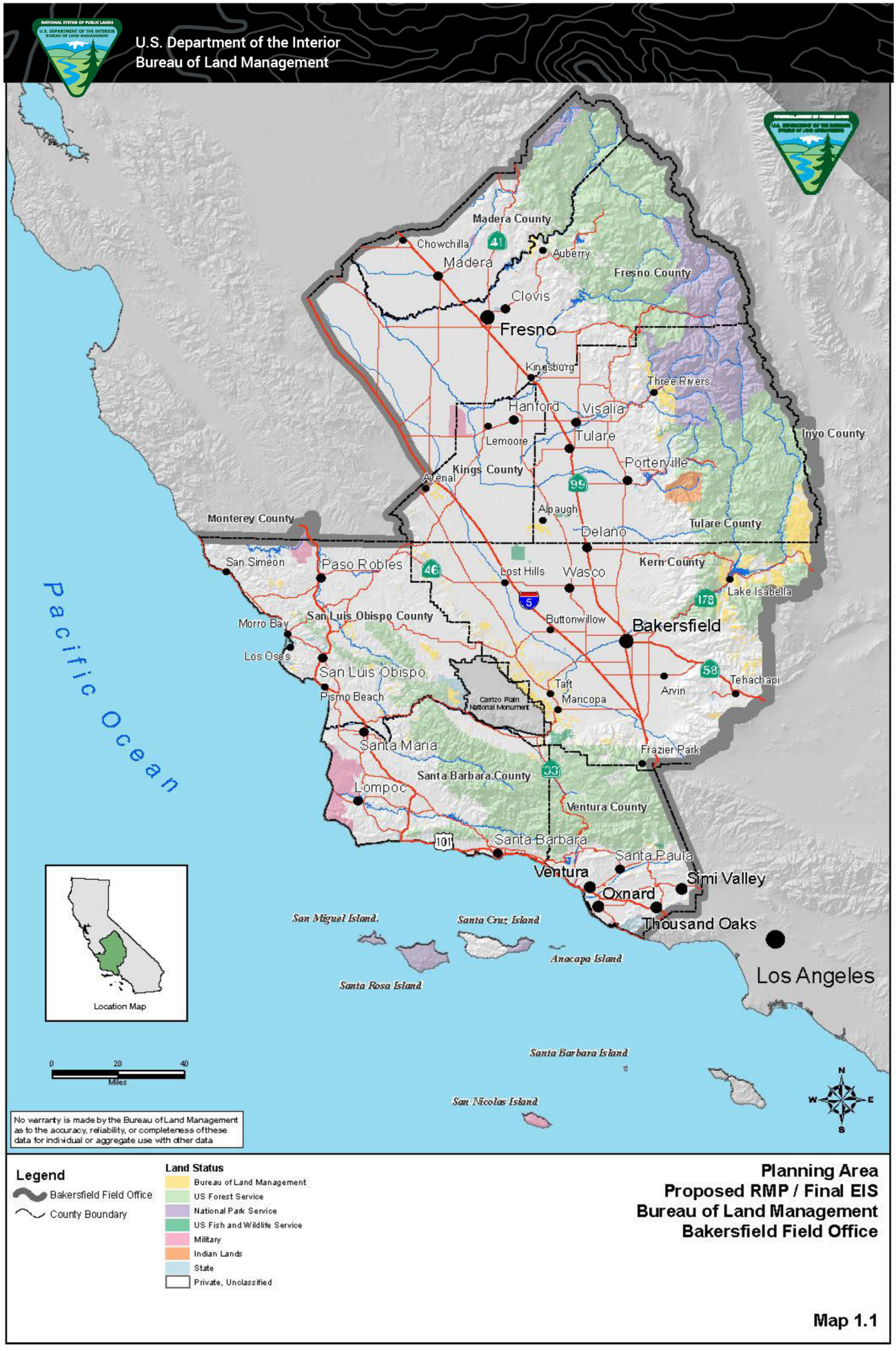
Hydraulic fracturing is a well completion process employed after drilling an oil or natural gas well. It involves injecting a mixture of highly pressurized fluids and proppant (usually sand) into a geologic formation to create and prop open fissures, or pathways, through which the produced fluids can more easily flow into the wellbore. When the hydraulic pressure is removed from the well, the small grains of sand remain in the fissures and hold the fractures open, allowing for higher production rates of the desired resource than would otherwise be achieved.

1.5.2 Overview of Hydraulic Fracturing in California Compared to Other Regions of the United States

Hydraulic fracturing was first used in Kansas in 1947. Since then, it has become a regular practice to pump previously unrecoverable reserves, or to stimulate increased production from existing oil or gas wells in reservoirs throughout the United States. Hydraulic fracturing in a variety of forms has been widely applied over many decades in California (CCST 2014). The use of the process in California, and specifically within the Planning Area, differs considerably from processes used in other locations in the country (CCST 2014). The Bakersfield Field Office ROD/ARMP Executive Summary discusses the factors most relevant to the Planning Area (BLM 2014).

1.5.3 Geology

Due to geological factors, most oil and natural gas reservoirs in California are considered conventional; i.e., the reservoirs are found in layers of underground rock, which lie beneath a layer of less permeable rock known as cap rock. These conventional reservoirs typically were under pressure when they were first drilled, some resulting in well-known historic gushers. Section 3.14.1.1 of the 2012 Final EIS provides a comprehensive description of the oil and natural gas reserves, and their historic development, in the Planning Area.


U.S. Department of the Interior
Bureau of Land Management
Madera County
Chowchilla
Madera
Auberry
Fresno County
Clovis
Fresno
Kingsburg
Three Rivers
Hanford
Visalia
Tulare
Lemoore
Inyo County
Porterville
Kings County
Avenal
Alpaugh
Monterey County
Delano
Tulare County
San Simeon
Paso Robles
Lost Hills
Wasco
Kern County
Lake Isabella
Morro Bay
San Luis Obispo County
Buttonwillow
Bakersfield
Los Osos
San Luis Obispo
Taft
Arvin
Tehachapi
Pismo Beach
Carrizo Plain National Monument
Maricopa
Santa Maria
Frazier Park
Santa Barbara County
Lompoc
Ventura County
Santa Barbara
Santa Paula
Ventura
Simi Valley
Oxnard
Thousand Oaks
Los Angeles
Pacific Ocean
San Miguel Island
Santa Cruz Island
Anacapa Island
Santa Rosa Island
Santa Barbara Island
San Nicolas Island
Location Map
0 20 40
Miles
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data
Legend
Bakersfield Field Office
County Boundary
Land Status
Bureau of Land Management
US Forest Service
National Park Service
US Fish and Wildlife Service
Military
Indian Lands
State
Private, Unclassified
Planning Area
Proposed RMP / Final EIS
Bureau of Land Management
Bakersfield Field Office
Map 1.1

In other oil and gas reservoirs such as the Marcellus Shale gas deposits in parts of New York, Pennsylvania, Ohio, Maryland, Virginia, and West Virginia, natural gas often occurs within uncapped rock formations. In these unconventional cases, hydraulic fracturing is necessary to free the resource for production. In California, by contrast, hydraulic fracturing is principally a means of well stimulation to ensure that individual wells attain maximum and sustained production, often a preferred alternative to drilling additional wells to produce the same resources. Production economics, including the cost of drilling and completing a well, also drive the need to maximize resource recovery. In various reservoirs in the eastern United States, producers use horizontal hydraulic fracturing to extract oil and natural gas, whereas in California, vertical hydraulic fracturing is used to access smaller pockets of oil resources (Appendix U, Kern County Environmental Impact Report [EIR]; Kern County 2015).

1.5.4 Number of Wells Utilizing Hydraulic Fracturing

In California, a relatively small number of new wells are hydraulically fractured each year. Due to the location of resources, hydraulic fracturing usually occurs in old fields on existing leases, many of which have been continuously developed over the last 100 years. Discovery of new fields resulting in development of new areas and new leases has not occurred in any notable way. There have been few new onshore oil discoveries in California the past two decades. One new field, Rose Field, has been discovered since 1990 (Ganong et al. 2003). The 30 largest onshore oil fields in California were discovered prior to 1950 (CCST 2016). The use of hydraulic fracturing in California has continued at the same low rate for many years, and it is unlikely to increase any time soon (CCST 2014).

1.5.5 Fracturing Duration, Direction, and Length of Fractures

According to BLM and the California Division of Oil, Gas, and Geothermal Resources (DOGGR), there is little or no fracturing of horizontal shale gas wells in California of the type performed in other parts of the United States (CCST 2016). Due to the geologic factors discussed previously, most of California's oil and gas production to date has been from vertical wells into traditional oil and natural gas reservoirs. In other states, the extraction of unconventional natural gas resources requires extended periods of hydraulic fracturing along lengthy stretches of horizontally drilled production wells. The extent of fracturing in unconventional rock stretches for hundreds of yards along the horizontal well, and the fractures stretch farther away from an individual well. In California, approximately 85 percent of hydraulic fracturing projects tend to be associated with shallower wells (less than 2,500 feet deep), as opposed to reservoirs in different parts of the country where hydraulically fractured wells might extend thousands of feet (California Legislative Affairs Office 2016). In California, hydraulic fracturing is used to puncture oil-containing rock within a narrow vertical band along a single well bore with the fractures extending only tens to hundreds of feet away from the well (DOGGR 2018a). This process consumes far less fluid to fracture and far less time to complete, as the period of pressurizing the reservoir rock is much shorter (Appendix U, Kern County EIR; Kern County 2015).

1.5.6 Water Use

In locations with unconventional reservoirs, hydraulic fracturing requires millions of gallons of water to be injected under constant pressure, a process that may take days or weeks to fracture reservoir substrate effectively. A typical hydraulically fractured well in California uses approximately 100,000 gallons of water on average per well (DOGGR 2015a, 2016, 2018c), as compared to an average of 4 to 8 million gallons for a typical well in the Marcellus Shale (STAC 2013). The process uses fluids with more concentrated chemicals than hydraulic fracturing in other locations (CCST 2014). The fracture flowback water, disposed of in injection wells or recycled for other purposes, is made up of approximately 99.5

percent water (BLM 2015). As a point of comparison, the total amount of water used for all hydraulic fracturing well completions in California in a typical year is a few hundred acre-feet, whereas the amount of water used in the same area for agriculture amounts to tens of millions of acre-feet of water consumed (DOGGR 2018a).

1.5.7 Subsidence

Subsidence is occurring throughout California, as a result of drought and water overdraft due to a variety of uses. Hydraulic fracturing accounts for a relatively small annual quantity of water use compared to other uses, such as agricultural and municipal water use. According to the Kern County Oil and Gas Zoning EIR, Section 4.6: "Land Subsidence of less than one foot from oilfield withdrawals is known to occur in a few isolated areas in southwest Kern County" (Kern County 2015). This estimated number includes impacts from several activities, including oil and gas extraction activities. Therefore, hydraulic fracturing activities are understood to form a negligible contribution to overall subsidence.

1.5.8 Environmental Protections

California Senate Bill 4 (SB4) regulates the drilling, operation, maintenance, and abandonment of oil and gas wells in the state, including the use of hydraulic fracturing on federal mineral estate. Compliance with SB4 is overseen by DOGGR. The California Office of Administrative Law approved the Final Permanent Well Stimulation Treatment Regulations (Permanent Regulations), effective July 1, 2015 (DOGGR 2014). The Permanent Regulations are the result of multiple regulatory revisions and reflect extensive input from the public, industry, and various state agencies. Under the Permanent Regulations, DOGGR is required to ensure that well stimulation permitting is conducted safely and mandates operators to comply with public disclosure requirements and neighbor notification.

The Permanent Regulations stipulate that well stimulation treatments do not include steam flooding, water flooding, cyclic steaming, routine well cleanout work, routine well maintenance, routine removal of formation damage due to drilling, bottom hole pressure surveys, or routine activities that do not affect the integrity of the well or the formation.

The following is a summary of the most significant revisions to the Permanent Regulations (Mills 2015).

- **Single-Project authorization:** A single project authorization is a single Division approval for multiple applications for permits to perform well stimulation treatments (Section 1751).
- **Well stimulation permit application:** The requirements for the application are described in detail, including the requirement of identification of all wells and the anticipated water source for the operation (Section 1783.1).
- **Evaluation prior to a well stimulation treatment:** The operator must perform the following prior to a well stimulation treatment: cement evaluation, pressure testing of the well, well stimulation treatment area analysis, and well stimulation treatment design (Section 1784, 1784.1, 1784.2).
- **Monitoring during a well stimulation treatment:** The operator must monitor the following during the well stimulation treatment: the surface injection pressure, the slurry rate, the proppant concentration, the fluid rate, and the pressure of each annulus of the well (Section 1785). Further, the operator must monitor and evaluate seismic activity in the vicinity of the hydraulic fracturing activity (Section 1785.1).

- **Well maintenance and cleanout history:** The operator must provide a description of the well maintenance activity and supply necessary data to DOGGR within 60 days of completing "an operation on a well that involves emplacing fluid containing acid in the well" (Section 1777.4).
- **Disclosures:** Within 60 days after cessation of a well stimulation treatment, the operator must publicly disclose specified information including the location of the well, "measured and true vertical depth of the well," and the "source, volume, and specific composition and disposition of all water associated with the well stimulation treatment" (Section 1788). DOGGR will publicly post this information on their website and on FracFocus.org.
- **Trade secrets:** SB4 limits the information that can be considered a trade secret for purposes of disclosure. In addition, trade secret information must be disclosed in the case of a medical injury related to well stimulation treatment, and trade secret information must be included in the operator's permit application to DOGGR (Public Resources Code, section 3160(j)).
- **Storage and handling of well stimulation fluids:** Well stimulation fluids are subject to strict regulatory requirements, including "secondary containment requirements." The operator must create and adhere to a Spill Contingency Plan. If a spill occurs, the operator must notify the Regional Water Board and other entities, such as BLM, as appropriate. Further, well stimulation fluids and waste must be properly stored and are prohibited from being stored in unlined sumps or pits (Section 1786).

DOGGR also requires all wells to meet the following construction and design requirements to ensure the maximum protection of ground water supplies and nearby ecosystems.

- Each well must be lined with a steel pipe casing that extends below the depth of any groundwater aquifers and below an impervious layer of rock that would prevent migration of fluids into the drinking water supply;
- Each well must comply with groundwater protection standards (Division 6. Part 2.76. Groundwater Quality Monitoring: Section 10783), and upon completion, a report must be submitted to DOGGR;
- Each well's casing is required to be secured by well cement and tested to ensure the casing meets industry integrity and operating standards; and
- Each well has additional strings of steel casing installed at depths below the surface casing, keeping any fluids or other material in the well bore from entering the groundwater supply zones.

Furthermore, state and federal water quality laws, including the Clean Water Act, Porter-Cologne Water Quality Control Act, and Safe Drinking Water Act, regulate the disposal of hydraulic fracturing fluids. Well completion treatments, such as hydraulic fracturing, do not include steam flooding, water flooding, or cyclic steaming and do not include routine well cleanout work, routine well maintenance, routine removal of formation damage due to drilling, bottom hole pressure surveys, or routine activities that do not affect the integrity of the well or the formation.

The California State Water Resources Control Board also plays a significant regulatory role and must approve operators' groundwater monitoring plans, develop model groundwater monitoring criteria, and implement a regional groundwater-monitoring plan. In addition, the Water Resources Control Board supervises and reviews water quality sampling and testing at permitted wells. The Groundwater

Ambient Monitoring and Assessment Program, as authorized by AB599 - Groundwater Quality Monitoring Act of 2001, is the source of monitoring requirements.

In addition, air emissions are regulated by the California Air Resources Board (ARB). The ARB requires any operator of greenhouse gas (GHG) sources in the Petroleum and Natural Gas Systems source category to quantify and report carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions when: 1) stationary combustion and process emissions equal or exceed 10,000 metric tons of carbon dioxide equivalent ($MTCO_2e$), or 2) when the stationary combustion, process, fugitive, and vented emissions equal or exceed 25,000 $MTCO_2e$ from 17 source types on a well pad or associated with a well pad (17 California Code of Regulations [CCR] 95152(c)).

1.6 Scoping and Planning Issues

The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including alternatives if necessary, and guide the planning process.

1.6.1 Scoping Process

A Notice of Intent (NOI) to prepare a Draft Supplemental EIS and potential RMPA was issued by the DOI on August 7, 2018, and published in the Federal Register on August 8, 2018.

The NOI identified the purpose and need for the Supplemental EIS and provided information about the Supplemental EIS, preliminary planning issues and criteria, the scoping process, and contact information. It also initiated a 30-day scoping period, which closed September 7, 2018. The complete results of the scoping process are summarized in the Public Scoping Summary Report (BLM 2018), located in Appendix A of this Draft Supplemental EIS.

1.6.2 Issues Addressed

Public scoping for the 2012 PRMP/Final EIS identified six planning issues that were addressed during the development of the alternatives for the entire 2014 RMP. These are described in Section 1.4.2 of the 2012 Final EIS.

Preliminary issues for this Draft Supplemental EIS, concerning resources that may be impacted by hydraulic fracturing, were identified during internal scoping by BLM personnel; federal, state, and local agencies; and other stakeholders. The issues, partially listed in the 2018 NOI, are:

- Air and Atmospheric Values;
- Biological Resources;
- Cultural Resources;
- Native American Values;
- Paleontological Resources;
- Soil Resources;
- Visual Resources;
- Water Resources (quality and quantity);
- Livestock Grazing;
- Minerals Management;
- Areas of Critical Environmental Concern;

- Social and Economic Resources
- Seismicity; and
- Special Status Species.

BLM identified and evaluated other issues raised during public scoping to be addressed in this Draft Supplemental EIS analysis and grouped them into one of three categories in the 2018 Public Scoping Summary Report:

1. Issues to be resolved on the basis of the analysis;
2. Issues to be resolved through policy or administrative action; or
3. Issues beyond the scope of a Supplemental EIS and potential RMPA.

1.6.3 Issues Considered but Not Further Analyzed

All substantive issues raised during public scoping are analyzed in this Draft Supplemental EIS.

1.7 Planning Criteria and Legislative Constraints

1.7.1 Planning Criteria

Planning criteria are the standards, rules, and guidelines that help to guide the development of a Supplemental EIS and potential RMPA. These criteria are based on applicable laws and regulations, agency guidance, and the result of consultation and coordination with the public; other federal, state, and local agencies; and Native American Tribes.

Planning criteria are used to ensure that a Supplemental EIS and potential RMPA are tailored to the identified issues and to deter unnecessary data collection and analysis. They also help guide the development of alternatives and the selection of the preferred alternative. The following preliminary planning criteria, as stated in the NOI, were used for this Draft Supplemental EIS:

1. “Only the portions of the existing plan that need to be updated to respond to the issues and management concerns identified in the court order and settlement agreement will be reviewed.”
2. “The planning process will be completed in compliance with FLPMA and all other applicable laws.”
3. “The planning process will include a Supplemental EIS that will comply with NEPA standards.”
4. “The scope of analysis will be consistent with the level of analysis in approved plans and in accordance with Bureau-wide standards and program guidance.”
5. “Public comments will be addressed during the planning process.”

1.7.2 Legislative Constraints

Section 1.5.2 of the 2012 Final EIS fully discusses legislative constraints for this Draft Supplemental EIS document.

1.8 Planning Process

The BLM planning process integrated into the Bakersfield Field Office PRMP/2012 Final EIS is fully described in Section 1.6 of the 2012 Final EIS. This process would apply to any planning decision that may arise on the basis of this supplemental analysis, whether that be to establish, revise, amend, or, in this instance, possibly supersede, an RMP.

1.9 Collaboration

A full description of the collaboration and coordination conducted as part of the Bakersfield Field Office 2012 RMP planning process is located in Section 1.7 of the 2012 Final EIS. These actions would apply to any planning decision that may arise on the basis of this supplemental analysis, whether that be to establish, revise, amend, or, in this instance, possibly supersede, an RMP.

1.10 Related Plans

Per FLPMA, BLM coordinates planning efforts with land use planning and management programs of Native American Tribes, other federal departments, and agencies of state and local governments. While states are authorized to furnish advice regarding revision of land use plans for the public lands, the Secretary of the Interior is directed to develop land use plans consistent with state and local plans to the maximum extent found consistent with Federal law and the purposes of FLPMA. 43 U.S.C. 1712 (c)(9). A complete description of other land management plans that relate to the 2014 RMP is provided in Section 1.8 of the 2012 Final EIS.

1.11 Policy

The 2014 RMP is consistent with requirements identified in various laws, regulations, and policies, as described in Section 1.9 of the 2012 Final EIS.

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2 Chapter Two

2.1 Introduction and General Description of Alternatives

This chapter details the proposed alternative management actions for fluid minerals management, under the Minerals Management program area as defined in the 2014 RMP.

The PRMP/2012 Final EIS presented a range of alternatives reflecting direction provided by numerous laws, mandates, policies, and plans. These include FLPMA, NEPA, and BLM planning regulations, criteria, and guidance. As a result, the alternatives analyzed in the 2012 Final EIS consisted of different combinations of management actions and resource allocations or use. The following range of alternatives for fluid mineral management, under the Minerals Management program area, has been carried forward for analysis in this Draft Supplemental EIS.

The Court Order upheld the range of alternatives analyzed in the 2012 Final EIS. Therefore, per the Court Order to take a "hard look" at the environmental impact of hydraulic fracturing in the 2012 Final EIS, this supplemental analysis considers the alternative proposed fluid mineral management decisions previously analyzed in that document. The No Action Alternative reflects management under the previous land use plans, as carried-forward in the 2012 FEIS. Alternative B, the Proposed Plan was adopted in 2014 RMP. Goals and objectives for the five alternatives analyzed in the 2012 Final EIS are provided below. The fluid mineral management decisions from the 2014 RMP for each alternative are summarized in Table 2.1.

2.2 Alternative A (No Action)

As required by NEPA, the No Action Alternative brings forward the existing management as described in the Caliente and Hollister RMPs including applicable amendments, as they apply to the Bakersfield Planning Area. In the absence of specific resource decisions, management has occurred based on federal law, regulation, and BLM policy and guidance; in these cases, no decisions were described in this alternative.

Both the Caliente and Hollister RMPs divided their decision areas into Management Areas (MAs). The Caliente RMP divided the Planning Area into three MAs: Coast, Valley, and South Sierra. The Hollister RMP divided the Planning Area into 16 MAs, two of which are incorporated into this alternative: Central San Joaquin and Squaw Leap (now known as San Joaquin River Gorge). Decisions made for specific MAs are only brought forward and applied to those areas; as such, each decision source is identified and, if applicable, the area to which it applies.

2.2.1 Minerals Management - Leasable Minerals

Goals

Central San Joaquin MA: Oil, gas, and mineral resources will be managed to meet the demand for increased energy and mineral production while protecting other resource values (Hollister RMP).

Objectives

Valley MA: Collaborate with the oil and gas and livestock industries in meeting mutually beneficial management objectives (Caliente RMP).

2.3 Proposed Plan (Alternative B)

The following section briefly describes components of Alternative B (Proposed Plan) related to leasable fluid minerals. Alternative B balances resource conservation and ecosystem health with the production of commodities and public use of the land.

2.3.1 Minerals Management – Leasable Minerals

Goal

Support development of mineral resources on public lands in an environmentally sound manner.

Objective

Facilitate reasonable, economical, and environmentally sound exploration and development of leasable minerals while minimizing impacts to resources.

2.4 Management Common to Alternatives C, D, and E

This section describes land use planning decisions related to fluid minerals management that are common to Alternatives C, D, and E.

- **Alternative C** emphasizes conserving cultural and natural resources, maintaining functioning natural systems, and restoring natural systems that are degraded. Management would focus on protecting sensitive resources through greater limitation of resource uses in sensitive areas.
- **Alternative D** follows Alternative C in all aspects except livestock grazing. Therefore, in this supplemental analysis, these two alternatives are identical in terms of fluid mineral management.
  Alternative E emphasizes the production of natural resources commodities and public use opportunities. Resource uses such as recreation, livestock grazing, mining, and oil/gas leasing, consistent with BLM guidance and constraints, would be emphasized.

2.4.1 Minerals Management – Leasable Minerals

Goal

Support development of mineral resources on public lands in an environmentally sound manner.

Objective

Facilitate reasonable, economical, and environmentally sound exploration and development of leasable minerals while minimizing impacts to resources.

2.5 Comparison of Alternatives

Table 2.1 summarizes and compares alternative fluid minerals management decisions.

2.6 Comparison of Impacts

The environmental consequences of integrating hydraulic fracturing as a result of future leasing and development decisions consistent with the fluid mineral management decisions in the 2014 RMP are summarized, by alternative, in Table 2.2.

2.7 Potential Land Use Planning Decision

The potential environmental impacts of integrating hydraulic fracturing as a result of future leasing and development decisions consistent with the 2014 RMP fluid mineral management decisions are summarized below in Table 2.1. The results of this supplemental analysis calculating the impacts of limited hydraulic fracturing, additive to those identified in the 2012 Final EIS, did not show a notable increase in total impacts. No conflicts were found between the estimated impacts of hydraulic fracturing and the resource or program management goals and objectives stated in the 2012 Proposed RMP. Therefore, an amendment to the 2014 RMP has been determined to be unnecessary.

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Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
Coast MA: Public acreage that is currently leased will not be subject to additional stipulations; however, if leases expire, and new leasing occurs [or renewal leases are renewed], special stipulations may be applied *(Caliente RMP)*. Coast MA: Approximately 42,800 acres are proposed to be open to oil and gas leasing under standard terms and conditions; of that total 2,800 acres are currently leased *(Caliente RMP).* Valley MA: Public acreage that is currently leased will not be subject to additional stipulations; however, if leases expire, and new leasing occurs, special stipulations may be applied *(Caliente RMP).* Valley MA: Approximately 18,000 acres would be open to oil and gas leasing under standard terms and conditions *(Caliente RMP)*. South Sierra MA: Approximately 234,700 BLM acres would be open to oil and gas leasing under standard terms and conditions *(Caliente RMP)*.	Identify 0 acres as open to fluid mineral leasing, subject to existing regulations and formal orders; and the terms and conditions of the standard lease form.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Coast MA: Approximately 100 acres are proposed to be closed to leasing *(Caliente RMP)*. Coast MA: Approximately 1,900 acres are proposed to be closed to leasing within designated Wilderness *(Caliente RMP)*. Valley MA: Approximately 5,800 BLM acres at Bitter Creek SMA would be closed to oil and gas leasing *(Caliente RMP)*.	Identify 149,600 acres as closed to fluid mineral leasing: • Non-discretionary closures – Wilderness, WSAs, Piedras Blancas ONA, and the PCNST Discretionary closures – some ACECs (Bitter Creek ACEC, Blue Ridge, Erskine Creek, Piute Cypress, and Point Sal) lands with wilderness characteristics, suitable segments of WSR and Deer Spring area of ecological importance.	Identify 149,200 acres as closed to fluid mineral leasing: • Non-discretionary closures – Wilderness, WSAs, Piedras Blancas ONA, and the PCNST • Discretionary closures – some ACECs (Blue Ridge, Erskine Creek, Piute Cypress, and Point Sal) and Deer Spring area of ecological importance.	Same as Alternative C.	Same as Alternative C.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
No similar management action.	No similar management action.	Identify 46,850 acres as closed to fluid mineral leasing: • Discretionary closures – ACECs (Bitter Creek and Compensation Lands), State of California's Chimineas Unit of the Carrizo Plain Ecological Reserve, federal minerals below lands managed as compensation, lands managed for wilderness characteristics, and suitable WSR corridors	Same as Alternative C.	No similar management action.
No similar management action.	These stipulations and decisions do not apply to geophysical exploration conducted *outside the rights granted by a Federal oil and gas lease*. *Stipulations governing geophysical exploration would be established in site-specific NEPA documentation and incorporate appropriate protective measures (Appendix L, 2012 Final EIS).*	These stipulations and decisions do not apply to geophysical exploration.	Same as Alternative C.	Same as Alternative C.
	Identify 0 acres as open to fluid mineral leasing, subject to moderate constraints.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
	Identify 0 acres as open to fluid mineral leasing, subject to existing regulations and formal orders; and the terms and conditions of the standard lease form.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
No similar management action.	Identify approximately *1,011,470* acres as open to fluid mineral leasing, subject to major constraints (both CSU – Protected Species and CSU – Sensitive Species). Of this at least 3,880 acres would also be subject to a No Surface Occupancy stipulation. Additional CSU stipulations may be applied to all new leases in conjunction with the lease sale as determined appropriate and in conformance with the 2014 RMP. *Additional information regarding the application, review process, and coordination requirements of the stipulations is included in Appendix G [2012 Final EIS].*	Identify approximately 966,160 acres as open to fluid mineral leasing, subject to major constraints (both CSU – Protected Species and CSU – Sensitive Species). Of this at least 8,400 acres would also be subject to a No Surface Occupancy stipulation. Additional CSU stipulations may be applied to all new leases in conjunction with the lease sale as determined appropriate and in conformance with the 2014 RMP.	Same as Alternative C.	Identify approximately 1,013,010 acres as open to fluid mineral leasing, subject to major constraints (both CSU – Protected Species and CSU – Sensitive Species). Of this at least 3,590 acres would also be subject to a No Surface Occupancy stipulation. Additional CSU stipulations may be applied to all new leases in conjunction with the lease sale as determined appropriate and in conformance with the 2014 RMP.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
South Sierra MA: Approximately 10,100 BLM acres would be closed to oil and gas leasing, and an additional 18,500 acres would be closed to geothermal development *(Caliente RMP)*.	Identify 26,440 acres, in addition to that closed to all fluid mineral leasing, as closed only to geothermal leasing: • Discretionary closures – Kaweah ACEC.	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Coast MA: Approximately 1,500 acres are proposed to open with a No Surface Occupancy stipulation *(Caliente RMP)*. South Sierra MA: Approximately 3,000 acres would be open to oil and gas leasing with a No Surface Occupancy (NSO) Stipulation *(Caliente RMP)*.	No similar management action.	No similar management action.	No similar management action.	No similar management action.
Valley MA: Approximately 500 BLM acres in Goose Lake and Alkali Sink ACEC would be open to oil and gas leasing with a No Surface Occupancy Stipulation (NSO). Approximately 300 acres are currently leased *(Caliente RMP)*.	No similar management action.	No similar management action.	No similar management action.	No similar management action.
No similar management action.	Establish the major constraint of "NSO – Compensation Lands ACEC" that prohibits surface disturbance on the entire lease for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on lands acquired as compensation lands with the following stipulation language: *[(b)]All or a portion of this lease occurs within the boundaries of the Compensation Lands ACEC. These lands may have a governing document that prohibits certain activities. No new surface disturbing activity is allowed on the lease. Furthermore, access to federal minerals within the lease will only be allowed from off-site sources not considered to be compensation lands (e.g., compensation land in private ownership). This stipulation shall not be waived, however may be granted exception or modified as follows:* ***Exception:** The Authorized Officer may grant an exception if, after coordination with appropriate agency (e.g., CDFG[(c)] and USFWS), an environmental review determines the action as proposed or conditioned would not impair the values present and is consistent with the document that established the compensation land.* ***Modification:** The Authorized Officer may modify this stipulation to allow surface use on a portion or the entire lease if, after coordination with appropriate agency (e.g., CDFG and USFWS), an environmental review determines the action as*	No similar management action.	No similar management action.	No similar management action.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
	proposed or conditioned would not impair the values present and is consistent with the document that established the compensation land.			
No similar management action.	Establish the major constraint of "NSO – General" that prohibits surface disturbance on the entire lease for the purpose of minimizing or eliminating adverse effects on unique or significant natural and cultural resources that are incompatible with fluid mineral development with the following stipulation language: *All or a portion of this lease has been identified by the current RMP (e.g., ACECs and areas of ecological importance with this stipulation prescribed) as containing unique or significant natural or cultural values. No new surface disturbing activity is allowed on the lease. This stipulation may be granted exception, modified, or waived as follows:* ***Exception:** The Authorized Officer may grant an exception if, after coordination with appropriate agency (e.g., CDFG, SHPO, and USFWS), an environmental review determines the action as proposed or conditioned would not impair the values present because of temporary conditions.* ***Modification:** The Authorized Officer may modify this stipulation to allow surface use on a portion or even all of the lease if an environmental review determines the action as proposed or conditioned would not impair the values present.* ***Waiver:** The Authorized Officer may grant a waiver if an environmental review determines the values for which the NSO was applied no longer exist.*	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
No similar management action.	Establish the major constraint of "CSU – Compensation Lands" for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on lands managed as compensation land with the following stipulation language: *All or a portion of this lease underlies lands managed as compensation land by the BLM or an entity other than the BLM that may have a governing document that prohibits certain activities.*	No similar management action.	No similar management action.	No similar management action.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
	To allow only a compatible amount of disturbance to unique or significant biological values, no more than ten (10) percent of the surface within any parcel may be disturbed on the surface reserve lands overlying the lease. Furthermore, access to federal minerals within the lease will not disturb more than ten (10) percent of the surface within any parcel from off-site sources that are compensation lands (e.g., compensation land in private ownership). This stipulation may be granted exception, modified, or waived as follows: ***Exception:*** *The Authorized Officer may grant an exception if, after coordination with appropriate agency (e.g., CDFG and USFWS), an environmental review determines the action as proposed or conditioned would not impair the values present and is consistent with the document that established the compensation land.* ***Modification:*** *The Authorized Officer may modify this stipulation if, after coordination with appropriate agency (e.g., CDFG and USFWS), an environmental review determines the action as proposed or conditioned would not impair the values present and is consistent with the document that established the compensation land.* ***Waiver:*** *The Authorized Officer may grant a waiver to the stipulation if the lease parcel no longer considered as compensation land by the appropriate agency (e.g., BLM, CDFG and USFWS).*			
No similar management action.	Establish the major constraint of "CSU – Chimineas Ranch" for the purpose of preventing or reducing disturbance to unique or significant natural resources from fluid mineral development with the following stipulation language: *This lease is within the boundaries of, or adjacent to, the State of California's Chimineas Unit of the Carrizo Plain Ecological Reserve, an area that contains unique or significant natural or cultural values. Prior to the authorization of any surface disturbing activities, a preliminary environmental review will be conducted to identify the potential presence of natural or cultural values. Authorizations may be delayed until completion of the necessary surveys during the appropriate time period for these resources. Surface disturbing*	No similar management action.	No similar management action.	No similar management action.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
	activities may be prohibited on portions or the entire lease, and some activities may be prohibited during seasonal time periods. This stipulation shall not be waived, however may be granted exception or modified as follows: ***Exception:*** *The Authorized Officer may grant an exception if, after coordination with CDFG, an environmental review determines that the activity, as proposed or conditioned, would not impair the values present and is consistent with the management of the ecological reserve.* ***Modification:*** *The Authorized Officer may modify this stipulation to further restrict surface use on a portion of or the entire lease if a more stringent requirement is deemed necessary to protect resource values following an environmental review.*			
Coast MA: Approximately 22,700 acres are proposed to be open to oil and gas leasing subject to a Controlled Surface Use (CSU) stipulation *(Caliente RMP)*. Special categories of the CSU stipulations include: • 16,500 acres open subject to the CSU - Protected Species stipulation. Coast MA: Both the CSU-Protected Species and the CSU-Sensitive Species stipulations would apply to one township and range (25S, 10E) immediately southwest of Camp Roberts in an area with limited oil exploration potential *(Caliente RMP).* Valley MA: Approximately 348,300 acres would be open to oil and gas leasing with a Controlled Surface Use (CSU) stipulation; of that total, approximately 136,000 acres are currently under lease *(Caliente RMP)*. Special categories of the CSU stipulations include: • 212,300 acres would be subject to the CSU - Protected Species stipulation. Valley MA: Areas within the Valley [MA] that would be subject to more than one category of the CSU stipulations include: the Carrizo Plain Natural Area ACEC where protected species, sensitive species and raptor stipulations apply; Lokern ACEC, where both protected species and sensitive species stipulations apply; and Kettleman Hills where	Establish the major constraint "CSU - Protected Species" for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on federally proposed and listed species with the following stipulation language: *All or a portion of the lease occurs within the range of one or more plant or animal species that are either listed or proposed for listing as threatened or endangered by the USFWS. A list of such species will be provided at the time of leasing and updated as necessary over the term of the lease. To determine whether species on this list or their habitat are present, a preliminary environmental review will be conducted for all surface disturbing activities.* *Presence of habitat or species may result in the proposed action being moved, modified, or delayed to mitigate project effects. Offsite compensation that would satisfactorily offset the loss of habitat may be required. Prohibition of all surface disturbing activities on the lease will only occur as needed to avoid jeopardizing the continued existence of a listed or proposed species, or when the proposed action is inconsistent with the recovery needs of a species as identified in an approved USFWS Recovery Plan through consultation with USFWS. Furthermore, processing times for proposed actions may be delayed beyond established standards to accommodate species*	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
protected species and raptor stipulations apply *(Caliente RMP)*. South Sierra MA: Approximately 95,600 acres would be open to oil and gas leasing under a Controlled Surface Use (CSU) stipulation *(Caliente RMP)*. Special categories of the CSU stipulation will be applied as follows: • 34,400 acres are subject to the CSU - Protected Species stipulation	*surveys, and consultation or conferencing with the USFWS. This stipulation shall not be waived; however, it may be modified or an exception may be granted as follows:* ***Exception:*** *The Authorized Officer may grant an exception if an environmental review determines the action as proposed or conditioned would have no effect on listed or proposed species.* ***Modification****: The Authorized Officer may modify this stipulation to reflect new information with regard to the range of listed or proposed species through the expansion or reduction of lands subject to this stipulation for a specific species.*			
Coast MA: Approximately 22,700 acres are proposed to be open to oil and gas leasing subject to a Controlled Surface Use (CSU) stipulation *(Caliente RMP)*. Special categories of the CSU stipulations include: • 6,000 acres open subject to the CSU - Sensitive Species stipulation. Coast MA: Both the CSU - Protected Species and the CSU - Sensitive Species stipulations would apply to one township and range (25S, 10E) immediately southwest of Camp Roberts in an area with limited oil exploration potential *(Caliente RMP)*. Valley MA: Approximately 348,300 acres would be open to oil and gas leasing with a Controlled Surface Use (CSU) stipulation; of that total, approximately 136,000 acres are currently under lease *(Caliente RMP)*. Special categories of the CSU stipulations include: • 126,500 acres would be subject to the CSU - Sensitive Species stipulation. Valley MA: Areas within the Valley [MA] that would be subject to more than one category of the CSU stipulations include: the Carrizo Plain Natural Area ACEC where protected species, sensitive species and raptor stipulations apply; Lokern ACEC, where both protected species and sensitive species stipulations apply; and Kettleman Hills, where protected species and raptor stipulations apply *(Caliente RMP)*.	Establish the major constraint "CSU - Sensitive Species" for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on federal candidate, State listed and BLM sensitive species with the following stipulation language: *All or a portion of this lease is within the range of one or more plant or animal species that are either federal candidates for listing as threatened or endangered (federal candidate), are listed by the State of California as threatened or endangered (state listed), or are designated by the BLM as sensitive (BLM sensitive). A list of species will be provided at the time of leasing and updated as necessary over the term of the lease. To determine whether species on this list or their habitat are present, a preliminary environmental review will be conducted for all surface disturbing activities. Presence of habitat or species may result in the proposed action being moved more than 200 meters (656 feet) but not more than a quarter-mile or off of the lease and prohibition of activities during seasonal use period. Furthermore, processing times for proposed actions may be delayed beyond established standards to accommodate species surveys, and coordination with the USFWS and California Department of Fish and Game. This stipulation shall not be waived; however, it may be granted exception or modified as follows:* ***Exception****: The Authorized Officer may grant an exception if an environmental review determines*	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
South Sierra MA: Approximately 95,600 acres would be open to oil and gas leasing under a Controlled Surface Use (CSU) stipulation *(Caliente RMP)*. Special categories of the CSU stipulation will be applied as follows: • 27,400 acres are subject to the CSU - Sensitive Species stipulation	*the action as proposed or conditioned would have no effect on federal candidate, state listed, and BLM sensitive species.* ***Modification**: The Authorized Officer may modify the stipulation to reflect new information with regard to federal candidate, state listed or BLM sensitive species lists. Furthermore, the authorized officer may modify the maximum distance that a potential location could be moved to extend farther than the stated quarter-mile to maintain the sensitive species protection goals.*			
Valley MA: Approximately 348,300 acres would be open to oil and gas leasing with a Controlled Surface Use (CSU) stipulation; of that total, approximately 136,000 acres are currently under lease *(Caliente RMP)*. Special categories of the CSU stipulations include: • 113,100 acres would be subject to the CSU-Raptor stipulation. Valley MA: Areas within the Valley [MA] that would be subject to more than one category of the CSU stipulations include: the Carrizo Plain Natural Area ACEC, where protected species, sensitive species and raptor stipulations apply; Lokern ACEC, where both protected species and sensitive species stipulations apply; and Kettleman Hills, where protected species and raptor stipulations apply *(Caliente RMP)*. South Sierra MA: Approximately 95,600 acres would be open to oil and gas leasing under a Controlled Surface Use (CSU) stipulation *(Caliente RMP)*. Special categories of the CSU stipulation will be applied as follows: • 18,500 acres are subject to the CSU - Raptor stipulation	Establish the major constraint "CSU - Raptor" for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on sensitive raptor foraging areas, winter roosting areas, or nest sites with the following stipulation language: *All or a portion of this lease has been identified as an important raptor foraging, wintering, or nesting area. Any proposed surface disturbing activity will be reviewed to determine if the activity would affect raptor foraging, wintering, or nesting habitat. Determination of effects to raptor foraging, wintering, or nesting habitat may result in the proposed action being moved more than 200 meters (656 feet) but not more than a half-mile and prohibition of activities during seasonal use period. This stipulation may be granted exception, modified, or waived as follows:* ***Exception:** The Authorized Officer may grant an exception if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.* ***Modification:** The Authorized Officer may modify the distance and other provisions of this stipulation based on new information and increasing or decreasing levels of the impacts anticipated from fluid mineral development.* ***Waiver**: The Authorized Officer may waive the stipulation should new information show the area no longer contains sensitive raptor habitat for foraging, winter roosting, or nesting.*	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
Valley MA: Approximately 348,300 acres would be open to oil and gas leasing with a Controlled Surface Use (CSU) stipulation; of that total, approximately 136,000 acres are currently under lease *(Caliente RMP)*. Special categories of the CSU stipulations include: • 300 acres would be subject to the CSU - Critical Habitat stipulation. South Sierra MA: Approximately 95,600 acres would be open to oil and gas leasing under a Controlled Surface Use (CSU) stipulation *(Caliente RMP)*. Special categories of the CSU stipulation will be applied as follows: • 22,300 acres are subject to the CSU- Critical Habitat stipulation	Establish the major constraint "CSU – Critical Habitat" for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on habitat designated as critical, or is proposed for designation as critical habitat by the USFWS with the following stipulation language: *All or a portion of this lease lies within an area that is designated as critical habitat, or is proposed for designation as critical habitat by the USFWS. A list of these areas affecting this lease will be provided at the time of leasing and will be updated as necessary over the term of the lease. Any proposed surface disturbing activity occurring on the affected portions of this lease will be reviewed to determine if the activity would affect designated or proposed critical habitat. Determination of effects to designated or proposed critical habitat may result in the proposed action being moved, modified, seasonally restricted, or delayed. Consultation or conference with the USFWS is required if designated or proposed critical habitat may be affected. Off-site compensation that would satisfactorily offset the loss of habitat may be required. Prohibition of all surface disturbing activities on the lease will only occur as needed to avoid destroying or adversely modifying critical habitat or proposed critical habitat, or when the proposed action is inconsistent with the recovery needs identified in an approved USFWS Recovery Plan based on consultation with USFWS.* *Furthermore, processing times for proposed actions may be delayed beyond established standards to accommodate species surveys, and consultation or conferencing with the USFWS. This stipulation shall not be waived; however, it may be granted exception or modified as follows:* ***Exception:** The Authorized Officer may grant an exception if an environmental review determines the action as proposed or conditioned would have no effect on critical habitat or proposed critical habitat.*	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
	***Modification**: The Authorized Officer may modify this stipulation to reflect new information with regard to the critical habitat or proposed critical habitat through the expansion or reduction of lands subject to this stipulation for a specific species.*			
Coast MA: Approximately 22,700 acres are proposed to be open to oil and gas leasing subject to a Controlled Surface Use (CSU) stipulation *(Caliente RMP)*. Special categories of the CSU stipulations include: • 4,300 acres open subject to the CSU - [Priority Species, Plant Communities and Habitats] stipulation.	Establish the major constraint "CSU – Priority Species, Plant Communities and Habitats" for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on rare and/or endemic vegetation, plants, and communities, including riparian and serpentine endemics, with the following stipulation language: *All or a portion of the lease has been identified by the current RMP (i.e., ACECs and areas of ecological importance with this stipulation prescribed) as containing priority species, plant communities, or habitat that may be adversely affected by fluid mineral development. A list of affected parcels or portions of the lease will be provided at the time of leasing. To identify the possibility of adverse impact resulting from fluid mineral development, a preliminary environmental review will be conducted for all surface disturbing activities. Identification of adverse impacts may result in the proposed action being moved, modified, seasonally delayed, or prohibited from all or a portion of this lease. Furthermore, processing times for proposed actions may be delayed beyond established standards to accommodate species surveys. This stipulation shall not be waived, but may be granted exception or modified as follows:* ***Exception:** The Authorized Officer may grant an exception if an environmental review determines the action as proposed or conditioned would have no effect on priority species, plant communities, or habitats.* ***Modification**: The Authorized Officer may modify the stipulation to reflect new information with regard to the presence of priority species, plant communities, or habitat through the expansion or reduction of lands subject to this stipulation.*	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
No similar management action.	Establish the major constraint "CSU – Cultural Resources" for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on National Register-listed or eligible cultural properties with the following stipulation language: *All or a portion of the lease contains National Register-listed or potentially eligible cultural properties that may be adversely affected by fluid mineral development. A list of affected parcels or portions of the lease will be provided at the time of leasing. To identify the possibility of adverse impacts resulting from fluid mineral development, a preliminary cultural resource review/survey will be conducted for all surface disturbing activities. Identification of adverse impacts may result in the proposed action being moved or modified. Surface-disturbing activities would be prohibited on the portion of the lease where National Register-listed properties or properties potentially eligible for listing on the National Register occur. This stipulation may be modified, waived, or granted exception as follows:* ***Exception:** The Authorized Officer may grant an exception, with concurrence from the California State Historic Preservation Office and Native American Tribes, if a subsequent formal eligibility evaluation indicates the cultural property is ineligible.* ***Modification:** The Authorized Officer may modify the stipulation to reflect new information from formal eligibility evaluations for cultural properties through the expansion or reduction of land where surface disturbing activities would be prohibited.* ***Waiver:** The Authorized Officer may grant a waiver to the stipulation should the results of formal eligibility evaluation determine all cultural properties ineligible for listing on the National Register.*	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Coast MA: The 69,700 acres of mineral estate under the administration of the Department of Defense (DOD) would be open subject to the CSU - Defense stipulation *(Caliente RMP)*.	Establish the major constraint "CSU – Defense" for the purpose of minimizing or eliminating conflict between fluid mineral development and military base operations with the following stipulation language:	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
Valley MA: The 16,600 acres of federal mineral estate under the administration of the Department of Defense (DOD at Lemoore Naval Air Station) would be open to oil and gas leasing subject to the CSU - Defense stipulation *(Caliente RMP)*.	*All or a portion of this lease contains federal mineral estate under the surface administration of the Department of Defense. Surface disturbing activities may be moved, modified, or prohibited at the discretion of the Base Commander(s) to ensure these activities do not interfere with military activity on the base and to ensure personnel safety. Furthermore, processing times for proposed actions may be delayed beyond established standards to accommodate review and coordination with the Base Commander(s). This stipulation shall not be modified or granted exception; however, it may be waived as follows:* ***Waiver:** The Authorized Officer may grant a waiver to this stipulation if the surface administration changes from the Department of Defense to another entity.*			
No similar management action.	Establish the major constraint "CSU – Existing Surface Use/Management" for the purpose of minimizing or eliminating conflict between fluid mineral development and existing surface use on both public lands and split estate overlying federal minerals, including risk to public health and safety, and social and economic impacts (noise, aesthetics, etc.) with the following stipulation language: *All or a portion of the lease contains federal mineral estate underlying surface with an established use or management that may be incompatible with fluid mineral development. A preliminary environmental review will be conducted for all surface disturbing activities to identify possible conflict between surface use and fluid mineral development. Surface disturbing activities may be moved, modified, or prohibited to accommodate the existing surface use should the Authorized Officer determine the incompatibility of these uses.* *Specifically, fluid mineral development shall not occur:* *(1) Closer to any development (e.g., public highway, institution, place of public assembly, or occupied dwelling) than allowed by the county/city regulation or statue applicable to the area in which the proposed action occurs (including those exceptions where closer spacing is allowed);*	Establish the major constraint "CSU – Existing Surface Use/Management" for the purpose of minimizing or eliminating conflict between fluid mineral development and existing surface use on both public lands and split estate overlying federal minerals, including risk to public health and safety, and social and economic impacts (noise, aesthetics, etc.) with the following stipulation language: *All or a portion of the lease contains federal mineral estate underlying surface with an established use or management that may be incompatible with fluid mineral development. A preliminary environmental review will be conducted for all surface disturbing activities to identify possible conflict between surface use and fluid mineral development. Surface disturbing activities may be moved, modified, or prohibited to accommodate the existing surface use should the Authorized Officer determine the incompatibility of these uses.* *Specifically, fluid mineral development shall not occur:* *(1) Closer to any development (e.g., public highway, institution, place of public assembly, or occupied dwelling) than allowed by the county/city regulation or statue applicable to the area in which the proposed action occurs (including those exceptions where closer spacing is allowed);*	Same as Alternative C.	Same as Alternative C.

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
	~~*(2) Within 200 feet of an occupied dwelling;*~~[d] *(3) In a manner that significantly and adversely impacts natural and/or cultural resources of which the surface owner/administrator is charged with the management and protection; or* *(4) In a manner that significantly and adversely impacts existing recreation opportunity of which the surface owner/administrator is charged with the management and protection.* *Furthermore, processing times for proposed actions may be delayed beyond established standards to accommodate review and coordination with the surface owner/administrator.* *This stipulation shall not be waived, but may be granted exception or modified as follows:* ***Exception**: The Authorized Officer may grant an exception where a surface use agreement exists between the lessee and surface owner/administrator that allows for the proposed fluid mineral development. Furthermore, exception may be granted where the proposed action is deemed, following an environmental review, to have discountable or insignificant impacts on the existing surface use.* ***Modification**: The Authorized Officer may modify this stipulation to further restrict surface use for mineral development on a portion of or all the lease if a more stringent requirement with regard to the location of facilities is deemed necessary following an environmental review (e.g., greater than county/city restrictions on fluid mineral development).*	*(2) Within 200 feet of an occupied dwelling;* *(3) In a manner that significantly and adversely impacts natural and/or cultural resources of which the surface owner/administrator is charged with the management and protection; or* *(4) In a manner that significantly and adversely impacts existing recreation opportunity of which the surface owner/administrator is charged with the management and protection.* *Furthermore, processing times for proposed actions may be delayed beyond established standards to accommodate review and coordination with the surface owner/administrator.* *This stipulation shall not be waived, but may be granted exception or modified as follows:* ***Exception**: The Authorized Officer may grant an exception where a surface use agreement exists between the lessee and surface owner/administrator that allows for the proposed fluid mineral development. Furthermore, exception may be granted where the proposed action is deemed, following an environmental review, to have discountable or insignificant impacts on the existing surface use.* ***Modification**: The Authorized Officer may modify this stipulation to further restrict surface use for mineral development on a portion of or all the lease if a more stringent requirement with regard to the location of facilities is deemed necessary following an environmental review (e.g., greater than county/city restrictions on fluid mineral development).*		
No similar management action.	No similar management action.	No similar management action.	No similar management action.	*Establish the major constraint of "CSU – Bitter Creek ACEC" for the purpose of preventing or reducing disturbance to current or future refuge resources from fluid mineral development with the following stipulation language:* *All or a portion of this lease occurs within the boundaries of the Bitter Creek ACEC and the Bitter Creek National Wildlife Refuge. No new surface disturbing activity is allowed on the lease. Furthermore, access to federal minerals within the*

Table 2.1
Alternative Fluid Minerals Management Actions

Alternative A – No Action(a)	Alternative B – Proposed Plan	Alternative C	Alternative D	Alternative E
				lease will only be allowed from off-site sources not within the Bitter Creek National Wildlife Refuge boundary. This stipulation shall not be waived, however may be granted exception or modified as follows: ***Exception**: The Authorized Officer may grant an exception if, after coordination with USFWS, an environmental review determines the action as proposed or conditioned would not impair the values present and is consistent with the management of the National Wildlife Refuge.* ***Modification:** The Authorized Officer may modify this stipulation to allow surface use on a portion or the entire lease if, after coordination with USFWS, an environmental review determines the action as proposed or conditioned would not impair the values present and is consistent with the management of the National Wildlife Refuge.*

Notes (expanded from notes section the 2014 RMP/2012 Final EIS table):
[(a)] The text describing the alternatives is taken directly from the 2014 RMP
[(b)] The langue of the CSUs, presented in italics, is taken directly from the 2014 RMP
[(c)] The California Department of Fish and Game (CDFG) changed its name to the California Department of Fish and Wildlife (CDFW) in 2013, after this text was written. To maintain consistency with the 2014 RMP/Final EIS, this text retains the original acronym.
[(d)] Revisions in the 2012 Final EIS, e.g. strikethroughs, have been retained in this table.

Key *(added to the original table for this Draft Supplemental EIS):*
2012 Final EIS = 2012 Bakersfield Final Environmental Impact Statement
ACEC = Area of Critical Environmental Concern
BLM = Bureau of Land Management
CDFG = California Department of Fish and Game
CSU = Controlled Surface Use
DOD = United States Department of Defense
MA = Management Area
NEPA = National Environmental Policy Act
NSO = No Surface Occupancy
ONA = Outstanding Natural Area
PCNST = Pacific Crest National Scenic Trail
RMP = Resource Management Plan
SHPO = State Historic Preservation Officer
SMA = Special Management Area
USFWS = United States Fish and Wildlife Service
WSA = Wilderness Study Area
WSR = Wild and Scenic River

Table 2.2
Comparison of Estimated Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
Air and Atmospheric Values	No change from 2012 Final EIS	See Section 4.1, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. Emissions from hydraulic fracturing well development are summarized in Table 4.1.1. These emission increases are minimal, with the largest being NO_X at 2.74 tons per year. Greenhouse gas emissions from hydraulic fracturing well development are summarized in Tables 4.1.5, 4.1.6, and 4.1.7.	See Section 4.1, Impacts Common to All Action Alternatives	See Section 4.1, Impacts Common to All Action Alternatives	See Section 4.1, Impacts Common to All Action Alternatives	See Section 4.1, Impacts Common to All Action Alternatives
Biological Resources	No change from 2012 Final EIS	See Section 4.2, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. On BLM surface, BMPs, SOPS, and lease stipulations, in Sections L3 and L.7, Appendix L in the 2014 RMP, would mitigate potential impacts. On non-BLM surface, constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulations. In addition, and as applicable, protective measures, mitigation, and BMPs from SB4, Chapter 313, as well as Kern County Zoning Ordinance, Chapter 19.98 (Oil and Gas Production) (Kern County 2015) would apply to mitigate potential impacts. Wells on non-BLM surface would likely be subject to additional environmental impact analysis under CEQA. Required surveys, mitigation, and monitoring from the Programmatic BO (USFWS 2017) would apply to all T&E species on BLM surface.	See Section 4.2, Impacts Common to All Action Alternatives CSU for Compensation Lands ACEC, would further reduce potential surface impacts after mitigation	See Section 4.2, Impacts Common to All Action Alternatives	See Section 4.2, Impacts Common to All Action Alternatives	See Section 4.2, Impacts Common to All Action Alternatives CSU for Bitter Creek ACEC would prevent/reduce disturbance to current or future refuge resources from fluid mineral development
Cultural Resources	No change from 2012 Final EIS	See Section 4.3, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. On both BLM and non-BLM surface: When issuing permits related to the extraction of subsurface federal minerals, federal agencies must follow National Historic Preservation Act (54 U.S.C. 306108) Section 106 guidelines and regulations and other related statutes for cultural resource compliance. This includes projects that employ hydraulic fracturing technology. Federal agencies will also follow their internal cultural resource policies, guidance documents, agreements with the California Office of Historic Preservation, and tribal agreements. This process, the application of Bakersfield Field Office BMPs, SOPS, and stipulations, as well as a full avoidance lease stipulation for NRHP eligible historic properties located within new federal leases, as outlined in Section L.6 of Appendix L in the 2014 RMP, would avoid, minimize, and mitigate adverse effects to historic properties. Federal cultural resource compliance, according to the above process, is not required for projects located on private lands absent federal involvement.	See Section 4.3, Impacts Common to All Action Alternatives	See Section 4.3, Impacts Common to All Action Alternatives	See Section 4.3, Impacts Common to All Action Alternatives	See Section 4.3, Impacts Common to All Action Alternatives

Table 2.2
Comparison of Estimated Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		For non-federally permitted projects, protection of cultural resources on State of California Lands is regulated under the California Public Resources Code (PRC), CEQA (Sec. 21083.2 and 21084.1) and may require the evaluation of effects on any project undertaken, assisted, or permitted by the state or the state's political subdivisions.				
Native American Values	No change from 2012 Final EIS	See Section 4.4, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. Impacts to Native American values would be avoided by following BLM Handbook 1780-1 *Improving and Sustaining BLM- Tribal Relations* (BLM 2016). On BLM surface, BMPs, SOPS, and stipulations, as well as full avoidance policy for cultural resources, as outlined in Section L.6 of Appendix L in the 2014 RMP, would mitigate potential impacts. On both BLM and non-BLM federal surface, when issuing permits related to the extraction of subsurface federal minerals, federal agencies must follow their specific agency guidance regarding consultation and coordination with Native peoples and at a minimum must include adherence to the National Historic Preservation Act (54 U.S.C. 306108) Section 106 guidelines and regulations, Executive Order (EO) 13007, Indian Sacred Sites; American Indian Religious Freedom Act (42 U.S.C. 21.1 Sec. 1996 and 1996a); and the Religious Freedom Restoration Act of 1993 (42 U.S.C. 21B, Sec. 2000bb et seq.). Federal agencies will also follow any existing agreements with Tribes. This includes projects that employ hydraulic fracturing technology. For non-federally permitted projects, protection of Native American values on State of California Lands and political subdivisions is under PRC Sections 5097.91 – 5097.97 that establishes a Native American Heritage Commission (NAHC), governs state and local agency cooperation with the NAHC, and creates a process to identify and protect sacred places.	See Section 4.4, Impacts Common to All Action Alternatives	See Section 4.4, Impacts Common to All Action Alternatives	See Section 4.4, Impacts Common to All Action Alternatives	See Section 4.4, Impacts Common to All Action Alternatives
Paleontological Resources	No change from 2012 Final EIS	On both BLM and non-BLM surface, potential impacts to paleontological values from permits issued in relation to extraction of subsurface federal minerals, would be addressed through guidance and policies provided in BLM Handbook H- 8270-1, General Procedural Guidance for Paleontological Resource Management and the BLM Manual MS-8270, Paleontological Resource Management. Procedures in these guidance documents are meant to satisfy the requirements of the Paleontological Resources Preservation Act subtitle (16 U.S.C. 470 aaa -470aaa-11) of the Omnibus Public Land Management Act of 2009, National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.), and other federal authorities. Potential impacts to paleontological values would also be addressed by guidance provided in the 2014 RMP and Record of Decision (BLM 2014). Paleontological Resources Decision 1 implements measures to protect paleontological resources from inadvertent damage or destruction through:	See Section 4.5, Impacts Common to All Action Alternatives	See Section 4.5, Impacts Common to All Action Alternatives	See Section 4.5, Impacts Common to All Action Alternatives	See Section 4.5, Impacts Common to All Action Alternatives

Table 2.2
Comparison of Estimated Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		• Avoidance • Fencing • Stabilization • Collection or excavation and deposit in museum repository • Interpretation, or • Administrative closure Paleontological Resources Decision 4 ensures that site-specific NEPA analysis, which may include field inventory and fossil specimen recovery, implements the Potential Fossil Yield Classification as a standard part of the review for all surface disturbing projects throughout the Decision Area. On both BLM and non-BLM surface, potential impacts to paleontological values from permits issued in relation to extraction of subsurface federal minerals, would be addressed through guidance and policies provided in BLM Handbook H- 8270-1, General Procedural Guidance for Paleontological Resource Management and the BLM Manual MS-8270, Paleontological Resource Management. Procedures in these guidance documents disturbing projects throughout the Decision Area. On non-federal lands, potential impacts to paleontological resources may be addressed through California Public Resources Code, CEQA Appendix G (Sec. 8.16.2.2) and regulations depending on the county.				
Soil Resources	No change from 2012 Final EIS	See Section 4.6, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. On BLM surface, BMPs, SOPS, and lease stipulations, in Section L.6 of Appendix L in the 2014 RMP, would mitigate potential impacts. On non-BLM surface, constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulations. In addition, and as applicable, protective measures, mitigation, and BMPs from SB4, Chapter 313, as well as Kern County Zoning Ordinance, Chapter 19.98 (Oil and Gas Production) (Kern County 2015) would apply to mitigate potential impacts. Additionally, all wells on non-BLM surface would likely be subject to additional environmental impact analysis under CEQA.	See Section 4.6, Impacts Common to All Action Alternatives	See Section 4.6, Impacts Common to All Action Alternatives	See Section 4.6, Impacts Common to All Action Alternatives	See Section 4.6, Impacts Common to All Action Alternatives
Visual Resources	No change from 2012 Final EIS	See Section 4.7, Impacts Common to All Action Alternatives Supplemental analysis indicated no substantive change from estimated impacts in the 2012 Final EIS.	See Section 4.7, Impacts Common to All Action Alternatives	See Section 4.7, Impacts Common to All Action Alternatives	See Section 4.7, Impacts Common to All Action Alternatives	See Section 4.7, Impacts Common to All Action Alternatives
Water Resources	No change from 2012 Final EIS	See Section 4.8, Impacts Common to All Action Alternatives Surface Water Use - negligible impacts due to lack of surface water in the supplemental hydraulic fracturing analysis areas.	See Section 4.8, Impacts Common to All Action Alternatives	See Section 4.8, Impacts Common to All Action Alternatives	See Section 4.8, Impacts Common to All Action Alternatives	See Section 4.8, Impacts Common to All Action Alternatives

Table 2.2
Comparison of Estimated Impacts, by Alternative

Resource/Program	Alternative A No Action	Common to all Action Alternatives	Alternative B	Alternative C	Alternative D	Alternative E
		Groundwater Use – negligible impacts in context of regional agricultural consumption Hydraulic fracturing constituent mixing and handling - Impacts to groundwater due to spills of fracturing fluids would be negligible. Injection of hydraulic fracturing fluids/flowback management and disposal – groundwater impacts from loss of well integrity or out-of-zone migration of fracturing fluids from an average of zero to four wells/year would be negligible. If present trends continue, the drilling of up to 40 wells over the 10-year planning period would also have negligible impact.				
Livestock Grazing	No change from 2012 Final EIS	See Section 4.9, Impacts Common to All Action Alternatives Supplemental analysis indicated no substantive change from estimated impacts in the 2012 Final EIS.	See Section 4.9, Impacts Common to All Action Alternatives	See Section 4.9, Impacts Common to All Action Alternatives	See Section 4.9, Impacts Common to All Action Alternatives	See Section 4.9, Impacts Common to All Action Alternatives
Minerals Management	No change from 2012 Final EIS	See Section 4.10, Impacts Common to All Action Alternatives Access to fluid mineral reserves for leasing - supplemental analysis indicated no substantive change from estimated impacts in the 2012 Final EIS. Seismicity - negligible impacts related to hydraulic fracturing or wastewater disposal.	See Section 4.10, Impacts Common to All Action Alternatives	See Section 4.10, Impacts Common to All Action Alternatives	See Section 4.10, Impacts Common to All Action Alternatives	See Section 4.10, Impacts Common to All Action Alternatives
Areas of Critical Environmental Concern	No change from 2012 Final EIS	See Section 4.11, Impacts Common to All Action Alternatives Potential short- and long-term surface disturbance from hydraulic fracturing is the same for all Action Alternatives, summarized in Table 4.2. NSOs and CSUs would provide protection to ACECs from hydraulic fracturing operations, and there would be negligible impacts.	See Section 4.11, Impacts Common to All Action Alternatives CSU for Compensation Lands ACEC would further reduce potential surface impacts after mitigation.	See Section 4.11, Impacts Common to All Action Alternatives	See Section 4.11, Impacts Common to All Action Alternatives	See Section 4.11, Impacts Common to All Action Alternatives CSU for Bitter Creek ACEC would prevent/reduce disturbance to current or future refuge resources from fluid mineral development
Social and Economic Resources	No change from 2012 Final EIS	See Section 4.12, Impacts Common to All Action Alternatives Supplemental analysis indicated no substantive change from estimated impacts in the 2012 Final EIS.	See Section 4.12, Impacts Common to All Action Alternatives	See Section 4.12, Impacts Common to All Action Alternatives	See Section 4.12, Impacts Common to All Action Alternatives	See Section 4.12, Impacts Common to All Action Alternatives

Key:
2012 Final EIS = 2012 Bakersfield Final Environmental Impact Statement
ACEC = Area of Critical Environmental Concern
BLM = Bureau of Land Management
BMP = best management practice
BO = Biological Opinion
CEQA = California Environmental Quality Act
CSU = Controlled Surface Use
NAHC = Native American Heritage Commission
NO_x = oxides of nitrogen
NSO = No Surface Occupancy
RMP = Bakersfield Field Office Resource Management Plan
SB4 = California Senate Bill 4
SOP = standard operating procedure
T&E = Threatened or Endangered
U.S.C. = United States Code

3 Chapter Three

Introduction and Overview of Planning Area

Chapter 3 of the 2012 Final EIS describes existing conditions for BLM resource programs, resource uses, special designations, and the social and economic environment in the Planning Area. The description of the affected environment uses the best and most recent data available. However, this chapter does not provide detail about environmental components that would not be affected or that are not essential to the understanding or resolution of planning issues.

Resources

3.1 Air and Atmospheric Values

The affected environment for air quality, climate, and meteorology is summarized in detail in Section 3.1 of the 2012 Final EIS. Additional regional information regarding greenhouse gases climate change is available in the *Central Coast Field Office Draft Resource Management Plan Amendment and Draft Environmental Impact Statement for Oil and Gas Leasing and Development* (Central Coast Field Office Draft RMPA/EIS) (BLM 2017).

3.1.1 Greenhouse Gases and Climate Change

The global climate depends on the presence of GHGs to naturally provide the "greenhouse effect." The greenhouse effect stems from water vapor, aerosols, CO_2, CH_4, N_2O, and other GHGs that trap heat radiated from the earth's surface. Globally, the presence of GHGs affects temperatures, precipitation, storm activity, sea levels, ocean currents, and wind patterns. Although GHGs have always been present, concentrations of CO_2 in the atmosphere have increased by more than 40 percent since the Industrial Revolution. Human activity since this time has increasingly contributed to emissions of six primary GHGs: CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

The main source of the increase in recent decades of the most important and widely occurring GHG pollutant, CO_2, is combustion of fossil fuels for energy. Natural carbon cycling by the terrestrial biosphere occurs through photosynthesis (CO_2 uptake by plants) and respiration (CO_2 release by plants, animals, and microorganisms) (U.S. GCRP 2014). Global emissions of CO_2 from fossil fuel combustion and cement production in 2011 were equivalent to 8.3 billion metric tons of carbon, 54 percent above the 1990 level (IPCC 2013). Along with CO_2, CH_4 is the second most important anthropogenic GHG in the atmosphere. CH_4 is the principal component of natural gas, which is also produced biologically under anaerobic conditions in ruminant animals, landfills, and waste handling. In addition, fertilizer use, agriculture, and changes in land are major sources of increasing CH_4 and N_2O in the atmosphere.

Each GHG has a global warming potential (GWP) that is calculated to reflect how long emissions remain in the atmosphere and how strongly the pollutant absorbs energy relative to CO_2. The GWP indicates the relative climate forcing of a given mass of emissions. CH_4 in the atmosphere over a 100-year horizon has a GWP of 25, according to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report and 28 according to the IPCC Fifth Assessment Report, meaning that 1 pound of CH_4 causes the equivalent warming potential of 25 to 28 pounds of CO_2. When quantifying GHG emissions, the different GWP of each GHG pollutant is multiplied by the mass of that pollutant to arrive at a CO_2 equivalent mass.

3.1.2 Regional Setting

The oil and gas enterprise worldwide is responsible for a large fraction of the total GHGs emitted to the atmosphere. By far the largest factor in these emissions is burning the fuel, not producing it (CCST 2014). Anthropogenic activity globally results in approximately 49,000 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) of annual GHG emissions (IPCC 2014), and the U.S. GHG inventory for 2012 was 6,526 $MMTCO_2e$ (USEPA 2015), or roughly 14 percent of the global emissions. Oil and gas production across the United States results in about 224 $MMTCO_2e$ annually (USEPA 2015), with about 18 $MMTCO_2e$ of annual GHG emissions resulting from oil and gas extraction and processing before refining in California (ARB 2018).

The Third U.S. National Climate Assessment, released on May 6, 2014, and the Fourth U.S. National Climate Assessment, released on November 23, 2018, provide authoritative and comprehensive sources of scientific information about climate-change impacts across all U.S. regions and on critical sectors of the economy.

3.1.3 Current Conditions and Trends

The effects of global climate change on California's public health, infrastructure, and natural resources are described in the *2009 Biennial Report of the California Climate Action Team* (CAT 2009) and *Our Changing Climate 2012* from the California Climate Change Center (CEC 2012). The Climate Action Team finds that "extreme events from heat waves, floods, droughts, wildfires and bad air quality are likely to become more frequent in the future and pose serious challenges to Californians. These impacts pose growing demands on individuals, businesses and governments at the local, State, and Federal levels to minimize vulnerabilities, prepare ahead of time, respond effectively, and recover and rebuild with a changing climate and environment in mind" (CAT 2009). These findings are refined in *California's Fourth Climate Change Assessment Statewide Summary Report* (Bedsworth et al. 2018), which reinforces past findings regarding the potential for more extreme events from heat waves, floods, droughts, and wildfires. These extreme climate event impacts will increase human mortality and damage to property that together will cost in the order of tens of billions of dollars.

Additional research by the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (OEHHA) identifies climate change drivers, observed changes in climate, how natural physical systems respond, and other emerging issues related to climate change. The documented effects of climate change also include impacts on terrestrial, marine, and freshwater biological systems, with resulting changes in habitat, agriculture, and food supply. Examples of the terrestrial effects include increasing tree mortality, large wildfires, and changes in vegetation density and distribution. The OEHHA categorizes climate change indicators in California as: changes in California's climate; impacts to physical systems, including oceans, lakes, rivers, and snowpack; and impacts to biological systems, including humans, vegetation, and wildlife. The primary observed changes in California's climate are increased annual average air temperatures, more frequent extremely hot days and nights, and increasingly severe drought. Impacts to physical systems affected by warming temperatures and changing precipitation patterns include decreasing snowmelt runoff, shrinking glaciers, and rising sea levels. These changes all carry the potential to impact human well being (OEHHA 2013, 2018).

3.2 Biological Resources

The affected environment for biological resources is summarized in detail in Section 3.2 of the 2012 Final EIS. New and relevant information to support this Draft Supplemental EIS was provided in the Programmatic Biological Opinion on Oil and Gas Activities on Bureau of Land Management Lands in the San Joaquin Valley (USFWS 2017).

3.2.1 Special Status Species

The affected environment for special status species is summarized in detail in Section 3.2.1 of the 2012 Final EIS.

3.2.2 Featured Species and Communities

The affected environment for featured species and communities is summarized in detail in Section 3.2.2 of the 2012 Final EIS.

3.2.3 Aquatic, Wetland, and Riparian Habitat

The affected environment for aquatic, wetland, and riparian habitat is summarized in detail in Section 3.2.3 of the 2012 Final EIS.

3.2.4 Weeds

The affected environment for weeds is summarized in detail in Section 3.2.4 of the 2012 Final EIS.

3.3 Cultural Resources

The affected environment for cultural resources is summarized in detail in Section 3.4 of the 2012 Final EIS. New and relevant information to support this Draft Supplemental EIS is provided below.

3.3.1 Archaeological Sites within the Supplemental Hydraulic Fracturing Analysis Areas

Several cultural resource inventories have been conducted within the four supplemental hydraulic fracturing analysis areas (Chapter 4, Introduction) since the publication of the 2012 Final EIS. These inventories resulted in the recordation of 501 cultural resources. Of these, 413 are sites, 67 are isolated finds, 11 are objects, and 10 are structures. Of the sites, 17 are prehistoric, three are multicomponent, and the remaining 393 are historic. Prehistoric site types include open camps, lithic scatters, shell scatters, and lithic quarries. Multicomponent sites are prehistoric lithic and shell scatters with historic refuse scatters. The majority of the historic sites are related to the historic oil fields. These sites include tanks, pipelines, and other miscellaneous infrastructure, standing well pipes, fragments of derrick and pump jack foundations, refuse and brick scatters, fragmentary structural remains, and railroad segments. The 11 resources recorded as objects and the eight recorded as structures are all related to the historic oil fields. These objects comprise capped wellheads, utility poles, and associated oil field equipment. Sites, objects, and structures recorded within the supplemental hydraulic fracturing analysis areas after the publication of the 2012 Final EIS are presented in Table A-1 of Appendix A.

Due to over a century of continuous development, many of the San Joaquin Valley oil fields, including those within the supplemental hydraulic fracturing analysis areas, have been heavily disturbed. This has

resulted in the displacement and destruction of much of the archaeological record in these areas. In addition, state mandated oil field cleanup efforts in the 1970s were extensive, resulting in the demolition, removal, and disturbance of many of the historic period oil field features and infrastructure.

As a result of these impacts, most sites within the San Joaquin Valley oil fields, including the supplemental hydraulic fracturing analysis areas, lack the degree of integrity, setting, and association necessary for inclusion in the National Register of Historic Places (NRHP). Many of the sites located within the San Joaquin Valley oil fields have not been formally evaluated for NRHP eligibility. However, based on previously conducted formal evaluations of 134 oil field sites, approximately 92 percent of sites within the supplemental hydraulic fracturing analysis areas are likely not eligible for NRHP inclusion. The majority of these comprise historic period remains, which display poor integrity and lack setting and association due to continuous oil field development. Approximately 4 percent of the recorded sites are recommended or likely eligible for inclusion in the NRHP and consist largely of prehistoric remains. The remaining 4 percent of recorded sites have not been evaluated for NRHP eligibility or the eligibility is unknown. These sites include a variety of prehistoric, historic, and multicomponent site types. It is important to note that this discussion is included in order to provide a general sense of the nature of cultural sites within the supplemental hydraulic fracturing analysis areas. During project assessments, formal NRHP evaluations would be conducted as required and all sites would be treated as eligible unless formally determined otherwise.

3.3.2 Isolated Finds within the Supplemental Hydraulic Fracturing Analysis Areas

Sixty-seven isolated finds have been recorded since the publication of the 2012 Final EIS. Thirty-nine are historic, 24 are prehistoric, and four are unknown. The historic resources consist of historic artifacts and isolated mining claim markers. The prehistoric resources consist of isolated debitage, cores, and ground stone. Isolated finds recorded within the supplemental hydraulic fracturing analysis areas after the publication of the 2012 Final EIS are presented in Table A-2 of Appendix A.

3.4 Native American Values

The 2012 Final EIS did not analyze impacts to Native American values. Therefore, the following text provides new and relevant information about these values.

Nine federally recognized Tribes and three non-federally recognized Tribes and groups have interests in and historical ties to lands within the supplemental hydraulic fracturing analysis areas. These include the Chumash, Yokuts, Mono, Shoshone, Kitanemuk, Tubatulabal, and Tejon peoples. Federally recognized Tribes include:

- Santa Ynez Band of Chumash Indians
- Tachi Yokut Tribe of the Santa Rosa Rancheria
- Big Sandy Rancheria
- Cold Springs Rancheria
- North Fork Rancheria of Mono Indians
- Table Mountain Rancheria

- Picayune Rancheria of the Chukchansi Indians
- Tejon Indian Tribe
- Tule River Reservation

Non-federally recognized groups include:

- Tubatulabal Tribe
- Northern Chumash
- Chalon Indian Nation

Each of these Native groups and Tribes have historical roots in and around the San Joaquin Valley. The Santa Ynez Band of the Chumash and the Northern Chumash are coastal groups who ranged into the western part of the San Joaquin Valley. The Chalon traditional territory is concentrated around the Soledad and Pinnacles National Monument areas. The western portion of the San Joaquin Valley is part of their historical territory. The Big Sandy Rancheria, Cold Spring Rancheria, North Fork Rancheria of the Mono Indians, Table Mountain Rancheria, and the Picayune Rancheria of the Chukchansi Indians are all Mono or Yokut peoples currently living to the north of Fresno. Historically, these peoples occupied the western slope of the Sierra Nevada and parts of the San Joaquin Valley and ranged as far south as the Tehachapi Mountains. The Tachi Yokut Tribe of the Santa Rosa Rancheria historically occupied the San Joaquin Valley and today are located in Lemoore. The Tule River Reservation and the Tejon Indian Tribe are located in the Porterville vicinity. The people of these groups occupied the western slope of the Sierra Nevada and ranged into the San Joaquin Valley. The Tubatulabal people occupy the area east of Bakersfield along the Kern River and utilized the Sierra Mountains and the San Joaquin Valley.

In the native view, landscapes, topographic features, water sources, and locations of material to make stone tools and other natural features all reflect and support the practical, social, historical, and spiritual aspects of life. Place names may reflect the location of resources, tribal histories, and links to the spiritual. Wildlife, water, and air all have a story to tell and are linked to Native peoples' relationship to the landscape on a practical, social, historical, and spiritual level (Gulliford 2000).

Scoping comments for this Draft Supplemental EIS were received from the following four federally recognized Tribes, two non-federally recognized Tribes, and three tribal nonprofit groups:

- Santa Ynez Band of Chumash Indians
- North Fork Rancheria of Mono Indians
- Table Mountain Rancheria
- Picayune Rancheria of the Chukchansi Indians
- Chalon Indian Nation
- Tribal Trust Foundation
- Wishtoyo Chumash Foundation
- Tubatulabal Tribe
- Mr. Michael Khus Zarate, Northern Chumash and Chairman Carrizo Plain Native American Advisory Committee

The concerns of these groups overlapped considerably. Most commented on the potential for air and water pollution caused by hydraulic fracturing. Potential pollution was linked to direct effects on habitat, protected species, and native vegetation. The Santa Ynez Band of Chumash Indians and Wishtoyo Chumash Foundation also expressed concern regarding links between hydraulic fracturing and climate change and degradation of the ocean environment, particularly the Santa Barbara channel that supports fish and sea mammals they consider sacred and important to the Chumash economy. Another major issue expressed is sacred sites not being considered cultural resources. These include caves, rocks, water sources, and other topographic and natural features. Finally, the Santa Ynez Band of Chumash Indians, Picayune Rancheria of the Chukchansi Indians, and the North Fork Rancheria of Mono Indians all expressed a wish to be consulted on these values and the development that may impact these values. A major concern expressed in the comment letters was that the development area maps and descriptions for the potential hydraulic fracturing sites are not available for public comment.

The BLM Bakersfield 2012 Final EIS noted several places and topographic features important to Native peoples. None of these locations are within the supplemental hydraulic fracturing analysis areas. The comment letters did not document any known or potential concerns within the supplemental hydraulic fracturing analysis areas.

3.5 Paleontological Resources

The affected environment for paleontological resources is summarized in detail in Section 3.6 of the 2012 Final EIS. New and relevant information to support this Draft Supplemental EIS is provided below.

A single paleontological resource has been documented in the supplemental hydraulic fracturing analysis areas since publication of the 2012 Final EIS. The find consists of an eroding fossil-bearing outcrop of shell, exposed in the cut slopes and bottom of a natural drainage.

3.6 Soil Resources

The affected environment for soil resources is summarized in detail in Section 3.7 of the 2012 Final EIS.

3.7 Visual Resources

The affected environment for visual resources is summarized in detail in Section 3.8 of the 2012 Final EIS.

3.8 Water Resources

The affected environment for water resources is summarized in detail in Section 3.9 of the 2012 Final EIS.

3.9 Livestock Grazing

The affected environment for livestock grazing is summarized in detail in Section 3.13 of the 2012 Final EIS.

3.10 Minerals Management

The affected environment for minerals management is summarized in detail in Section 3.14 of the 2012 Final EIS. New and relevant information to support this Draft Supplemental EIS is provided below.

3.10.1 Seismicity

Approximately 158,500 acres are considered to have high potential for oil and gas occurrence in the Planning Area. The largest area of high oil and gas potential is the San Joaquin Valley, as illustrated in Map 3-14.1 in the 2012 Final EIS. Moderate to high potential for fluid minerals exists outside the San Joaquin Valley region throughout the Coast Range; however, the southern Sierra Nevada are considered to have little to no potential for oil and gas.

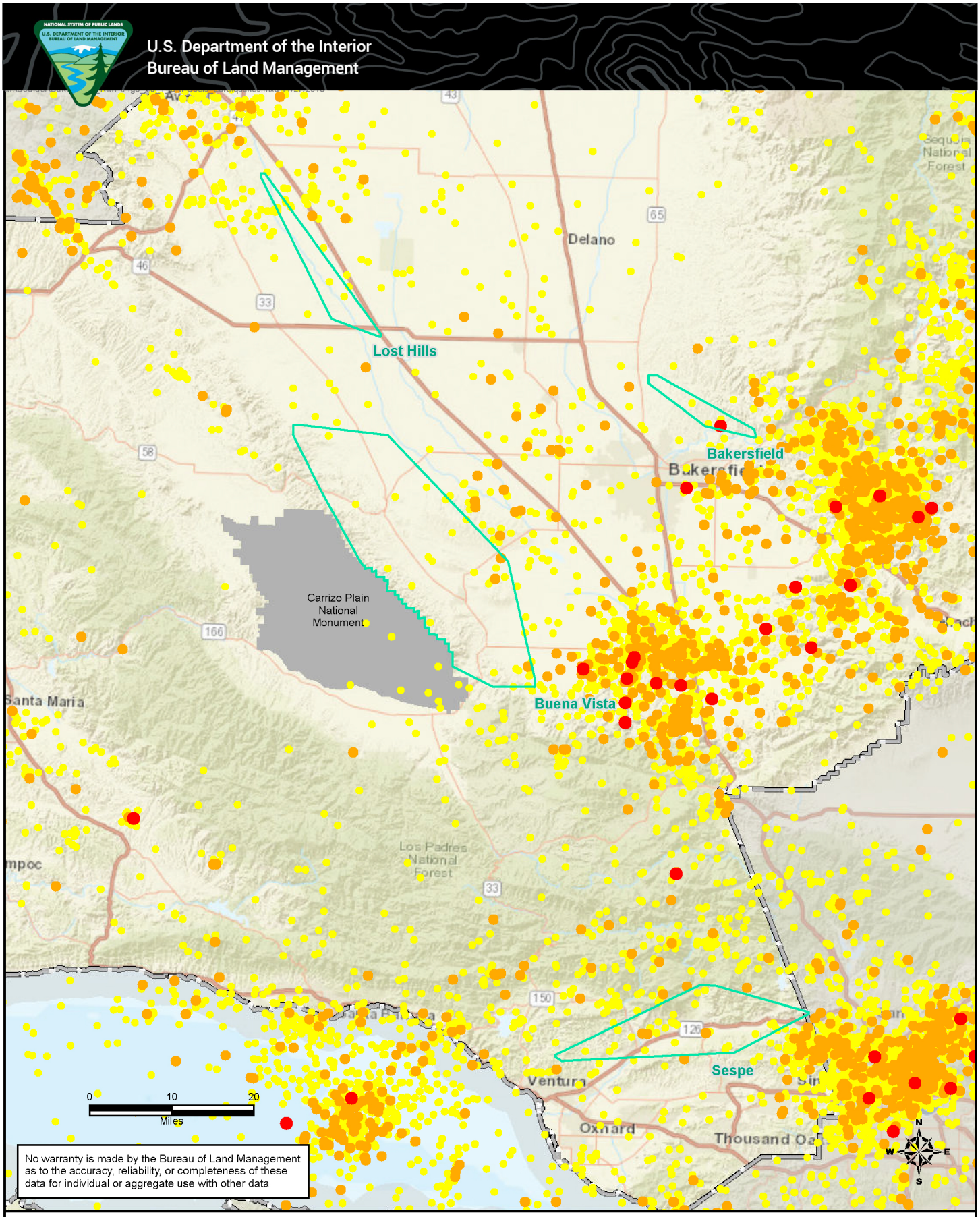
A large number of magnitude 2.5 (Richter scale) and greater earthquakes have been recorded in California (CCST 2016). The locations and magnitudes of earthquakes that have occurred in the supplemental hydraulic fracturing analysis areas are shown on Figure 3.10.1.

3.11 Areas of Critical Environmental Concern

The affected environment for Areas of Critical Environmental Concern (ACECs) is summarized in detail in Section 3.17 of the 2012 Final EIS.

3.12 Social and Economic Resources

The affected environment for social and economic resources is summarized in detail in Section 3.23 of the 2012 Final EIS.



Legend

- Carrizo Plain National Monument (Excluded from analysis)
- Bakersfield Field Office
- SHF Analysis Area - named for adjacent oil fields

Earthquake Magnitude

- 2.5 - 3.4
- 3.41 - 4.5
- > 4.5

Location and Magnitudes of Earthquakes from 1922 to 2018 within the SHF Analysis Areas
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Figure 3.10

4 Chapter Four

Introduction

Impact Analysis Process

Chapter 4 of this Draft Supplemental EIS supplements the impact analysis of resources and programs from implementation of the 2014 RMP, as fully described in Chapter 4 of the 2012 Final EIS. These impacts are categorized as direct and indirect, described by resource and program in the following sections. Cumulative impacts are discussed by the 2014 RMP planning issues in Section 4.14, below.

Direct impacts result from a specific action and occur at the same time and place as that action. Indirect impacts are caused by a specific action, but are observed later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative impacts result from the interaction of impacts of the implemented alternative with impacts resulting independently from unrelated actions and activities. For this supplemental analysis, cumulative impacts include actions related to developing fluid minerals using hydraulic fracturing within the Planning Area.

As noted in Chapter 1, an important assumption for the planning-level analysis in the 2012 Final EIS, as supplemented in this Draft Supplemental EIS, is the number of new wells expected to be drilled on new federal mineral leases, over the course of the 2014 RMP's 10-year planning scenario. Apparent contradictions regarding this parameter were noted in the 2012 Final EIS Air and Atmospheric Values analysis (Appendix A) and the 2012 Final EIS RFDS (Appendix M). This discrepancy arose from integrating the same data trends regarding a wide range of oil and gas wells drilled in a given year. The two appendices used scenarios with differing assumptions to calculate the projected number of total wells. The two discussions used different assumption scenarios to calculate the assumed number of total wells, versus total new wells on new leases, expected to be drilled annually. However, both analyses used the same range of new wells on new leases expected to be drilled in the 10-year planning scenario. This resolution is detailed in revised text in the Air and Atmospheric impact analysis of the 2012 Final EIS (Section 4.1.2), which notes: "Based on the RFD scenario, the proposed action is projected to result in an estimated 4,000 wells over the next 10-year period [*sic*] or an average of 400 wells per year. This would result in 40 new wells on new leases annually… ." Resolving this discrepancy allows the analysis of the potential impacts of hydraulic fracturing in this Draft Supplemental EIS to proceed utilizing the assumption of an average of 40 new wells on new leases per year.

Supplemental Impact Analysis Methods and Assumptions

The 2012 Final EIS impact analyses addressed direct, indirect, and cumulative impacts of potential implementation of fluid mineral management decisions in the PRMP. This conceptually included the potential use of hydraulic fracturing for completing a subset of the 400 new wells (40 per year) on new leases estimated over the 10-year life of the 2014 RMP. However, impacts from potential implementation of hydraulic fracturing were not specifically addressed in this analysis, nor did the 2012 Final EIS analyses provide an estimate of the assumed number of wells that could be hydraulically fractured.

This supplemental impact analysis necessitated numerous assumptions for the required land use planning level of analysis. First, although potential impacts from possible hydraulic fracturing were conceptually included in the 2012 Final EIS analysis, this supplemental analysis will present them as

additive to the 2012 Final EIS analysis, in order to show the work of taking a hard look at these potential impacts. Similarly, throughout this Draft Supplemental EIS, the most conservative impact assumptions were chosen to integrate into the supplemental impact analyses.

Conventional versus Hydraulic Completions Comparison

As described in Chapter 1, hydraulic fracturing is a well completion process, not a well drilling process. It is employed after a lease is issued and after an oil or natural gas well is drilled; it is conducted differently in California than in other parts of the country. The hydraulic fracturing completion technique is compared in detail to conventional well completion in Table 4.1. The parameters described for conventional well completions are provided for comparison purposes only. The hydraulic fracturing parameter values summarized in Table 4.1 are integrated into the supplemental impact analysis.

Number of Hydraulic Wells Assumption

As described in Chapter 1, the hydraulic fracturing process is not as commonly employed for well completions in the Bakersfield Field Office Planning Area as in other regions of the country. A critical assumption for this supplemental analysis is the percentage of new wells on new leases analyzed in the 2012 Final EIS that would be hydraulically fractured. BLM fluid minerals specialists conducted an analysis of existing data to determine that zero to four of these new wells on new leases would be hydraulically fractured in any given year, or 0 to 40 over the 10-year life of the 2014 RMP (Prude 2018). This analysis integrated data from DOGGR (2018b) and FracFocus (2018) databases (Prude 2018). All wells hydraulically fractured since 2011 were cross-referenced with location data. All of these wells were either in, or within a two-mile buffer, of existing oil field boundaries. Most of these wells occurred within a very small number of existing oil fields.

Surface Disturbance Assumptions

Many direct and indirect impacts may result from surface disturbance associated with oil and gas well development, including wells that are hydraulically fractured. Table 4.2 summarizes the assumed surface impacts that could occur as a result of the hydraulic fracturing of 0 to 40 wells over the 10-year life of the 2014 RMP. These assumed impacts were calculated integrating the parameters summarized in Table 4.1. It is important to note that there is no difference between the Action Alternatives in terms of the estimated disturbance areas due to hydraulically fractured wells.

Supplemental Hydraulic Fracturing Analysis Areas

Since the 2014 RMP was not vacated, and in order to address potential hydraulic fracturing–related impacts in an explicitly additive way, this supplemental analysis assumes that all of the 2014 RMP decisions remain in place. Therefore, a more refined analysis area was calculated. Given the land use planning level analysis of this Draft Supplemental EIS, it is not possible to know where potential new wells on new federal minerals leases, integrating hydraulic fracturing, would be located. Therefore, an analysis of historic data was integrated into a geospatial analysis of the Bakersfield Field Office Planning Area to create estimated supplemental hydraulic fracturing analysis areas. It is important to note that although future hydraulic fracturing is expected to occur within these analysis areas, based on the existing data, it is possible that these activities could occur on any federal mineral lease issued within the Planning Area. Potential impacts in any of these other areas would be similar in magnitude and duration to potential impacts in the supplemental hydraulic fracturing analysis areas evaluated in this Draft Supplemental EIS. The same mitigation and avoidance measures would be applied to those hydraulic fracturing activities.

Table 4.1
Comparison of Conventionally Completed Wells and Hydraulically Fractured Wells[a]

	Conventional Wells/Pads	Hydraulic Fractured Wells/Pads
Location and Area	New wells on new leases are expected to occur in the vicinity of areas where: • Lands are available for leasing; • Federal mineral leases are available for leasing; • Recoverable resource potential is moderate or high; • Interest has been expressed; and • Land has been developed for oil and gas in the past. The total estimated Decision Area is 1,172,480 acres (Table 1.2, 2012 Final EIS)	New wells on new leases that may be hydraulically fractured are expected to occur in the vicinity of areas where: • Lands are available for leasing; • Federal mineral leases are available for leasing; • Recoverable resource potential is moderate or high; • Interest has been expressed; • Land has been developed for oil and gas in the past; and • Hydraulic fracturing currently occurs. The total estimated supplemental hydraulic fracturing Analysis Area is 416,515 acres (Figure 4.1)
Pad Area: • **Short-term Surface Disturbance** • **Long-term Disturbance**	• The typical pad area is approximately 0.2 to 0.4 acres (8,712 to 17,424 square feet) (California Department of Conservation 2015). • Approximately 35% of the pad surface disturbance is short-term (0.07 to 0.14 acres; 3,049 to 6,098 square feet) (Appendix M, BLM 2012) (calculated based on 35% of 0.2 and 0.4 acres). • Approximately 65% of pad surface disturbance is long-term (0.13 to 0.26 acres; 5,663 to 11,326 square feet (Appendix M, BLM 2012) (calculated based on 65% of 0.2 and 0.4 acres). • During drilling, temporary oil, water, and gas handling equipment, such as tanks, vessels, pumps, and compressors, is typically located on the well pad (Kern County 2015).	• The typical pad area is approximately 4 acres (174,240 square feet) (California Department of Conservation 2015). • Approximately 35% of pad surface disturbance is short-term (1.4 acres; 60,984 square feet) (Appendix M, BLM 2012) (calculated based on 35% of 4.0 acres). • Approximately 65% of pad surface disturbance is long-term (2.6 acres; 113,256 square feet) (Appendix M, BLM 2012) (calculated based on 65% of 4 acres). • During hydraulic fracturing, temporary oil, water, and gas handling equipment, such as tanks, vessels, pumps, and compressors, is typically located on the well pad (Kern County 2015).
Associated Infrastructure: • **Roads** • **Pipelines**	**Roads:** • Existing roads are typically up to the last 0.5 miles to each new pad. • Each new access road comprises approximately 1.1 acres (47,520 square feet) (0.5 miles long by 18 feet wide) per new pad (Kern County 2015). **Pipelines:** • All required pipeline is typically installed within access road right-of-way. • Pipelines typically include a 4-foot corridor within a 20-foot construction corridor (Kern County 2015). **Distribution Lines:** • 467 feet of new distribution line are typically required for each new well. • Distribution lines are typically suspended from wooden poles 30 feet tall, spaced 200 feet apart. • Distribution poles are typically constructed along the existing access road rights-of-way or within the well pad area. Therefore, ground disturbance for distribution line construction is included in the new oil and gas well disturbance acreages (Kern County 2015).	Roads: • Existing roads are typically used up to the last 0.5 miles to each new pad. • Each new access road comprises approximately 1.1 acres (47,520 square feet) (0.5 miles long by 18 feet wide) per new pad (Kern County 2015). Pipelines: • All required pipeline is typically installed within access road right-of-way. • Pipelines typically include a 4-foot corridor, within a 20-foot construction corridor (Kern County 2015). **Distribution Lines:** • 467 feet of new distribution line are typically required for each new well. • Distribution lines are typically suspended from wooden poles are typically 30 feet tall, spaced 200 feet apart. • Distribution poles are typically constructed along the existing access road rights-of-way or within the well pad area. Therefore, ground disturbance for distribution line construction is included in the new oil and gas well disturbance acreages (Kern County 2015).
Well Depth	• Well depth varies from less than 1,000 feet to more than 17,000 feet. Typical exploratory wells are 5,000 to 10,000 feet (California Department of Conservation 2015).	• The average vertical depth of wells that were hydraulically fractured in California between February 2011 and 2013 was 2,688 feet (range: 890 to 14,343 feet) (California Department of Conservation 2015).

Table 4.1
Comparison of Conventionally Completed Wells and Hydraulically Fractured Wells[a]

	Conventional Wells/Pads	Hydraulic Fractured Wells/Pads
Process duration	• Drilling time depends on the depth of the formation; wells in shallower formations may take less than 24 hours to drill, while wells in deeper formations may take more than 60 days to drill (Kern County 2015). • BLM data indicate that most of the wells are typically drilled into shallow formations where little site preparation is necessary and the drilling normally takes 2 to 4 days (Appendix A, 2012 Final EIS). • Operation frequency varies from field to field, but the wells generally operate 24 hours per day, 7 days per week, and 365 days per year (California Department of Conservation 2015).	• Depending on the depth of the formation, some wells may take less than 24 hours to drill, while some wells in deeper formations may take more than 60 days to drill (Kern County 2015). • BLM data indicate that most of the wells are typically in shallow formations where little site preparation is necessary and the drilling normally only takes 2 to 4 days (Appendix A, 2012 Final EIS). • Hydraulic fracturing is considered part of the "well completion" phase. The process typically takes 1 to 2 days (California Department of Conservation 2015).
Well Lateral Reach	• All new wells on a given pad are generally close to vertical. Downhole locations are not typically greater than 200 yards (600 feet) from surface locations.	• All new wells on a given pad are generally close to vertical and downhole locations are typically not greater than 200 yards (600 feet) from surface locations. • Hydraulic fracturing in California is generally vertical as opposed to the horizontal drilling method that is employed in locations outside of California (California Department of Conservation 2015). • The length of fracture on vertical wells is not typically deeper than 200 feet (California Department of Conservation 2015).
Noise Impacts per Pad:	• Operation frequency varies from field to field, but the wells generally operate 24 hours per day, 7 days per week, and 365 days per year (California Department of Conservation 2015).	• A single day of hydraulic fracturing pumping activities typically produce sound of approximately 107 decibels. Noise typically attenuates to 80 to 90 decibels at the edge of the site (California Department of Conservation 2015).
Visual Impacts per Pad: • **Short-Term** ○ **height** ○ **duration** • **Long-Term** ○ **height** ○ **duration**	**Short-Term:** • The height of the drilling rig (tallest component) is typically 100 to 150 feet, depending on well depth (California Department of Conservation 2015). • During drilling, wells are typically drilled on a 24-hour basis. Sites are lit at night, and the rig masts are lit for aircraft safety (California Department of Conservation 2015). • Short-term impacts associated with construction would also include heavy equipment and employee vehicles (stationary and traveling to/from well pad locations), fugitive dust, etc. **Long-Term:** • Wells might produce for many years, depending upon the resource; drilling rigs are typically in place during the drilling phase only.	**Short-Term:** • The height of the drilling rig (tallest component) is typically 100 to 150 feet, depending on well depth (California Department of Conservation 2015). • During drilling, wells are typically drilled on a 24-hour basis. Sites are lit at night, and the rig masts are lit for aircraft safety (California Department of Conservation 205). • The tallest hydraulic fracturing–related unit on site is typically a 43-feet tall pump in place for limited days needed to conduct hydraulic fracturing on all wells (California Department of Conservation 2015). • Short-term impacts associated with construction would also include heavy equipment and employee vehicles (stationary and traveling to/from well pad locations), fugitive dust, etc. **Long-Term:** • Wells might produce for many years, depending on the resource. However, the drilling rig would only be in place during drilling phase.
Emissions	Projected emissions from oil and gas development typically increase above inventory, by pollutant, as follows: • Nitrogen oxide – 2.18 tons/year • Sulfur oxide – 0.41 tons/year • Reactive organic gases – 7.35 tons/year • Particulate matter less than 10 microns in diameter – 0.35 tons/year • Particulate matter less than 2.5 microns in diameter – 0.35 tons/year (Appendix A, Table A-2, 2012 Final EIS):	Projected emissions from hydraulic fracturing typically increase above inventory, by pollutant, as follows: • Nitrogen oxide – 2.18 + 2.74 = 4.92 tons/year • Sulfur oxide – 0.41 + 0.004 = 0.41 tons year • Reactive organic gases – 7.35 + 0.21 = 7.56 tons/year • Particulate matter less than 10 microns in diameter – 0.35 + 0.08 = 0.43 tons/year • Particulate matter less than 2.5 microns in diameter – 0.35 + 0.08 = 0.43 tons/year [Note: emissions calculation = conventional well development in addition to hydraulic fracturing well development]

Table 4.1
Comparison of Conventionally Completed Wells and Hydraulically Fractured Wells[a]

	Conventional Wells/Pads	Hydraulic Fractured Wells/Pads
Water Use	• Drilling activities typically use approximately 4,200 gallons of water per day. • Water sources for drilling comprise produced water, water supply wells, or public water source (Kern County 2015).	• Drilling activities typically use approximately 4,200 gallons of water, per day. • The hydraulic fracturing process typically uses 80,000 to over 200,000 gallons of water during the proppant phase and 2,730 to 12,600 gallons of fresh water or brine to flush excess proppants (California Department of Conservation 2015). • Water sources for hydraulic fracturing comprise produced water (8.8%), water supply wells (groundwater, 25.4%), or surface water from public water source (65.8%) (Kern County 2015).
Groundwater Use:	See "Water Use," above.	See "Water Use," above.
Surface Water Depletions	No surface water depletions are expected in the Bakersfield Field Office Planning Area, due to limited availability.	No surface water depletions are expected in the Bakersfield Field Office Planning Area, due to limited availability.
Water Disposal:	See "Water Use," above.	See "Water Use," above. • Flowback from hydraulic fracturing is required to be treated separately. It is typically maintained in segregated tanks and disposed of per Senate Bill 4 regulation.
Pad Construction Duration	• Pad construction typically lasts 7 to 10 days (including sump construction, if required) (California Department of Conservation 2015).	• Pad construction typically lasts 7 to 10 days (including sump construction, if required) (California Department of Conservation 2015).
Pad Operations	• Pad operations typically have a 20- to 30-year life span, but some wells in California are over 100 years old (California Department of Conservation 2015).	• Pad operations typically have a 20- to 30-year life span, but some wells in California are over 100 years old (California Department of Conservation 2015). • Hydraulic fracturing could occur at any time during a well's productive life (1 to 2 days). This most frequently occurs as soon as a well drilling is complete, or shortly thereafter.
Potential for Surface Subsidence	• Potential surface subsidence is caused by cumulative, regional activities. The potential for surface subsidence cannot be calculated for a single well or well pad.	• There is no difference between a conventional and a hydraulically fractured well or well pad, in terms of potential surface subsidence. Therefore, the potential for surface subsidence cannot be calculated for a single well or well pad.
Vehicle Trips per Pad **Drilling/Completions Operations**	**Drilling/Completions:** • Vehicle trips during the construction phase include equipment trucks, worker trips, water trucks, and product transport. • Refer to emissions assumptions, above. **Operations:** • Vehicle trips during the operations phase could include water trucking to dispose of produced water.	**Drilling/Completions:** • Vehicle trips during the construction phase include equipment trucks, worker trips, water trucks, product transport. • Refer to emissions assumptions, above. • Additional vehicle traffic for 1 to 2 days of hydraulic fracturing. **Operations:** • Vehicle trips during the operations phase could include water trucking to dispose of produced water.
Workers	• Crews of 2 to 5 workers (daytime) are typically employed to construct each well pad (California Department of Conservation 2015). • Crews of approximately 12 workers are typically employed to drill each well (Kern County 2015).	• Crews of 2 to 5 workers (daytime) are typically employed to construct each well pad (California Department of Conservation 2015). • During a standard hydraulic fracturing operation, 8 to 15 employees are typically required for each shift, and usually no more than one shift is required per day. Additional personnel from the owner operator may be on site to observe and run ancillary equipment, as necessary (Kern County 2015).

Note:
[a] When a notable difference is not identified the information related to a conventional well applies to a hydraulically fractured well

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To delineate this supplemental hydraulic fracturing analysis area, buffers were connected to a number of geospatial assumptions and overlapping data polygons. It was assumed that new hydraulically fractured wells would be located in the vicinity of previously hydraulically fractured wells. It was also assumed that new wells on new federal mineral leases that would be hydraulically fractured would also likely be located near areas designated for high resource potential, associated with BLM minerals available for leasing. Finally, areas that have been identified with expressions of interest in leasing were included in the analysis. The supplemental hydraulic fracturing analysis areas are illustrated in Figure 4.1. Acreage of each supplemental hydraulic fracturing analysis area is summarized in Table 4.3. The total area of the four supplemental hydraulic fracturing analysis areas is 416,515 acres. This represents 11 percent (312,137 acres) of BLM surface, and 4 percent (45,324 acres) of unleased federal minerals, in the Planning Area. The four supplemental hydraulic fracturing analysis areas are named for associated oil fields and are assumed to be the most likely places for locating new wells on new federal mineral leases that would be hydraulically fractured. It is important to note that this resulting supplemental analysis would be followed up with project-specific environmental impact analyses, including detailed analysis of proposed project-specific locations prior to any wells being drilled, as described below.

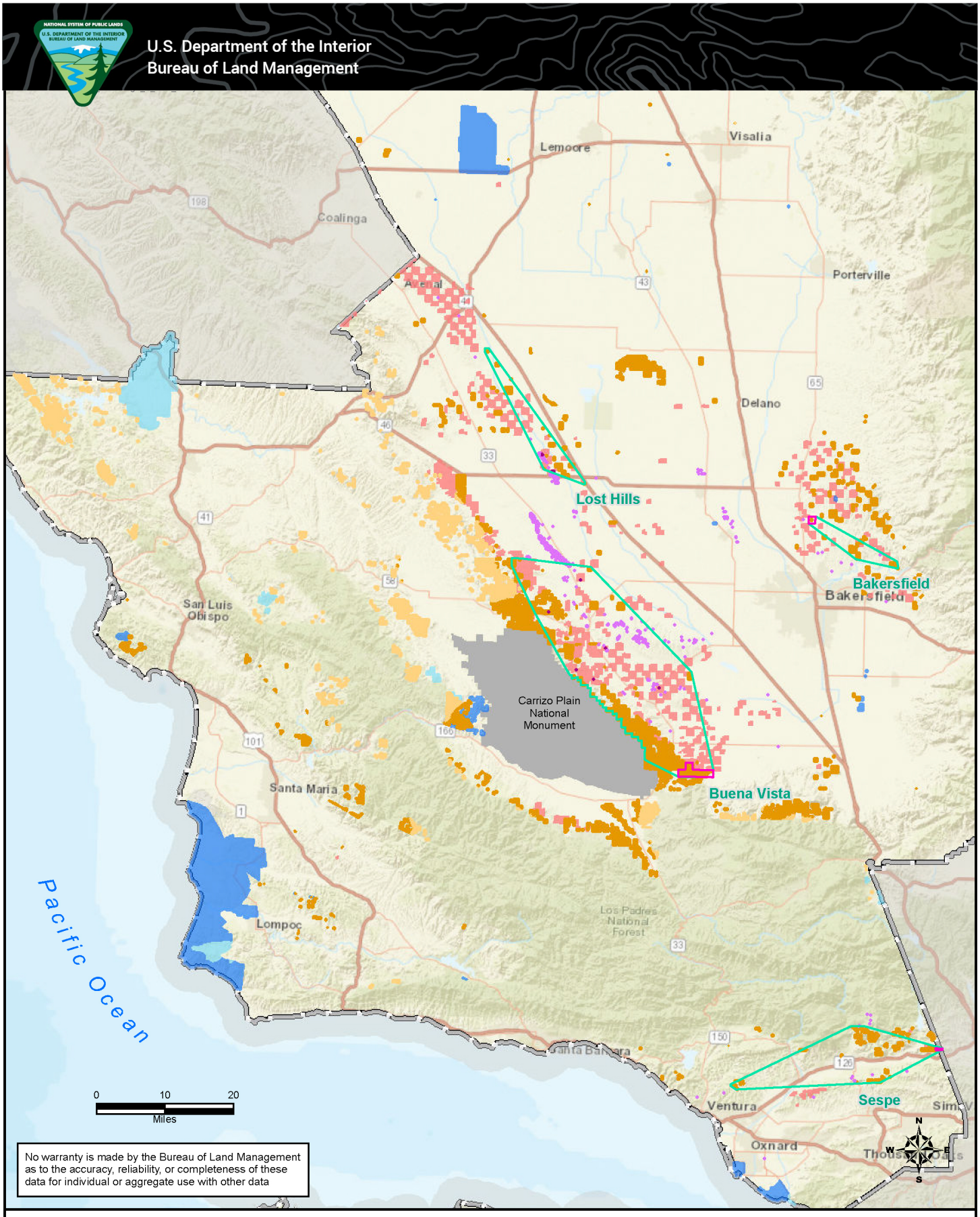
No proposed drilling operations, including hydraulic fracturing and related surface disturbance activities, may be initiated without an approved APD. This includes drilling from private surface into federal minerals. APDs on federal leases are not approved by BLM until after completion of an environmental analysis in accordance with NEPA and surface management agency requirements. An APD must be approved by an authorized BLM officer, in consultation with the surface management agency, as appropriate. On U.S. Forest Service lands, the U.S. Forest Service must approve the Surface Use Plan of Operations portion of the APD (DOI and USDA 2006).

Constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. Constraints may result from lease stipulations, BLM review and environmental analysis of proposed operations, COAs, Notices to Lessees, Onshore Orders, or regulations. This includes appropriate coordination or consultation with the State Historic Preservation Officer, Tribes, or the USFWS. BLM will offer the surface owner the same level of surface protection that BLM provides on federal surface (DOI and USDA 2006).

All leases will contain stipulations established by the 2014 RMP. An operator may request that BLM grant an exception, waiver, or modification to a lease stipulation. When proposed drilling and development are conducted on land managed by another surface management agency, BLM will forward operator requests to the surface management agency and obtain its concurrence or recommendation (DOI and USDA 2006).

Surface Management

Federal mineral leases may be developed on BLM surface, or on surface under the jurisdiction of several other entities. For the purposes of this supplemental analysis, non-BLM surface may be owned and managed by the Department of Defense, Department of Energy, State of California, counties and other local governments, USFWS, United States Forest Service, or private landholders. It is important to note that new wells on new federal mineral leases, integrating hydraulic fracturing, and developed on BLM surface would be subject to all protective measures, including lease stipulations, specified in the 2014 RMP. New wells on new federal mineral leases, integrating hydraulic fracturing, that are developed on non-BLM surface would be subject to constraints consistent with the rights granted by



Supplemental Hydraulic Fracturing Analysis Area
Bureau of Land Management
Bakersfield Field Office
DRAFT SEIS

Figure 4.1

a lease on federal minerals that may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulation. In addition, these leases would be subject to a number of other surface use plan restrictions and protective measures required by operators, as well as local, state, and federal authorities. These would include those outlined in the Draft Environmental Impact Report associated with Revisions to the Kern County Zoning Ordinance – 2015 (C), which focused on oil and gas local permitting (Kern County 2015). In addition, SB4 (2013) established a comprehensive regulatory program for oil and gas well stimulation treatments in conjunction with DOGGR, whose authority extends to regulating well stimulation treatment (WST) and WST-related activities, including hydraulic fracturing. Moreover, per SB4, DOGGR has been tasked with entering into formal agreements with certain state and local agencies regarding WST and WST-related activities to delineate each agency's authority, responsibilities, and notification and reporting requirements. DOGGR is also responsible for verifying that well operators are complying with regulations (California Department of Conservation 2015).

Table 4.2
Estimated Short- and Long-Term Surface Impacts of Wells Completed by Hydraulic Fracturing, on BLM and Non-BLM Surface

Disturbance Type	Short-term Disturbance BLM Surface[a] (acres)	Long-term Disturbance BLM Surface[a] (acres)	Short-term Disturbance Non-BLM Surface[a] (acres)	Long-term Disturbance Non-BLM Surface[a] (acres)	Total Estimated Disturbance[d] (acres)
New pads[b]	0–9.0	0–16.8	0–47.0	0–87.3	0–160.1
Roads	0–0.7	0–7.0	0–3.7	0–36.6	0–48
Pipelines	0–0.1	0	0-0.4	0	0–0.5
Distribution lines	Included above[c]	Included above[c]	Included above[c]	Included above[c]	Included above[c]
Total	**0–9.8**	**0–23.8**	**0–51.1**	**0–123.9**	**0–208.6**

Notes:
[a] Estimated for a range of 0 to 40 wells, possibly developed over the life of the 2014 RMP
[b] Assumes a single well/pad
[c] Included in pipeline area estimation
[d] Total assumes no overlap of short- and long-term disturbance areas

Table 4.3
Acreage of Supplemental Hydraulic Fracturing Analysis Areas

Analysis Area	Acreage
Lost Hills	34,029
Buena Vista	268,469
Bakersfield	17,557
Sespe	96,460
Total	**416,515[a]**

Note:
[a] Represents 312,137 acres (11%) of BLM surface, and 45,324 acres (4%) of unleased federal minerals, in the Planning Area.

4.1 Air and Atmospheric Values

4.1.1 Introduction

The projected emissions included in the 2012 Final EIS are based on conventional well development for 400 wells over the 10-year period of the 2014 RMP, or an average of 40 wells per year on new leases. The analysis in this section projects the emissions of a maximum of four conventional wells that are also hydraulically fractured per year over a 10-year period. Emissions from hydraulically fracturing occur after a well is conventionally developed. The process employs equipment not included in conventional well development. For the purposes of this analysis, emissions from hydraulic fracturing are treated as additive to the well development emissions included in the 2012 Final EIS.

The 2012 Final EIS air quality analysis is based on various activities' potential to produce emissions, including conventional well development. Similarly, the analysis performed for this Draft Supplemental EIS is based on the potential to emit regulated air pollutants from various activities analyzed in the 2012 Final EIS, plus activity required to hydraulically fracture a well. The activities analyzed in the 2012 Final EIS that have the potential to emit pollutants and impact air quality include energy (well) development, mineral development, vehicle use on unpaved roads, fire management, and livestock grazing. All of these activities currently occur on BLM-managed lands and result in pollutant emissions. This Draft Supplemental EIS analysis only focuses on changes in emissions that would occur as a result of hydraulic fracturing during energy (well) development activities associated with the various alternatives. Emissions from activities analyzed in the 2012 Final EIS that are not impacted or changed by hydraulically fracturing wells under the proposed alternatives are noted as unchanged under each alternative.

This Draft Supplemental EIS quantifies emissions of reactive organic gases (ROG), oxides of nitrogen (NO_X), particulate matter smaller than 10 microns in diameter (PM_{10}), particulate matter smaller than 2.5 microns in diameter ($PM_{2.5}$), carbon monoxide (CO), and sulfur oxides (SO_X) from well development, processing equipment, and on-road vehicle emissions associated with hydraulically fractured wells. PM_{10}/$PM_{2.5}$, ROG, and NO_X analysis is important because ROG and NO_X are ozone precursors and a large portion of the Planning Area is designated as federal nonattainment for ozone and $PM_{2.5}$ and maintenance for PM_{10}.

This Draft Supplemental EIS also addresses impacts to emissions of GHGs as a proxy for impacts to climate change from activities allowed under the analyzed alternative fluid mineral management actions. The primary GHG impacts that can be reasonably expected to occur are releases of CO_2 and CH_4 from oil and gas development and production, as well as emissions from the combustion of these fuels. It is not possible to quantify precise impacts to GHG emissions from the analyzed alternative fluid mineral management decisions because the timing, location, and project details of future development are not available. Therefore, the potential impacts from the approximately 40 new hydraulically fractured wells are estimated based on hydraulic fracturing assumptions carried forward throughout this Draft Supplemental EIS. This analysis follows the methods and assumptions used for a similar analysis developed in the Central Coast Field Office Draft RMPA/EIS (BLM 2017).

4.1.2 Analysis Methods and Assumptions

The emission estimate methodology used for this Draft Supplemental EIS consists of applying emission factors presented in publicly available studies and reports of hydraulic fracturing activities in California.

Emission factors based on per-well analysis are used in conjunction with a maximum new well development of an average of four new hydraulically fractured wells per year over the 10-year life of the plan. Well development emissions presented in the 2012 Final EIS remain part of the overall air quality analysis. As with all supplemental analyses, hydraulic fracturing emissions are added to the previously estimated total emissions, resulting in a new total emissions figure.

It is important to use hydraulic fracturing emission factors based on California activity only. The geology of the region, and the drilling techniques used, result in hydraulic fracturing being conducted differently in California than in other areas where hydraulic fracturing is highly utilized, such as the Marcellus shale region (see Section 1.5, above).

Emission factors used to estimate the emissions from hydraulic fracturing are taken from the California Department of Conservation (2015) *Analysis of Oil and Gas Well Stimulation Treatment in California, Volume II* (referred to herein as the SB4 EIR). The SB4 EIR provides emission factors for five criteria pollutants and distinguishes between on-road and off-road sources from hydraulic fracturing activity. The SB4 EIR emission factors are used due to the detail they provide and because they apply specifically to hydraulic fracturing in California.

This analysis follows the methods and assumptions used for a similar analysis developed in the Central Coast Field Office Draft RMPA/EIS (BLM 2017).

The potential GHG emissions from oil and gas development would occur in the following context:

- All activities would be conducted in compliance with applicable laws and regulations and may be subject to review for certain types of GHG emissions by the local air permitting authority.
- The oil and gas produced by the development described in the RFD Scenario would be delivered into California's existing energy supply system, which would not need to be modified to accommodate the incremental production. California is implementing, and will continue to implement, numerous State laws, policies, and programs specifically designed to reduce the demand and need for conventional energy from oil and gas resources.
- The ARB requires any operator of GHG sources in the Petroleum and Natural Gas Systems source category to quantify and report CO_2, CH_4, and N_2O emissions, when stationary combustion and process emissions equal or exceed 10,000 $MTCO_2e$ or their stationary combustion, process, fugitive, and vented emissions equal or exceed 25,000 MT CO_2e, from 17 source types on a well-pad or associated with a well-pad (17 CCR 95152(c)).
- Operators of GHG sources in the category of Petroleum and Natural Gas Systems became covered by the Cap-and-Trade Program on January 1, 2013 (17 CCR 95852.2(b)), along with other large industrial facilities, electric generating utilities, and electricity importers.
- Entities operating oil and gas production, processing, storage, and transmission compressor stations are required by the ARB through regulations approved in April 2017 (17 CCR 95665-95677) to reduce CH_4 emissions. The effects of these controls are not reflected in the current analysis estimate of directly emitted GHG.
- The GHG emissions from end-use of oil and gas produced by leasing and development activity in the Planning Area, while not technically indirect effects of that production, are nevertheless presented here, as they were in the 2012 FEIS, as "indirect effects" in order to contextualize oil and gas production from BLM-managed public lands in the Planning Area.

4.1.3 Impacts of Alternative A (No Action)

Alternative A maintains the same level of well development as it currently exists. Therefore, barring some other development, the emissions from conventional and hydraulically fractured wells would remain at the current levels. Table A-1 of the 2012 Final EIS estimates the current level of BLM well development. These emissions are taken from the actual emissions inventories from the Planning Area. They include any wells that were developed by hydraulic fracturing. No changes or additions are necessary to this table.

4.1.4 Impacts Common to All Action Alternatives

The same number of new wells would be developed by hydraulic fracturing under each of the Action Alternatives. A range of zero to four new wells per year, or up to 40 total wells over the 10-year span of the 2014 RMP, would be developed by hydraulic fracturing under Alternatives B through E. Thus, emissions due to hydraulic fracturing would remain constant across the alternatives, as did emissions from all well development as analyzed in the 2012 Final EIS. The exception to this was for emissions of fugitive particulate matter (PM) associated with varying routes available for motorized travel, which varied by alternative.

Table 4.1.1 shows the estimated annual increase in direct and indirect emissions due to hydraulic fracturing of an average of four wells per year in the Planning Area. The emission sources involved in hydraulic fracturing include off-road items such as pumping units, blenders, and cranes and on-road trucks transporting material to and from the well site. Emissions from hydraulic fracturing well development are minimal, with the largest being NO_X at 2.74 tons per year.

The 2012 Final EIS analyzed all land management decisions that would impact air emissions—for example, methane production from livestock grazing and particulate (dust) from travel management alternatives. This supplemental analysis only addresses potential changes to emissions from the development of an average of zero to four new wells a year, integrating hydraulic fracturing. In the sections below, differences between alternatives for resource management other than fluid minerals will be briefly discussed as a context for the consistent estimates of emissions changes due to hydraulic well fracturing.

Table 4.1.2 shows the estimated annual increase in emissions from conventional and hydraulically fractured well development. The estimated emissions from conventional well development are taken from Table A-2 of the 2012 Final EIS. The total increase in annual emissions from both types of wells is minor, with the largest being in ROG at 7.56 tons per year.

Table 4.1.1
Typical Annual Emissions from Hydraulic Fracturing Equipment

		ROG		NO_X		$PM_{10}/PM_{2.5}$		CO		SO_X	
Source	Wells/Year	lbs/ Well	Annual Emissions	lbs/ Well	Annual Emissions	lbs/ Well	Annual Emissions	lbs/ Well	Annual Emissions	lbs/ Well	Annual Emissions
Off-Road Equipment											
Pumps (Hydraulic Fracturing)	4	83.3	333.2	1,053.1	4,212.4	29.9	119.6	309.2	1,236.8	1.4	5.6
Blenders	4	11.0	44.0	102.1	408.4	3.4	13.6	32.9	131.6	0.1	0.4
Cranes	4	1.0	4.0	9.1	36.4	0.3	1.2	3.3	13.2	0.0	0.0
On-Road Motor Vehicles											
Heavy Duty Trucks	4	10.1	40.4	206.6	826.4	7.0	28.0	52.6	210.4	0.5	2.0
Light Duty Vehicles and Medium Trucks	4	0.5	2.0	0.6	2.4	0.1	0.4	5.1	20.4	0.0	0.0
Totals (lbs/year)		105.9	**423.6**	1,371.5	**5,486.0**	40.7	**162.8**	403.1	**1,612.4**	2.0	**8.0**
Totals (tons/year)			**0.21**		**2.74**		**0.08**		**0.81**		**0.004**

Source: California Department of Conservation 2015, Table 10.3-23.

Key:
CO = carbon monoxide
lbs = pounds
NO_X = oxides of nitrogen
$PM_{10}/PM_{2.5}$ = particulate matter smaller than 10 microns and 2.5 microns in diameter, respectively.
ROG = reactive organic gases
SO_X = sulfur oxides

Table 4.1.2
Typical Annual Emissions from Conventional and Hydraulic Fracturing Well Development

Pollutant	Baseline Emissions from BLM Activity with No Action (tons/year)	Projected Emissions Increase from Conventional Well Development[(a)] (tons/year)	Projected Emissions Increase from HF Well Development (tons/year)	Projected Total Emissions Increase (tons/year)
NO_X	409.18	2.18	2.74	**4.92**
SO_X	73.80	0.41	0.004	**0.41**
ROG	1,333.40	7.35	0.21	**7.56**
$PM_{2.5}$	63.19	0.35	0.08	**0.43**
PM_{10}	63.19	0.35	0.08	**0.43**

Note:
[(a)] Emissions are acquired by adding the projected increases for each pollutant from the three groupings of Air Pollution Control Districts in Table A-2 of the 2012 Final EIS.

Key:
BLM = Bureau of Land Management
CO = carbon monoxide
HF = hydraulic fracturing
NO_X = oxides of nitrogen
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in diameter
PM_{10} = particulate matter smaller than 10 microns in diameter
ROG = reactive organic gases
SO_X = sulfur oxides

Anticipated GHG emissions from oil and gas development include direct emissions of CO_2 due to fuel combustion by all equipment and vehicles, including drill rig engines, well pad construction equipment, temporary production flaring, remedial well work, equipment trucks, hauling of liquids, drill rig crew trucks/vehicles, portable lift equipment, portable testing equipment, and temporary production facilities. Combustion emissions also occur from equipment used during well stimulation treatments and from boilers or steam generators used during enhanced oil recovery.

Vented gases and fugitive leaks that occur during all phases of well development and production are sources of volatile organic compounds and ROG, which are regulated as air pollutants, and CH_4, although these can often be detected and cost-effectively reduced, captured, recovered, or controlled by flaring.

All Action Alternatives include development of, and production by, up to 40 hydraulically fractured wells over the over the 10-year life of the 2014 RMP. Reasonable emissions estimates for any year within the life of this plan were calculated based on four hydraulically fractured wells per year being constructed within the four supplemental hydraulic fracturing analysis areas. After the construction activities and emissions are completed, the new wells would transition into long-term operations and maintenance, when the oil and gas production activities and emissions would commence and then continue. The production-phase emissions assume that all 40 wells would transition to long-term operations and maintenance.

Table 4.1.3 quantifies the anticipated levels of GHG emissions during the years of wells being developed. Table 4.1.4 quantifies the GHG emissions from long-term operation and/or maintenance activities upon full buildout of the RFD Scenario.

The directly emitted GHGs would occur at levels well below the 25,000-$MTCO_2e$ annual threshold for mandatory reporting of GHG in the USEPA Mandatory Reporting Program (40 CFR Part 98). If combustion or process emissions for an individual production facility were to exceed 10,000 $MTCO_2e$ per calendar year, then the ARB mandatory reporting requirements would become applicable to that facility.

Table 4.1.3
Estimated Development Phase Greenhouse Gas Emissions

Development Activity (new well construction and hydraulic fracturing of four wells per year)	CO_2e ($MTCO_2e$ per year)
New Well Development with Surface Disturbance	266.8
Geophysical Exploration	76.4
Well Stimulation	436.0
Total (Development)	**779.2**

Key:
Co2e = carbon dioxide equivalent
MTCO2e = metric tons of carbon dioxide equivalent

Table 4.1.4
Estimated Production Phase Greenhouse Gas Emissions

Operations and Maintenance Activity (for estimated 40 wells over the life of the 2014 RMP)	CO_2e ($MTCO_2e$ per year)
Oil and Gas Production, combustion sources	20,000.0
Oil and Gas Production, vents, and fugitives	(included in estimated development phase emissions)
Total (Production)	**20,000.0**
Total (Development and Production)	**20,779.2**

Key:
CO_2e = carbon dioxide equivalent
$MTCO_2e$ = metric tons of carbon dioxide equivalent

Additional GHG emissions would occur as an indirect effect during transport to refiners and refining, and during the end use of oil and gas produced by hydraulically fractured wells in the Planning Area. A rough estimate of possible indirect CO_2 emissions is provided below based on the RFD Scenario, other publicly available information, and assumptions integrated into the Central Coast Field Office Draft RMPA/EIS (BLM 2017). Possible indirect emissions were estimated by assuming annual production per well of 318,718 barrels of crude oil. Table 4.1.5 estimates 221,119 $MTCO_2e$ of GHG emissions from the end use

of crude oil that could possibly be produced annually by 40 hydraulically fractured wells over the life of the 2014 RMP. Please note that all references cited in the GHG analysis in the Central Coast Field Office Draft RMPA/EIS (BLM 2017) are incorporated here by reference.

Table 4.1.5
Estimated End Use Greenhouse Gas Emissions for 40 Hydraulically Fractured Wells

End Use GHG Emissions (Reference)	CO_2 Emission Factor	Resulting Estimate of End Use Emissions	CO_2e ($MTCO_2e$ per year)
Production plus Transport (ARB LCFS and BLM 2017)	26.67 g CO_2e/MJ	—	**58,114**
End Use (IPCC 2006)	73,300 kg/TJ	352,117,532 CO_2 lb/yr	159,721
End Use (EIA 2011)	10.29 kg/gal	328,289,111 CO_2 lb/yr	148,912
End Use (USEPA 2016)	74.54 kg/MMBtu	328,178,086 CO_2 lb/yr	148,862
Estimated End Use CO_2 Emissions	(Average of End Use Values above)	**336,194,910 CO_2 lb/yr**	**152,498**
Estimated End Use GHG Emissions (CO_2e)	Include CH_4 and N_2O	—	**153,005**
Production Phase plus End Use GHG Emissions Total (CO_2e)		—	**221,119**

Sources:
ARB Calculation of 2012 Crude Average Carbon Intensity (CI) Values;
IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2, Energy, 2006;
USEPA, 2011. Voluntary Reporting of Greenhous Gases Program. Fuel Emission Coefficients Table 1 (CO_2 for Stationary Combustion);
USEPA, 2016. Mandatory Greenhouse Gas Reporting Regulation. 40 CFR Part 98, Subpart C, Table C-1. (Default HHV, CO_2 factors).
USEPA, 2019. Mandatory Greenhouse Gas Reporting Regulation. 40 CFR Part 98, Subpart C, Table C-1. (Default HHV, CO_2 factors):
USEPA, 2019. Mandatory Greenhouse Gas Reporting Regulation. 40 CFR Part 98, Subpart C, Table C-2. (Default CH_4 and N_2O Emission factors)
BLM, 2017. Central Coast Field Office Draft Resource Management Plan Amendment and Draft Environmental Impact Statement for Oil and Gas Leasing and Development

Key:
ARB = California Air Resources Board
CFR = Code of Federal Regulations
CH_4 = methane
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalent
g = grams
gal = gallons
GHG = greenhouse gases
HHV = high heat value
IPCC = Intergovernmental Panel on Climate Change
kg = kilograms
lb = pounds
LCFS = Low Carbon Fuel Standard
MJ = mega-joules
MMBtu = million British thermal units
MT = metric tons
N_2O = nitrous oxide
TJ = terajoules
USEPA = U.S. Environmental Protection Agency
yr = year

With respect to the estimate of end use CO_2 emissions, it should be noted that it is difficult to discern with certainty how transport would occur and what end uses for the fuels extracted from a particular lease might be reasonably foreseeable. For instance, some end uses of fossil fuels extracted from federal leases include combustion of transportation fuels, fuel oils for heating or industrial use, as well as production of asphalt and road oil, and the feedstocks used to make chemicals, plastics, and synthetic materials. The estimate provided in Table 4.1.5 is based on an approximation of these end uses on a national basis using the references cited. While the BLM based these estimates on state-specific transport and national data about typical end use of produced oil and gas, it is important to note that the BLM does not exercise control over the specific end use of the oil and gas produced from any individual federal lease.

The GHG emissions from oil and gas development and production, if allowed by leasing, would occur along with end use emissions from end-users of the fuels. However, these direct and end use emissions would not be likely to conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions. California's regulatory setting, including reporting of GHG and the Cap-and-Trade Program (Section 3.6.2, Regulatory Framework), provides oversight and management of GHGs directly emitted during development and production and indirectly emitted by end users of the petroleum products. The estimated GHG emissions and the associated direct and indirect impacts would be minor.

4.1.5 Conformity

Chapter 3 of the 2012 Final EIS describes the general conformity analysis required for any federal action within any nonattainment and/or maintenance area. The geographic areas and their associated plans in the Planning Area that are designated as nonattainment and/or maintenance areas are:

- San Joaquin Valley Air Pollution Control District (APCD), 2007 PM_{10} Maintenance Plan and Request for Redesignation (SJVAPCD 2007a);
- San Joaquin Valley APCD, 2007 Ozone Plan (SJVAPCD 2007b);
- San Joaquin Valley APCD, 2016 Moderate Area Plan for the 2012 $PM_{2.5}$ Standard (SJVAPCD 2016); and
- Ventura County APCD, 2016 Ventura County Air Quality Management Plan (VCAPCD 2017).

Table 4.1.6 lists the geographic areas, the attainment status of each pollutant, and the applicable control plan for that pollutant.

Table 4.1.6
Air Pollution Control District Attainment Status with Applicable Control Plans

Location (Air District)	Counties	Pollutant/Federal Attainment Status	Control Plan
San Joaquin Valley APCD	San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and a portion of Kern	Ozone / Nonattainment	2007 Ozone Plan
		NO_X / Attainment	
		SO_X / Attainment	
		$PM_{2.5}$ / Nonattainment	2016 Moderate Area Plan for the 2012 $PM_{2.5}$ Standard

Table 4.1.6
Air Pollution Control District Attainment Status with Applicable Control Plans

Location (Air District)	Counties	Pollutant/Federal Attainment Status	Control Plan
		PM_{10} / Portions are nonattainment, portions are maintenance.	2007 PM_{10} Maintenance Plan and Request for Redesignation
Ventura County APCD	Ventura	Ozone / Nonattainment NO_X / Attainment SO_X / Attainment $PM_{2.5}$ / Attainment PM_{10} / Attainment	2016 Ventura County Air Quality Management Plan
San Luis Obispo County APCD	San Luis Obispo	Ozone / Nonattainment (eastern portion) NO_X / Attainment SO_X / Attainment $PM_{2.5}$ / Attainment PM_{10} / Attainment	No control plan yet.
Santa Barbara County APCD	Santa Barbara	This area is classified as attainment/unclassified for all criteria pollutants.	Not applicable.

Key:
2012 Final EIS = 2012 Bakersfield Environmental Impact Statement.
APCD = Air Pollution Control District.
CO = carbon monoxide.
NO_X = oxides of nitrogen.
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in diameter.
PM_{10} = particulate matter smaller than 10 microns in diameter.
SO_X = sulfur oxides.

While a portion of eastern Kern County is in the Planning Area, there is no oil and gas development activity in this area. Therefore, the Eastern Kern APCD plans are not evaluated for associated pollutants in the 2012 Final EIS or in this Draft Supplemental EIS.

Chapter 4 of the 2012 Final EIS describes BLM's 10-step process to comply with federal conformity requirements. This process was followed for this Draft Supplemental EIS to determine the conformity of the hydraulically fractured wells. The 10 steps are: (1) Determine spatial and jurisdiction applicability; (2) Describe State Implementation Plan (SIP) status and content; (3) Develop any necessary background information; (4) Develop air quality impact analysis; (5) Compare activity to applicable SIP provisions and rules; (6) Develop a conclusion statement; (7) Prepare a formal determination; (8) Conduct an agency/public review; (9) Submit the determination to appropriate regulatory agencies; and (10) Archive the results. Similar to the analysis in the 2012 Final EIS, steps 1 through 6 have been completed as part of this Draft Supplemental EIS in accordance with 40 CFR 93.153 (b)(1&2). Steps 7 through 10 of this

process will not be completed because the total direct and indirect emissions are less than *de minimis* levels.

The emissions increases for conventional well development are broken into three groups according to APCDs in Table A-2 of the 2012 Final EIS in order to compare nonattainment/maintenance area increases to *de minimis* emission increase levels in those areas. Projected emissions from hydraulically fracturing an average of four wells per year were calculated for the entire Planning Area, as shown in Table 4.1.2, above. To obtain a total value of projected emissions (conventional well development plus hydraulically fractured well development), the annual maximum emissions for hydraulic fracturing were added to each group of conventional well development emissions. This was done since it is possible that average of the four-per-year hydraulically fractured wells could all occur in one of the three APCDs. Thus, this conservative estimate provides a total maximum emissions if all hydraulically fractured wells were developed in one APCD in one year. These totals are then compared to *de minimis* thresholds for the nonattainment APCD. This conservative analysis shows total projected emissions to be below *de minimis* thresholds, as shown in Table 4.1.7. As a result, the conformity analysis is complete and no conformity determination is required.

It should be noted that for CO, each of the APCDs is designated as a maintenance area within the Planning Area; however, CO was not quantified in the 2012 Final EIS since it is not listed in the existing emissions inventories for oil and gas production sources.

4.1.5.1 Prevention of Significant Deterioration

The federal Prevention of Significant Deterioration (PSD) program is a New Source Review program for major sources that are located in areas designated as in attainment with the National Ambient Air Quality Standards. PSD applies to both attainment and unclassifiable areas and PSD permitting requires the use of best available control technology, air quality modeling analysis, and public involvement or comment. None of the Action Alternatives proposed currently would require PSD permitting; however, if BLM-proposed actions resulted in emissions that met major source thresholds, a PSD review would have to be conducted and the relevant air quality permits would have to be issued prior to operations.

4.1.5.2 Climate Change

Chapter 4 of the 2012 Final EIS discusses climate change in general and annual temperature change in the Planning Area specifically. Oil and gas development, vehicle fuel usage, and site abandonment are some of the processes involved in hydraulic fracturing that create GHGs such as CO_2, CH_4, and N_2O. While minor GHG emissions would occur from well development, GHGs are not quantified for conventional well development in the 2012 Final EIS. GHG emissions estimated for 40 hydraulically fractured wells are discussed above and summarized in Tables 4.1.3, 4.1.4, and 4.1.5.

Table 4.1.7
Annual Emissions Increase by Air Pollution Control Districts Compared to General Conformity *De Minimis* Thresholds

Location (Air District)	Pollutant	Projected Emissions Increase from Conventional Well Development (tons/year)	Projected Emissions Increase from HF Well Development[(a)] (tons/year)	Projected Total Emissions Increase (tons/year)	Applicable General Conformity *De Minimis* Threshold[(b)] (tons/year)	Comments
San Joaquin Valley APCD	NO_X	2.06	2.74	**4.80**	10	This area is classified as extreme nonattainment for 8-hour ozone and moderate nonattainment for $PM_{2.5}$; maintenance for PM_{10}.
	SO_X	0.37	0.004	**0.38**	10	
	ROG	6.78	0.21	**6.99**	10	
	$PM_{2.5}$	0.34	0.08	**0.42**	100	
	PM_{10}	0.34	0.08	**0.42**	100	
Ventura County APCD	NO_X	0.06	2.74	**2.80**	50	This area is classified as serious nonattainment for 8-hour ozone.
	SO_X	0.01	0.004	**0.02**	50	
	ROG	0.38	0.21	**0.59**	50	
	$PM_{2.5}$	0.01	0.08	**0.09**	NA	
	PM_{10}	0.01	0.08	**0.09**	NA	
San Luis Obispo County APCD	NO_X	0.03	2.74	**2.77**	100	This area is classified as marginal nonattainment for 8-hour ozone.
	SO_X	0.01	0.004	**0.01**	100	
	ROG	0.09	0.21	**0.30**	100	
	$PM_{2.5}$	0.003	0.08	**0.08**	NA	
	PM_{10}	0.003	0.08	**0.08**	NA	

Table 4.1.7
Annual Emissions Increase by Air Pollution Control Districts Compared to General Conformity *De Minimis* Thresholds

Location (Air District)	Pollutant	Projected Emissions Increase from Conventional Well Development (tons/year)	Projected Emissions Increase from HF Well Development[(a)] (tons/year)	Projected Total Emissions Increase (tons/year)	Applicable General Conformity *De Minimis* Threshold[(b)] (tons/year)	Comments
Santa Barbara County APCD	NO_X	0.03	2.74	**2.77**	NA	This area is classified as attainment for criteria pollutants.
	SO_X	0.01	0.004	**0.01**	NA	
	ROG	0.09	0.21	**0.30**	NA	
	$PM_{2.5}$	0.003	0.08	**0.08**	NA	
	PM_{10}	0.003	0.08	**0.08**	NA	

Notes:

[(a)] HF emissions were not calculated by air districts like the conventional well development emissions. For the purpose of comparing total emissions from conventional and hydraulically fractured wells to *de minimis* thresholds, the assumption was made that the wells developed in a year would all be in the same APCD. Even with this conservative emissions estimate, none of the projected emissions equaled or were greater than the applicable *de minimis* thresholds. See Sections 4.1.2 and 4.1.5.

[(b)] USEPA 2017.

Key:
APCD = Air Pollution Control District.
CO = carbon monoxide.
HF = hydraulic fracturing.
NA = not applicable, area is in attainment
NO_X = oxides of nitrogen.
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in diameter.
PM_{10} = particulate matter smaller than 10 microns in diameter.
ROG = reactive organic gases.
SO_X = sulfur oxides.

4.1.6 Impacts of Alternative B

As noted above, the air quality impacts of hydraulically fracturing an average of four wells per year is the same for all Action Alternatives for all pollutants except for fugitive PM. Fugitive PM is slightly different for Alternative B, compared to other Action Alternatives, due to a difference in route miles available for motorized use compared to other alternatives. Changes discussed in the 2012 Final EIS for Alternative B that would result in changes from baseline emissions under Alternative A (No Action) are:

- Reduction in miles of routes available for motorized vehicle use;
- Reduction in the amount of non-energy minerals activity; and
- Slight increase in livestock grazing activity.

The 2012 Final EIS shows a decrease in total PM emissions of 16.1 percent from the baseline for travel associated with conventional well development and any hydraulically fractured well development included in the baseline. For this land use planning level analysis, route miles available for motorized vehicle use and the daily trip count for hydraulic fracturing are not specifically available. However, it is assumed that a decrease in the mileage of available routes would lead to a corresponding decrease in $PM_{2.5}$ and PM_{10} fugitive emissions compared to Alternative A. The inclusion of hydraulic fracturing emissions does not affect this conclusion since hydraulic fracturing has no effect on the route miles assumed for this alternative.

The 2012 Final EIS addressed PM_{10} emissions from non-energy minerals activity. This assumption is unchanged in this Draft Supplemental EIS since the assumption is not affected by inclusion of hydraulic fracturing.

The 2012 Final EIS addressed PM_{10} emissions from livestock grazing. This is unchanged in this Draft Supplemental EIS since it is not affected by inclusion of hydraulic fracturing.

4.1.7 Impacts of Alternative C

As noted above, the air quality impacts of hydraulically fracturing an average of four wells per year is the same for all Action Alternatives for all pollutants except for fugitive PM. Fugitive PM is slightly different for Alternative C (compared to Alternatives B and E) due to a difference in route miles available for motorized use. Changes discussed in the 2012 Final EIS for Alternative C that would result in changes from baseline emissions under Alternative A (No Action) are:

- Reduction in miles of routes available for motorized vehicle use;
- Reduction in the amount of non-energy minerals activity; and
- Slight increase in livestock grazing activity.

Alternative C would decrease route miles from 1,895 to 656 miles, which is a decrease of approximately 65 percent. The 2012 Final EIS shows a corresponding decrease in total PM emissions from the baseline. The inclusion of hydraulic fracturing emissions does not affect this conclusion since hydraulic fracturing has no effect on the route miles assumed for this alternative.

The 2012 Final EIS addressed PM_{10} emissions from non-energy minerals activity. Although the emissions decrease is not quantified in the 2012 Final EIS for non-energy mineral activity, the 2012 Final EIS analysis assumed that the 59 percent decline in activity would lead to a corresponding decline in PM_{10}

emissions (compared to Alternative A) from non-energy mineral activity. This is unchanged in this Draft Supplemental EIS since it is not affected by inclusion of hydraulic fracturing.

The small increase in livestock grazing in Alternative C from the baseline activity was assumed in the 2012 Final EIS to lead to a corresponding increase in PM_{10} emissions. PM_{10} emissions from grazing activities are not quantified in the 2012 Final EIS but were considered minor; thus, any emissions increase resulting from grazing was expected to be *de minimis.* The inclusion of hydraulic fracturing emissions does not affect this conclusion since this has no effect on grazing.

4.1.8 Impacts of Alternative D

As noted above, the air quality impacts of hydraulically fracturing an average of four wells per year is the same for all Action Alternatives for all pollutants except for fugitive PM. For other resource management, Alternative D is the same as Alternative C except that livestock grazing is completely eliminated. The air quality impact of hydraulically fracturing four wells per year is the same for all alternatives except for fugitive PM. The fugitive PM impact for Alternative D is the same as Alternative C. Changes discussed in the 2012 Final EIS for Alternative D that would result in changes from baseline emissions under Alternative A (no action) are:

- Reduction in miles of routes available for motorized vehicle use;
- Reduction in the amount of non-energy minerals activity; and
- Elimination of livestock grazing activity.

Alternative D would decrease route miles from 1,895 to 656 miles, which is a decrease of approximately 65 percent. The 2012 Final EIS shows a corresponding decrease in total PM emissions from the baseline. The inclusion of hydraulic fracturing emissions does not affect this conclusion since hydraulic fracturing has no effect on the route miles assumed for this alternative.

The 2012 Final EIS addressed PM_{10} emissions from non-energy minerals activity. Although the emissions decrease is not quantified in the 2012 Final EIS for non-energy mineral activity, the addition of hydraulic fracturing does not change the 2012 Final EIS's conclusion with regard to emissions from non-energy mineral activity.

The elimination of livestock grazing in Alternative D would lead to the complete elimination of PM_{10} emissions due to grazing activity. The inclusion of hydraulic fracturing emissions does not affect this conclusion since this has no effect on grazing.

4.1.9 Impacts of Alternative E

As noted above, the air quality impacts of hydraulically fracturing an average of four wells per year is the same for all Action Alternatives for all pollutants except for fugitive PM. Fugitive PM is slightly different for Alternative E, compared to the other Action Alternatives, due to route miles available for motorized use. Changes discussed in the 2012 Final EIS for Alternative E that would result in changes from baseline emissions under Alternative A (No Action) are:

- Reduction in miles of routes available for motorized vehicle use;
- Reduction in the amount of non-energy minerals activity; and
- Slight increase in livestock grazing activity.

Alternative E would decrease route miles from 1,895 to 1,683 miles, which is a decrease of approximately 11 percent. The 2012 Final EIS shows a corresponding decrease in total PM emissions from the baseline. The inclusion of hydraulic fracturing emissions does not affect this conclusion since hydraulic fracturing has no effect on the route miles assumed for this alternative.

The 2012 Final EIS addressed PM_{10} emissions from non-energy minerals activity. Although the emissions decrease is not quantified in the 2012 Final EIS for non-energy mineral activity, the 2012 Final EIS assumed that the 32 percent decline in activity would lead to a corresponding decline in PM_{10} emissions. This is unchanged in this Draft Supplemental EIS since it is not affected by inclusion of hydraulic fracturing.

The small increase in livestock grazing in Alternative E from the baseline activity was assumed in the 2012 Final EIS to lead to a corresponding increase in PM_{10} emissions. PM_{10} emissions from grazing activities were not quantified in the 2012 Final EIS but were considered minor; thus, any emissions increase resulting from grazing were expected to be *de minimis.* The inclusion of hydraulic fracturing emissions does not affect this conclusion since this has no effect on grazing.

4.2 Biological Resources

4.2.1 Introduction

Biological resources include the plant and animal species and populations—including upland vegetation and riparian/wetland areas, terrestrial and aquatic wildlife, special status plants and significant plant communities, special status fish and wildlife species, including natural communities, and ecosystem processes—that occur within the Planning Area. For the purposes of this Draft Supplemental EIS, special status species of both plants and animals include those listed as Sensitive by the BLM California State Office, as well as species listed under the Endangered Species Act as Threatened or Endangered (T&E), or their Designated Critical Habitat. In this analysis, vegetation resources will be discussed first, followed by wildlife resources. Finally, special status species, both plant and wildlife, will be discussed.

4.2.2 Analysis Methods and Assumptions

The analysis conducted for this Draft Supplemental EIS focused on the potential direct and indirect impacts that would result from hydraulic fracturing on species, populations, and habitats within the supplemental hydraulic fracturing analysis area (Figure 4.1). Direct and indirect impacts on biological resources could result from hydraulic fracturing actions that physically alter, damage, or destroy habitat; disrupt essential behaviors such as feeding, breeding, and sheltering; or result in injury or mortality to plants or animals. Direct impacts occur as a direct result of management actions, at the same time and place as those actions. Indirect impacts occur later in time or in a different location than the original action.

Since the issuance of the 2012 Final EIS in 2012, new and relevant information has become available to incorporate into this Draft Supplemental EIS analysis. On December 22, 2017, the USFWS issued a Programmatic BO on oil and gas activities on BLM lands in the San Joaquin Valley (USFWS 2017). The BO covers surface and subsurface lands administered by the BLM Bakersfield Field Office, in Kings and Kern Counties and a small portion of San Luis Obispo County. It covers individual actions or groups of actions

by a single applicant within a given lease and/or section that, within a given fiscal year, disturb less than 10 acres of habitat or, for linear actions, is less than 10 miles long.

The BO addresses mitigation of impacts on T&E species, including the endangered San Joaquin kit fox (*Vulpes macrotis mutica*), blunt-nosed leopard lizard (*Gambelia sila*), giant kangaroo rat (*Dipodomys ingens*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), Kern mallow (*Eremalche kernensis*), San Joaquin wooly-threads (*Monolopia congdonii*), California jewelflower (*Caulanthus californicus*), and Bakersfield cactus (*Opuntia basilaris* var. *treleasei*).

Estimated surface disturbance from construction of well pads, roads, and pipelines associated with the potential of 0 to 40 hydraulically fractured wells is summarized in Table 4.2. These disturbance estimates are provided as short and long-term, as well as by BLM surface and non-BLM lands. Because specific locations of potential hydraulically fractured wells within the supplemental hydraulic fracturing analysis area are unknown, estimated disturbance areas used in this analysis are assumed to be distributed among biological resources in proportion to the estimated relative acreage.

The analysis assumes that BLM would require all applicable lease stipulations (Table 2.1, above, and Appendix G of the 2012 Final EIS), as well as appropriate BMPs listed in Appendix L of the 2012 Final EIS, to be implemented for all surface-disturbing activities on BLM lands. In addition, BLM would require that public lands are to be restored. Additional actions on private lands such as placement of conservation easements, purchase of credits at conservation banks, or transfer to BLM, USFWS, or the California Department of Fish and Wildlife to be managed for listed species may be required. The BO details these conditions, including conservation measures, monitoring requirements, qualifications, reporting, and species survey requirements.

Where hydraulically fractured wells would be located on non-BLM surface, constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulations. The operator would also be required to comply with all applicable Federal, State, and local laws and regulations.

It is important to note that impacts resulting from proposed surface-disturbing activities on BLM surface associated with a specific oil and gas development, that may include hydraulic fracturing, will be evaluated by site-specific NEPA analyses. Similarly, proposed surface-disturbing activities on non-BLM surface may be evaluated by other federal agency, project-specific NEPA analyses, or CEQA.

4.2.2.1 Upland Vegetation and Riparian/Wetland Areas

For this analysis, a distinction is made between upland vegetation and areas classified as riparian/wetland areas. Additionally, noxious weeds are considered a separate vegetation category.

Direct impacts to upland vegetation could include disruption or removal of rooted vegetation, resulting in a reduction in areas of native vegetation, reduction in total numbers of plant species (species richness) within an area, and/or reduction in or loss of total area, diversity, structure, or function of wildlife habitat. Direct impacts to riparian/wetland areas may include those described for upland vegetation, as well as increased sedimentation due to local surface disturbance, soil and bank erosion, and changes to channel morphology. The potential for environmental impacts to vegetation resources is

assumed proportional to the area available for surface-disturbing activities, such as hydraulic fracturing, under each alternative. The larger the area of potential surface disturbance, the greater the potential for direct and indirect impacts to vegetation resources.

Potential indirect impacts to all vegetation types could include disruption or reduction of pollinator populations, loss of habitat suitable for colonization due to surface disturbance, introduction of noxious weeds by various vectors or conditions that enhance the spread of weeds, and general loss of habitat due to surface occupancy, surface compaction, or trampling. Upgradient physical disruption can result in sedimentation to vegetated areas. Failed reclamation or mitigation may also cause indirect impacts to these resources. Potential indirect impacts to riparian/wetland areas include disruption of hydrological processes, decreased ability to trap sediments and nutrients and moderate surface flow, decreased infiltration for groundwater recharge, increased run-off, and focused grazing pressure or wildlife use in less impacted riparian/wetland areas. Additional indirect impacts from increased erosion and sedimentation could occur to riparian/wetland areas located down gradient from surface disturbances, even if the resource itself may be purposely avoided to reduce direct impacts. Most indirect impacts to vegetation resources are assumed to result from direct impacts in proportion to the relative amount of surface disturbance.

Noxious Weeds

Potential negative indirect impacts regarding noxious weeds may include introduction of noxious weeds by various vectors or conditions that enhance the spread of weeds, resulting in degraded vegetation communities and/or complete loss of native habitat.

4.2.2.2 Terrestrial and Aquatic Wildlife

In general, the occurrence, abundance, and distribution of wildlife are most strongly affected by habitat type, quality, and accessibility. All of these habitat characteristics may be altered as a result of increased human activity and resource development, as well as by resource management activities aimed at specific wildlife or other environmental concerns.

Direct habitat loss occurs when required life-sustaining conditions for biological organisms are lost. This can occur from activities such as direct removal of vegetation, soil excavation, topsoil removal, crushing shrubs or other woody vegetation, destroying biological soil crusts, or off-road driving that result in topsoil impacts. Removal or other negative impacts to vegetation affect wildlife by reducing the extent or quality of habitat in terms of food, cover, and structure (e.g., bedding, nesting, or perching). Impacts to soils result in changes to soil structure and fertility. These changes may inhibit the reestablishment of vegetation in the future. These impacts are quantified by calculating the amount of habitat loss for any given action. For example, removal of an area of vegetation for construction of a road or well pad removes habitat value for that affected area of many wildlife habitat values.

Habitat loss can be characterized by the duration of the impact. In the example above, some of this surface disturbance would result in temporary habitat loss from short-term disturbance that would be reclaimed and returned to pre-construction habitat conditions. Permanent habitat loss results from long-term disturbance that would not be returned to usable habitat conditions.

Modifications in habitat are generally less obvious and less severe than losses of habitat, but can become important, especially if numerous small impacts accumulate across large areas. Examples include removal of forage and trampling of soils by domestic livestock, invasions of weeds in areas

where native plant vigor or cover is reduced, and removal of tree cover during timber harvesting. Modification of aquatic habitats can also occur from increased human use and resource development, including diversions for agricultural and other uses. Low-water crossings or culverted crossings of roads can create impassable segments that interfere with upstream-downstream movement by fish and aquatic macroinvertebrates.

Habitat fragmentation is increasingly recognized as an important, and often the most important, impact of human population growth and associated development on wildlife. Impacts of habitat fragmentation result from the reduced size of individual habitat blocks and the increased percentage of "edge" on smaller blocks as compared to larger blocks.

In addition to the potential effects of reduced patch size, increased edge, and shifts in vegetation composition associated with habitat fragmentation are impacts associated with increased human activity. This is because most sources of habitat fragmentation (e.g., roads, trails, timber clear-cuts, conversion of habitats to agricultural or residential uses, and energy developments) are also associated with increased levels of human activity. While some species are more tolerant of human activity than others, virtually all species have some threshold of disturbance above which they would abandon an area, or use it at a reduced level.

As with habitat loss, habitat modifications are often characterized by an area of surface disturbance, buffered with an area that is influenced by the disturbance. The temporal impacts of habitat modification are also described by duration, as temporary or short-term versus permanent or long-term.

Habitat loss or modification, habitat fragmentation, and disturbance impacts can also affect wildlife by altering important daily or seasonal movement patterns. These patterns may be altered through shifts to avoid human activity, to avoid crossing open areas that provide inadequate cover, or to circumvent a physical barrier (e.g., fences and steep road cuts).

Harassment is an extreme type of disturbance and involves intentional actions to frighten or chase a species. Because wildlife react more severely to directed movements by people rather than incidental movements, the magnitude and duration of the displacement is generally greater. This increases the risk of injury to the fleeing animal, placing greater stress on the animal by increasing metabolic rates and creating more prolonged disruption in behavior and habitat use.

Direct mortality can also result in areas of increasing human use due to crushing, entombment, vehicle strikes, electrocution of raptors on utility lines, increased likelihood of illegal hunting, or inadvertent trampling of nests.

4.2.2.3 Special Status Plants and Significant Plant Communities

Potential direct impacts to special status plants and significant plant communities include the physical disruption or removal of rooted vegetation or disruption of habitat in the immediate vicinity of rooted plants. Direct impacts also may include disruption of a plant community that results in the reduction of total numbers of plant species (species richness) within an area, and/or reduction or loss of total area, diversity, structure, and/or function of a community. Potential indirect impacts include disruption or reduction of pollinator populations; disruption of hydrological processes (particularly in relation to wetlands and riparian habitat); loss of habitat suitable for colonization due to surface disturbance; and disturbance to vegetation from dust generation and from herbicide use and drift.

4.2.2.4 Special Status Fish and Wildlife Species

Potential impacts to special status fish and wildlife species may include direct mortality and reduction or extirpation of a population; habitat loss or modification; habitat fragmentation or disturbance; and interference with movement pattern. These impacts can reduce numbers of one or more species, potentially to the point of local extirpation; disrupt community composition and function through changes in the distribution, relative abundance, and habitat use of various species (e.g., reduced prey abundance affects predator abundance); and make populations and communities hypersensitive to other perturbations. For example, increased habitat fragmentation can make forest-interior species more vulnerable to disturbance by reducing patch size, increasing the amount of edge, and increasing accessibility to predators or (in the case of songbirds) nest parasitism by brown-headed cowbirds.

4.2.3 Impacts of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic fracturing in the context of their respective management situations. The current supplemental analysis does not apply to the no action alternative, which is used as a baseline for comparative effects.

4.2.4 Impacts Common to All Action Alternatives

Different areas would be open to fluid mineral leasing under each of the Action Alternatives; however, estimated short- and long-term surface impacts from hydraulic fracturing are the same (Table 4.2). These would result in the same estimated impacts to biological resources, discussed below. Up to approximately 210 of the 416,515 acres in the supplemental hydraulic fracturing analysis area could be impacted by hydraulic fracturing operations (Table 4.2).

Based on the analysis assumptions described above, approximately 0 to 9.8 acres of short-term disturbance and 0 to 23.8 acres of long-term disturbance to BLM surface would be expected from hydraulic fracturing activities over the 10-year life of the 2014 RMP (Table 4.2). The surface impacts from hydraulic fracturing operations would affect approximately 0 to 51.1 acres on non-BLM surface in the short-term and 0 to 123.9 acres on non-BLM surface in the long-term. These disturbance areas could include both direct and indirect impacts to biological resources.

Controlled Surface Use (CSU) and No Surface Occupancy (NSO) stipulations would restrict potential well locations, based on the presence of protected resources. The major stipulation of NSO – General, which prohibits surface disturbance on an entire lease, would be established for the purpose of minimizing or eliminating adverse effects on unique or significant natural resources that are incompatible with fluid mineral development. The major stipulation CSU – Sensitive Species would be established for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on federal candidate, state-listed, and BLM-listed sensitive species. All of the Action Alternatives include numerous additional CSUs for the protection of specific biological resources such as raptors, critical habitat, priority species, plant communities, and habitats, as summarized in Table 2.1. These create additional, often overlapping protections for biological resources from disturbance or impact from potential hydraulic fracturing activities.

4.2.4.1 Upland Vegetation and Riparian/Wetland Areas

The analysis integrates the assumption that all NSO and CSU stipulations for resources would be applied in accordance with the 2014 RMP, reducing potential impacts to vegetation communities and wildlife habitat. Disturbance would be minimized on areas with ecologically important resources by compliance with requirements outlined in the Programmatic BO, as well as appropriate BMPs (Appendix L) and conditions in Appendix G and Appendix B of the 2012 Final EIS. In addition, it is assumed that any entity causing a permitted ground-disturbing activity would comply with specified reclamation and revegetation practices, as well as annual monitoring and reporting, until BLM deems that success criteria are achieved.

Mitigation would be required to replace vegetation communities permanently or temporarily altered by hydraulic fracturing activities. Where hydraulically fractured wells are located on non-BLM surface, constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulations. The operator would also be required to comply with all applicable Federal, State, and local laws and regulations. Under Alternative B, a number of NSO and CSU stipulations established by the 2014 RMP would protect relevant and important values from adverse effects associated with fluid mineral development. These stipulations would provide protection from long-term ground-disturbing activities and additional protection to relevant and important habitat. In addition, some hydraulic fracturing operations could result in negligible indirect impacts.

Since it is unknown where these impacts would occur, the assumption is that future applicants would propose surface-disturbing activities to be located in such a way as to avoid riparian/wetland vegetation, comply with applicable federal and state permitting requirements, implement appropriate BMPs, and comply with CSU and NSO stipulations. In addition, it is assumed that any entity causing a permitted ground- disturbing activity would comply with specified reclamation and revegetation practices, as well as annual monitoring and reporting, until BLM deems that success criteria are achieved. It is expected that the Action Alternatives would result in negligible impacts to upland vegetation and riparian/ wetland areas.

4.2.4.2 Terrestrial and Aquatic Wildlife

Potential impacts to terrestrial and aquatic wildlife would depend on the species occurrence, abundance, and distribution within areas proposed for hydraulic fracturing. To assess the potential for direct and indirect impacts, future applicants would be required to conduct surveys to assess species utilization and occurrence surrounding a proposed leasing area. Results from surveys would be analyzed in project-specific NEPA documents to determine what mitigation measures would be required in order to avoid or minimize impacts. Results of the NEPA process would also include development of appropriate mitigation measures and/or stipulations to ensure that potential habitat loss or modifications, habitat fragmentation, wildlife harassment, and mortality are analyzed to ensure that species populations and habitats are maintained. It is expected that the Action Alternatives would result in negligible impacts to terrestrial and aquatic wildlife.

4.2.4.3 Special Status Plants and Significant Plant Communities

Special status plants and significant plant communities receive important protections in the Action Alternatives. This includes ACECs to protect areas of ecological importance and habitat for 83 special status species, of which eight are listed as T&E. The purpose of an ACEC is to protect natural resource values and establish conditions or restrictions associated with any development within its boundary. Therefore, direct impacts would be avoided or minimized by requiring potential leasing applicants to conduct surveys for special status plants and significant plant communities. Leasing applicants would also be required to comply with documents developed for the ACECs. In some cases, lease stipulations established by the 2014 RMP would protect relevant and important values from adverse effects associated with fluid mineral development. These stipulations would provide protection from long-term ground-disturbing activities and additional protection to relevant and important habitat.

As noted above, the Programmatic BO (USFWS 2017) was issued after the publication of the 2012 Final EIS. Results from the Section 7 formal consultation process require additional conservation measures, reporting/ monitoring requirements, and species-specific and habitat restoration/compensation requirements that were not analyzed in the 2012 Final EIS. Therefore, BLM would require species-specific conservation measures, as well as general project surveys, monitoring, and reporting for potential hydraulic fracturing activities. In addition, BLM would also apply habitat restoration and compensation/replacement, as outlined in the BO. Implementation of these measures would be expected to result in negligible impacts to T&E species or their Designated Critical Habitat. These actions would be required for T&E plant and wildlife species.

Due to the limited surface disturbance, and numerous protective measures and lease stipulations, the Action Alternatives are expected to result in negligible impacts to special status plants and significant plant communities.

4.2.4.4 Special Status Fish and Wildlife Species

Potential direct and indirect impacts to special status fish and wildlife species from hydraulic fracturing activities depends on species occurrence within a potential leasing area. Leasing applicants would be required to conduct surveys to determine species occurrence and utilization within the leasing area to avoid or minimize species impacts. All leasing areas would be required to comply with applicable federal and state stipulations and mitigation requirements to ensure that hydraulic fracturing activities do not result in local extirpation of a species; disrupt community composition and function through changes in the distribution, relative abundance, and habitat use; or make populations and communities hypersensitive to other perturbations. Due to the limited surface disturbance, and numerous protective measures and lease stipulations, the Action Alternatives are expected to result in negligible impacts to special status fish and wildlife species.

4.2.5 Impacts of Alternative B

As shown in Table 2.1 and Table 2.2, this alternative includes CSU for the Compensation Lands ACEC, which would further reduce potential for surface impacts after mitigation. A potential fluid mineral leasing area could only be open for leasing if it is consistent with the documents that established the compensation lands. This ACEC provides managed habitat for the species identified in the compensation documents developed in coordination with the USFWS and California Department of Fish and Wildlife to promote species recovery. Disturbance within the Conserved Lands area of ecological importance would be managed not to exceed 10 percent in reserve areas and 25 percent in corridor areas. Conditions

established in the documents for the ACEC would be used to protect natural values in potential fluid mineral leasing areas.

4.2.6 Impacts of Alternative C

Alternative C includes a number of discretionary closures, including on the Compensation Lands ACEC, which overlaps with 203 acres in the Buena Vista supplemental hydraulic fracturing analysis area. This area could be closed to oil and gas leasing at the discretion of BLM. Closure of this area to oil and gas development, would also preclude hydraulic fracturing and reduce potential impacts from this activity to all biological resources within this area.

4.3 Cultural Resources

Potential impacts to cultural resources from all activities and programs except use of hydraulic fracturing in the oil and gas program are summarized in Section 4.4 of the 2012 Final EIS. Estimated impacts of hydraulic fracturing in the oil and gas program are provided below.

4.3.1 Methods of Analysis and Assumptions

Impacts to cultural resources are proportional to the amount of new surface disturbance associated with the number of wells subject to hydraulic fracturing. The amount of surface disturbance has the potential to negatively affect cultural resources. The negative effects may include whole or partial loss of the resource and its cultural or data values.

The following assumptions were used in this analysis:

- Development of the hydraulically fractured wells may result in direct and indirect impacts to cultural resources.
- Direct impacts may include any activity that physically destroys or irreversibly alters a cultural resource
- Indirect impacts are defined as degradation to cultural resources as a consequence of the activity that is removed in time or space from a potential impact (e.g., erosion outside of a construction zone), or effects to the setting and feel of a site's integrity (e.g., noise, light, and visual effects).
- The four supplemental hydraulic fracturing analysis areas (Lost Hills, Buena Vista, Bakersfield, and Sespe) comprise 416,515 acres (Table 4.3).

It is important to note that impacts resulting from proposed surface-disturbing activities on BLM surface associated with a specific oil and gas development project, which may include hydraulic fracturing, will be evaluated in the future with a site-specific NEPA analyses and Section 106 reviews. Similarly, proposed surface-disturbing activities on non-BLM federal surface would be subject to environmental impact analysis evaluated by other federal surface management agency-specific NEPA analyses.

Impacts of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. The current supplemental analysis does not apply to the no action alternative, which is used as a baseline for comparative effects.

4.3.2 Impacts Common to All Action Alternatives

For all Action Alternatives, an average of zero to four new wells on new leases are assumed to be hydraulically fractured per year. Over a 10-year program, 0 to 40 wells may be drilled. Disturbance associated with the construction and use of hydraulically fractured wells and pads would impact approximately 0 to 9.8 acres of BLM surface in the short-term and approximately 0 to 23.8 acres of BLM surface in the long-term after interim reclamation. Hydraulic fracturing operations would impact approximately 0 to 51.1 acres on non-BLM surface in the short-term and approximately 0 to 123.9 acres on non-BLM surface in the long-term (Table 4.2).

This analysis assumes that potential surface disturbance from hydraulically fractured wells, as identified in the supplemental analysis, would follow applicable surface use plans and restrictions, per land surface ownership. All applicable lease stipulations (Table 2.1, above, and Appendix G of the 2012 Final EIS), as well as appropriate BMPs listed in Appendix L of the 2012 Final EIS, would be implemented for all surface-disturbing activities on BLM lands. Where hydraulically fractured wells would be located on non-BLM surface, constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulations.

The 2014 RMP contains an avoidance stipulation for historic properties, as outlined in Section L.6 of Appendix L of the 2012 Final EIS. Therefore, no adverse effects to historic properties are anticipated from development of hydraulically fractured wells included in this supplemental analysis. The operator would also be required to comply with all applicable Federal, State, and local laws and regulations.

BLM and other Federal agencies must follow the National Historic Preservation Act (54 U.S.C. 306108) Section 106 guidelines and regulations and other related statutes when permitting oil and gas developments, including hydraulic fracturing, on their lands. Federal agencies will also follow their internal cultural resources guidance documents, agreements with the California Office of Historic Preservation, and tribal agreements. For non-federally permitted projects, protection of cultural resources on non-federal lands is regulated under the California Public Resources Code (PRC), CEQA (Sec. 21083.2 and 21084.1).

4.4 Native American Values

Potential impacts to Native American values from all activities and programs except use of hydraulic fracturing in the oil and gas program are summarized in Section 4.4 of the 2012 Final EIS. Estimated impacts of hydraulic fracturing in the oil and gas program are provided below.

4.4.1 Methods of Analysis and Assumptions

Impacts to Native American values are proportional to the amount of new surface disturbance and the number of wells subject to hydraulic fracturing. The amount of surface disturbance and the number of

wells have the potential to negatively affect cultural landscapes, topographic features, sacred sites, water sources, sensitive plant communities, and wildlife important to native peoples. The negative effects may include whole or partial loss of the resource, lack of access to the resource, and lack of consultation concerning the resource.

The following assumptions were used in this analysis:

- Development of hydraulically fractured wells may result in direct and indirect impacts to Native American values.
- Direct Impacts are any activity that physically destroys or irreversibly alters sites/areas of importance to the culture and traditions of Native peoples not covered under cultural resources laws and statutes. These include sacred sites/areas, traditional use areas, and natural features such as caves, topographic features, and water sources considered important to Native peoples.
- Indirect impacts are degradation to sites/areas that have meaning to Native peoples as a consequence of the activity that is removed in time or space from a potential impact (e.g., erosion outside of a construction zone), or effects to the setting, feeling, and association with the site/area. These could include, but are not limited to, visual effects, auditory effects, lack of access, and lack of consultation.
- The four supplemental hydraulic fracturing analysis areas (Lost Hills, Buena Vista, Bakersfield, and Sespe) comprise 416,515 acres.

It is important to note that impacts resulting from proposed surface-disturbing activities on BLM surface associated with a specific oil and gas development project, which may include hydraulic fracturing, will be evaluated in the future with site-specific NEPA analyses. This would include the appropriate level of tribal consultation. For non-federally permitted projects, on non-federal lands tribal consultation is regulated under the California Public Resources Code (PRC), CEQA (Sec. 21083.2 and 21084.1).

4.4.2 Impacts of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic fracturing in the context of their respective management situations. Therefore, the current supplemental analysis would not result in any substantive change to the estimated impacts to Native American values, had they been addressed in the 2012 Final EIS.

4.4.3 Impacts Common to All Action Alternatives

Under all Action Alternatives, an average of zero to four new wells on new leases are assumed would be hydraulically fractured per year. Over a 10-year program, 0 to 40 wells may be drilled. Disturbance associated with the construction and use of hydraulically fractured wells and pads would impact approximately 0 to 9.8 acres of BLM surface in the short-term and approximately 0 to 23.8 acres of BLM surface in the long-term after interim reclamation. Hydraulic fracturing operations would impact approximately 0 to 51.1 acres on non-BLM surface in the short-term and approximately 0 to 123.9 acres on non-BLM surface in the long-term (Table 4.2).

BLM and other Federal agencies must follow their specific agency guidance regarding consultation and coordination with Native peoples and at a minimum must include adherence to Executive Order (EO) 13007, Indian Sacred Sites; American Indian Religious Freedom Act (42 U.S.C. 21.1 Sec. 1996 and 1996a);

and the Religious Freedom Restoration Act of 1993 (42 U.S.C. 21B, Sec. 2000bb et seq.), Archaeological Resources Protection Act and National Historic Preservation Act. Non-BLM federal agencies would also follow any existing agreements with Tribes. Protection of native values on State of California Lands and political subdivisions is under PRC Sections 5097.91 – 5097.97 that establishes a Native American Heritage Commission (NAHC), governs state and local agency cooperation with the NAHC, and creates a process to identify and protect sacred places. Potential impacts to Native American values that may be associated with BLM permitted projects would be addressed by following the procedures for tribal relations and consultation in the BLM Handbook 1780-1 Improving and Sustaining BLM- Tribal Relations (BLM 2016), which promotes meaningful and effective tribal consultation. In addition, for federally permitted projects, implementation of Section 106 compliance, BMPs, SOPS, and stipulations as outlined in Section L.6 of Appendix L in the 2014 RMP, would avoid, minimize, or mitigate potential adverse effects to historic properties with religious and cultural significance to tribes.

4.5 Paleontological Resources

Potential impacts to paleontological resources from all activities and programs except use of hydraulic fracturing in the oil and gas program are summarized in Section 4.6 of the 2012 Final EIS. Estimated impacts of hydraulic fracturing in the oil and gas program are provided below.

4.5.1 Methods of Analysis and Assumptions

Impacts to paleontological resources are proportional to the amount of new surface disturbance and the number of wells subject to hydraulic fracturing. The amount of surface disturbance and the number of wells have the potential to negatively affect paleontological finds directly through well pad and associated infrastructure construction and indirectly through erosion and increased access for fossil collecting.

The following assumptions were used in this analysis:

- Development of the hydraulically fractured wells may result in direct and indirect impacts to paleontological resources.
- Direct impacts may include the destruction of fossil remains, which has the potential to occur during ground disturbance within paleontologically sensitive geologic formations.
- Indirect impacts could result from soil instability along slopes and road cuts within paleontologically sensitive formations. In addition, oil field development may increase ease of access to locations where paleontologically sensitive geologic formations are present, resulting in an increased risk of unauthorized fossil collection in these areas.
- The four supplemental hydraulic fracturing analysis areas (Lost Hills, Buena Vista, Bakersfield, and Sespe) encompass 416,515 acres.

It is important to note that impacts resulting from federally permitted projects associated with a specific oil and gas development project, which may include hydraulic fracturing, will be evaluated in the future with site-specific NEPA.

4.5.2 Impact of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic

fracturing in the context of their respective management situations. Therefore, the current supplemental analysis would not result in any substantive change to the estimated impacts to paleontological resources from fluid mineral management, as analyzed in Section 4.6 of the 2012 Final EIS.

4.5.3 Impacts Common to All Action Alternatives

The proposed number of wells hydraulically fractured per year would be an average of zero to four. Over a 10-year program, 0 to 40 wells may be drilled. Short- and long-term disturbance associated with the construction and use of hydraulically fractured well pads would impact approximately 0 to 9.8 acres of BLM lands in the short-term and approximately 0 to 23.8 acres of BLM soil in the long-term after interim reclamation. Hydraulic fracturing operations would impact approximately 0 to 51.1 acres on non-BLM soil in the short-term and approximately 0 to 123.9 acres on non-BLM soil in the long-term.

On both BLM and non-BLM surface, potential impacts to paleontological values from permits issued in relation to extraction of subsurface federal minerals, would be addressed through guidance and policies provided in BLM Handbook H-8270-1, General Procedural Guidance for Paleontological Resource Management and the BLM Manual MS-8270, Paleontological Resource Management. These documents are supplemented by Instruction Memorandum 2009-011, Assessment and Mitigation of Potential Impacts to Paleontological Resources (DOI 2009) and 2016-124, Potential Fossil Yield Classification System for Paleontological Resources on Public Lands (DOI 2016). Procedures in these guidance documents are meant to satisfy the requirements of the Omnibus Public Land Management Act of 2009, National Environmental Policy Act (NEPA) of 1969 (42 USC 4321 et seq.), FLPMA of 1976 (43 USC 1701 et seq.), and other federal authorities.

Potential impacts to paleontological values would also be addressed by guidance provided in the BLM, Bakersfield Field Office Approved Resource Management Plan and Record of Decision (BLM 2014). Paleontological Resources Decision 1 implements measures to protect paleontological resources from inadvertent damage or destruction through:

- Avoidance
- Fencing
- Stabilization
- Collection or excavation and deposit in museum repository
- Interpretation, or
- Administrative closure

Paleontological Resources Decision 4 ensures that site-specific NEPA analysis, which may include field inventory and fossil specimen recovery, implements the Potential Fossil Yield Classification as a standard part of the review for all surface disturbing projects throughout the Decision Area.
On non-federal lands, potential impacts to paleontological resources may be addressed through the PRC, CEQA Appendix G (Sec. 8.16.2.2) and regulations depending on the county.

BLM and other federal agencies must follow their agency guidance documents, NEPA and the Paleontological Resources Preservation Act, which protect paleontological resources on federal lands. Protection of paleontological resources on State of California Lands is regulated under the PRC, CEQA, Appendix G (Sec. 8.16.2.2) and may require the evaluation of effects on any project undertaken,

assisted, or permitted by the state or the state's political subdivisions. This can include projects on private land.

4.6 Soil Resources

Potential impacts to soil resources from all activities and programs except use of hydraulic fracturing in the oil and gas program are summarized in Section 4.7 of the 2012 Final EIS. Estimated impacts of hydraulic fracturing in the oil and gas program are provided below.

4.6.1 Methods of Analysis and Assumptions

Impacts to soil are proportional to the amount of new surface disturbance for each alternative (i.e., increased disturbance would result in a proportionate increase in adverse impacts to soils).

The increase or reduction in potential for accelerated soil erosion, and subsequent loss or maintenance of soil productivity, is qualitatively used to further describe these impacts.

Prime or Important Farmland soil, including Farmlands of State Importance and Prime Farmlands if Irrigated are present in the Lost Hills, Buena Vista, and Bakersfield supplemental hydraulic fracturing analysis areas (Figure 3.7.1 in the 2012 Final EIS). Most of the supplemental hydraulic fracturing analysis areas comprise a mix of soils with erosion potentials (Figure 4.6.1), and the acres of each are listed in Table 4.6. The Lost Hills, Buena Vista, and Bakersfield areas are known endemic areas for valley fever (Figure 3.7.4 in the 2012 Final EIS).

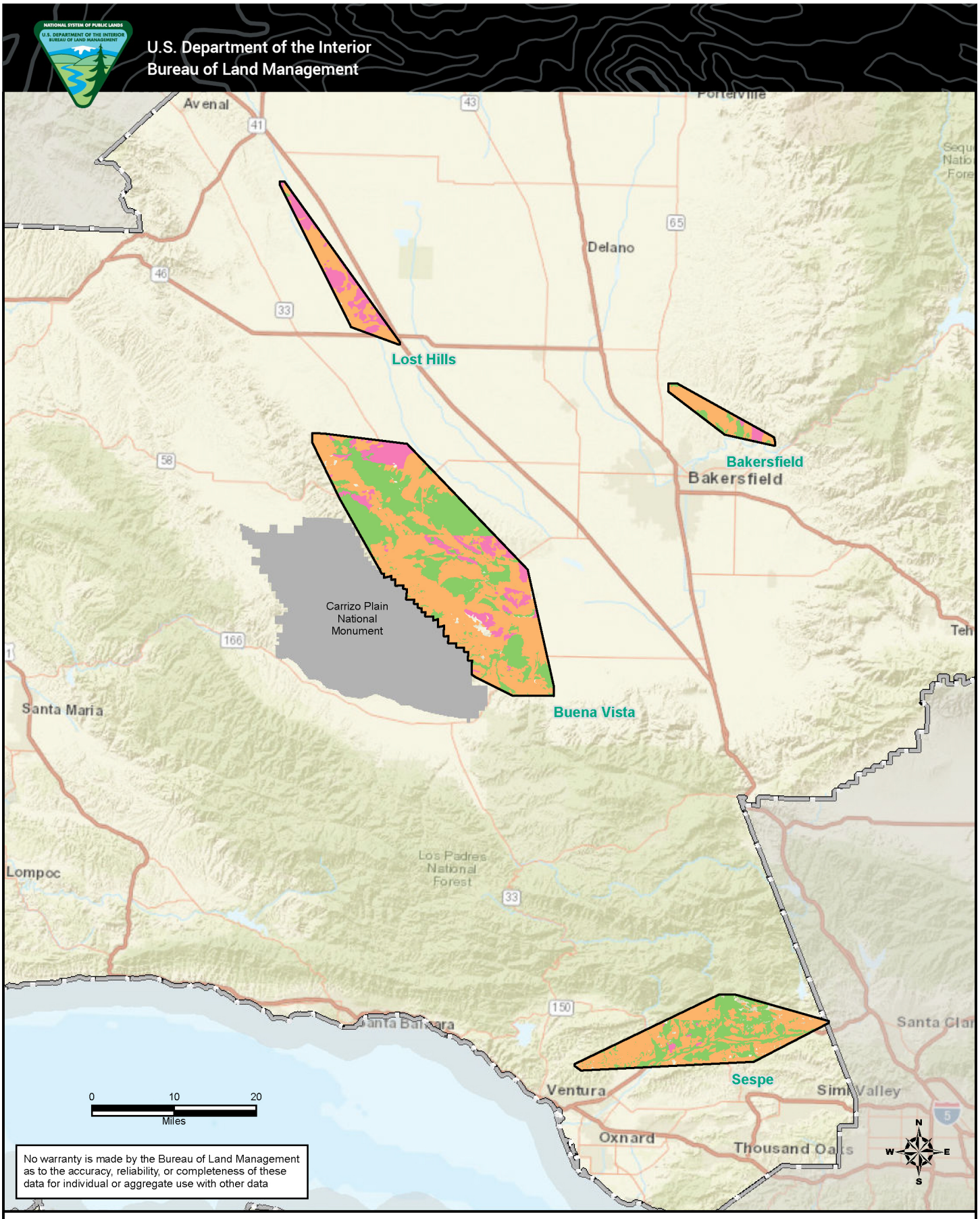
Table 4.6
Erosion Potential

Analysis Area	Analysis Area (acres)	High Erosion Potential (acres)	%	Moderate Erosion Potential (acres)	%	Low Erosion Potential (acres)	%
Lost Hills	34,029	11,987	35%	21,292	63%	199	1%
Buena Vista	268,469	22,289	8%	140,314	52%	191,433	71%
Bakersfield	17,557	1,418	8%	11,895	68%	4,169	24%
Sespe	96,460	500	1%	46,497	48%	41,962	44%

Source: U.S. Department of Agriculture, Natural Resources Conservation Service. (Various Dates as provided in the 2011 Draft RMP). Web Soil Survey, CA031 (Kings County, California), CA666 (Kern County California, Northwestern Part), CA667 (San Luis Obispo County, California, Carrizo Plain Area), CA668 (Kern County, Northeastern Part and Southeastern Part of Tulare County, California), CA674 (Ventura Area, California), CA675 (Antelope Valley Area, California), CA691 (Kern County California, Southwest Part), CA772 (Los Padres National Forest Area, California). Available Online at https://websoilsurvey.sc.egov.usda.gov/

Surface disturbance associated with hydraulic fracturing operations is summarized in Table 4.2. Interim reclamation would be implemented under all Action Alternatives and would minimize erosion from disturbed areas. Sensitive soils (highly erodible) are more susceptible to erosion and runoff than other soil types. Soil erosion could contribute to sedimentation in streams.

The lack of a detailed soil inventory that includes the location of biological crusts, as well as concern regarding soils hosting high levels of *Coccidioides immitis* (pathogenic fungus that causes valley fever), limits the ability to analyze impacts on these soil types at the land use planning level analysis of this Draft Supplemental EIS but would be included as necessary in analysis of site-specific projects.



Legend

Susceptibility to Erosion

- High: K factor > .4
- Moderate: K factor .24 - .4
- Low: K factor .02 - .20

- Carrizo Plain National Monument (Excluded from analysis)
- Bakersfield Field Office
- SHF Analysis Area - named for adjacent oil fields

Soils Susceptibility to Erosion
Bureau of Land Management
Bakersfield Field Office
DRAFT SEIS

Source: U.S. Department of Agriculture, Natural Resources Conservation Service. (Various Dates as provided in the 2011 Draft RMP). Web Soil Survey, CA031 (Kings County, California), CA666 (Kern County California, Northwestern Part), CA667 (San Luis Obispo County, California, Carrizo Plain Area), CA668 (Kern County, Northeastern Part and Southeastern Part of Tulare County, California), CA674 (Ventura Area, California), CA675 (Antelope Valley Area, California), CA691 (Kern County California, Southwest Part), CA772 (Los Padres National Forest Area, California. Available Online at https://websoilsurvey.sc.egov.usda.gov/

Figure 4.6.1

This analysis assumes that potential surface disturbance from hydraulically fractured wells, as identified in the supplemental analysis, would follow applicable surface use plans and restrictions, per land surface ownership. All applicable lease stipulations (Table 2.1, above, and Appendix G of the 2012 Final EIS), as well as appropriate BMPs listed in Appendix L of the 2012 Final EIS, would be implemented for all surface-disturbing activities on BLM lands. In addition, BMPs from the Gold Book BMPs (BLM and US Forest Service 2007) and interim and final reclamation measures (43 CFR 3101.1-2) would be followed for federal mineral leases developed through hydraulically fractured wells on BLM surface. Wells developed on U.S. Forest Service lands would be subject to the Gold Book BMPs as well.

Mitigation measures described in SB4, Chapter 313 would be applied to reduce impacts to natural resources on all hydraulically fractured wells. If the wells would be located in Kern County, the Kern County Zoning Ordinance, Chapter 19.98 (Oil and Gas Production) would also apply (Kern County 2015). Additionally, all wells on non-BLM surface would likely be subject to additional environmental impact analysis under CEQA.

It is important to note that impacts resulting from proposed surface-disturbing activities on BLM surface associated with a specific oil and gas development project, which may include hydraulic fracturing, would be evaluated in the future with site-specific NEPA analyses. Similarly, proposed surface-disturbing activities on non-BLM surface would be subject to environmental impact analysis evaluated by other federal agency-specific NEPA analyses, or under CEQA.

4.6.2 Impacts of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic fracturing in the context of their respective management situations. Therefore, the current supplemental analysis would not result in any substantive change to the estimated impacts to soil resources from fluid mineral management, as analyzed in Section 4.7 of the 2012 Final EIS.

4.6.3 Impacts Common to All Action Alternatives

Different areas would be open to fluid mineral leasing under each of the Action Alternatives; however, estimated short- and long-term surface impacts from hydraulic fracturing are the same (Table 4.2). These would result in the same estimated impacts to soil resources, discussed below.

Once disturbed, soil would be susceptible to accelerated erosion and transport by being exposed to the erosional forces of water and wind. Surface disturbance from hydraulic fracturing operations would degrade soil quality and productivity and lead to increased erosion, loss of soil stability, changes in vegetation, compaction, and reduced reclamation potential. The removal of organic matter and disturbance to natural soil horizons would decrease soil productivity.

Highly erodible soils are present throughout the supplemental hydraulic fracturing analysis areas, but impacts would be reduced through appropriate siting and BLM BMPs (Appendix L, Sections L4 and L7 of the 2012 Final EIS). Impacts to Prime and Unique Farmland (approximately 11,490 acres in supplemental hydraulic fracturing analysis areas) would include potential loss of productivity, along with other erosional effects depending on where wells would be located. Because of the relatively small area of disturbance, approximately 0 to 209 acres overall (Table 4.2), impacts would be negligible. Biological crusts are present in the Planning Area but are not well mapped. Biological crusts would be identified and evaluated during site-specific NEPA analysis for individual wells.

Potential indirect effects include potential changes in vegetation communities, increased erosion into and sedimentation of streams, and health impacts to agricultural products from blowing dust because of disturbed soil.

NSO and CSU stipulations for other resources would be applied per the 2014 RMP. Implementation of these stipulations would reduce potential erosion by limiting surface disturbance. Disturbance would be minimized on special soils (e.g., serpentine soils, soils highly susceptible to erosion, and Prime or Other Important Farmlands). BLM BMPs (Appendix L, Sections L4 and L7 of the 2012 Final EIS) would be used to limit soil erosion. Minimizing disturbance, conserving topsoil, reseeding disturbed areas, and avoiding steep slopes and special soil would mitigate some impacts to soil resources. The operator would also be required to comply with all applicable federal, state, and local laws and regulations.

A maximum of 0.02 percent of the supplemental hydraulic fracturing analysis areas would potentially experience surface disturbance to soils as a results of hydraulic fracturing activities. Under Alternative B, the abovementioned mitigation of impacts to soil resources would be applied to activities on BLM and non-BLM lands. Therefore, hydraulic fracturing operations under Alternative B would be expected to have negligible adverse soil impacts overall. Some impacts could be more severe in small, localized areas should mitigation measures not completely address long-term changes in soil fertility or structure resulting from topsoil loss and soil compaction. These impacts could result in loss or change in current plant cover patterns. These areas of localized impacts to soils could potentially extend beyond the 10-year analysis period.

4.7 Visual Resources

Potential impacts to visual resources from all activities and programs except use of hydraulic fracturing in the oil and gas program are summarized in Section 4.8 of the 2012 Final EIS. No new and relevant information is needed to support this Draft Supplemental EIS, as the analysis of visual resource management under the No Action and Action Alternatives accounted for a range of oil and gas production, which may include the potential for hydraulic fracturing.

4.7.1 Analysis Methods and Assumptions

Analysis methods and assumptions for visual resources are located in Section 4.8 of the 2012 Final EIS.

It is important to note that impacts resulting from proposed surface-disturbing activities on BLM surface associated with a specific oil and gas development project, which may include hydraulic fracturing, will be evaluated in the future with site-specific NEPA analyses. Similarly, proposed surface-disturbing activities on non-BLM surface would be subject to environmental impact analysis evaluated by other federal surface management agency-specific NEPA analyses, or under CEQA.

4.7.2 Impact of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic fracturing in the context of their respective management situations. Therefore, the current supplemental analysis would not result in any substantive change to the estimated impacts to visual resources from fluid mineral management, as analyzed in Section 4.8 of the 2012 Final EIS.

4.7.3 Impacts Common to All Action Alternatives

Section 4.8.2 of the 2012 Final EIS addresses impacts of management common to all Action Alternatives. As described in that section, for all four of the Action Alternatives the application of visual resource management (VRM) BMPs as terms and conditions (stipulations) to all drilling activities, including hydraulic fracturing, would aid in achieving VRM objectives.

Short-term visual impacts of hydraulic fracturing (i.e., height of the drilling rig, night lighting of the well site, and night lighting of the rig mast) would be the same as for conventional wells. An additional short-term visual impact of hydraulic fracturing would be a 43-foot-tall pump that would remain in place for the limited amount of time needed to complete the process, typically one to two days. Short-term impacts associated with construction would also include heavy equipment and employee vehicles (stationary and traveling to/from well pad locations), fugitive dust, etc.

The area of disturbance for each well would result in both short-term and long-term visual impacts. Compared to conventional wells, short-term impacts of hydraulically fractured well pads would be approximately 3.5 acres larger, and long-term impacts of hydraulically fractured well pads would be approximately 2 acres larger. Some impacts to visual resources could be more noticeable in small, localized areas should mitigation measures not completely address long-term changes in soil fertility or structure resulting from topsoil loss and soil compaction. These impacts could result in loss or change in current visual plant cover patterns. These areas of localized impacts to soils could potentially extend beyond the 10-year analysis period.

All of the four supplemental hydraulic fracturing analysis areas are classified as VRM Class IV. By definition, VRM Class IV provides for management activities that require major modification of the landscape character, and the level of change to the characteristic landscape can be high; however, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements. Given that the number of wells that would be hydraulically fractured is an average of zero to four-per-year over the 10-year period of the 2014 RMP and is limited to the four supplemental hydraulic fracturing analysis areas, it is expected that visual impacts from hydraulic fracturing would be negligible. Therefore, the information presented in the 2012 Final EIS, including the methods of analysis, assumptions, and impacts discussion, is incorporated by reference.

4.8 Water Resources

Potential impacts to water resources from all activities and programs except use of hydraulic fracturing in the oil and gas program are summarized in Section 4.9 of the 2012 Final EIS. Possible impacts of hydraulic fracturing in the oil and gas program are provided below.

4.8.1 Methods of Analysis and Assumptions

A detailed description of hydraulic fracturing is provided in Chapter 1. With regard to potential impacts to water resources, hydraulic fracturing consists of the following activities that are part of the water “life cycle”: water acquisition, constituent mixing and handling, injection of fluids through wells and into subsurface formations during hydraulic fracturing operations, and fracturing fluid flowback storage and disposal (USEPA 2016; Dunn-Norman et al. 2018). Each of these activities may present potential risks to surface and groundwater resources. This analysis will look at each of these activities to assess the severity and duration of potential impacts.

The following assumptions are provided to refine the scope of the assessment of potential impacts of hydraulic fracturing on water resources in the defined study area:

- The exact location of new wells on new leases that would be hydraulically fractured is not known. As in other supplemental analyses, it is assumed that these wells would be located within the supplemental hydraulic fracturing analysis areas (Figure 4.1). For analysis purposes, it is assumed that drilling and completion practices would be similar in all the supplemental hydraulic fracturing analysis areas.
- Data for California indicate that hydraulic fracturing consumes about 100,000 gallons (0.31 acre-feet) of water per well (DOGGR 2015a, 2016, 2018c). In addition, drilling would require 4,200 gallons per day (DOGGR 2015b). Wells take an average of 23 days to drill (Kern County 2015), which would consume about 100,000 gallons. Therefore, water consumption per hydraulically fractured well is assumed to be about 200,000 gallons (0.61 acre-feet).
- Water sources for hydraulic fracturing are produced water (8.8 percent), groundwater supply wells (25.4 percent), and surface water from public water sources (65.8 percent) (Kern County 2015).
- A maximum of 40 new wells on new leases would be hydraulically fractured during the planning period (10 years). These wells would have an average true vertical depth of 2,700 feet. However, it is possible that some of the wells could exceed 10,000 feet true vertical depth (DOGGR 2015b).
- Exploratory drilling and testing of the Monterey Formation as a shale play have not yielded promising results (CCST 2014). It is unlikely that the Monterey Formation would be exploited as a continuous and unconventional resource utilizing horizontal drilling and massive multi-stage hydraulic fracturing. A continuous and unconventional hydrocarbon resource is one in which the hydrocarbons are dispersed throughout a geologic formation rather than existing as a discrete, localized occurrence (USGS 2014a).
- Horizontal wells and hydraulic fracturing have been integral over 40 years into the development of oil fields in the southern San Joaquin Basin. Hundreds of horizontal wells have been drilled for injection and production, and some may have undergone hydraulic fracturing stimulation. In 2013, most (99 percent) of the permits for horizontal wells were in existing producing areas (CCST 2014). Barring a major change in economic conditions (oil prices), vertical and horizontal drilling would occur primarily in established field areas, but some of the 0 to 40 new hydraulically fractured wells under consideration would be vertical wells.
- Characterization of the salinity of aquifers or formation water is based on the concentration of total dissolved solids (TDS). Fresh water has less than 3,000 milligrams per liter (mg/L) TDS, and protected water has less than 10,000 mg/L TDS. Underground sources of drinking water (USDWs) as defined in 40 CFR, Section 144.3 are protected waters, subject to specific conditions or exemptions.
- The potential effects of hydraulic fracturing on surface water and soils may not be substantially different from routine oil field operations, and the chemicals used may be similar (USGS 2014b).

- In the analysis of flowback and produced water disposal, this assessment will rely on statistics from DOGGR Well Stimulation Annual Reports covering the reporting periods from January 1, 2014, to September 30, 2015; July 1, 2015, to June 30, 2016; and July 1, 2016, to December 31, 2016 (DOGGR 2015a, 2016, and 2018c).
- Hydraulic fracturing would be conducted on about 400 non-federal wells per year over the planning period based on four years of hydraulic fracturing data compiled by DOGGR (2015a, 2016, 2018c), assuming no substantial changes in wells drilled per year. Most of these wells would be in Kern County.

It is important to note that impacts resulting from proposed activities on BLM surface associated with a specific oil and gas development project, which may include hydraulic fracturing, will be evaluated in the future with site-specific NEPA analyses. Similarly, proposed surface-disturbing activities on non-BLM surface would be subject to environmental impact analysis evaluated by other federal agency-specific NEPA analyses, or under CEQA.

4.8.2 Impacts of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic fracturing in the context of their respective management situations. Therefore, the current supplemental analysis would not result in any substantive change to the estimated impacts to water resources from fluid mineral management, as analyzed in Section 4.9 of the 2012 Final EIS.

4.8.3 Impacts Common to All Action Alternatives

4.8.3.1 Impacts to Surface Water

Surface water quality could be directly impacted by leaks or spills into water bodies or wetland areas due to transportation, storage, and use of hazardous materials, including fuels, fracturing chemicals, and produced water. Indirect effects could occur by leaks or spills onto upland surfaces where contaminants could migrate to surface waters. However, protective measures to minimize the risk of contamination from accidental releases at oil and gas production and processing facilities would be implemented according to Spill Prevention, Control, and Countermeasure and emergency response plans. Lease stipulations could be used to provide setbacks between hydraulic fracturing activities and surface water resources.

Under California State regulations, the ephemeral and intermittent streams that occur in the hydraulic fracturing analysis areas are considered watercourses. Kern County also specifically defines intermittent streams as watercourses. Ephemeral and intermittent streams by definition do not regularly carry surface water. Therefore, direct adverse Impacts to surface water resources from hydraulic fracturing are expected to be negligible because of federal, state and local regulations governing discharges in protected waterways as defined by regulation (BLM 2012; Kern County 2015). BLM BMPs for well construction and drilling would also minimize impacts to surface water. There is a small potential for adverse impacts to the dry watercourses themselves, should mitigation measures and protective measures fail or be misapplied. These in turn could indirectly affect surface water during subsequent precipitation events.

4.8.3.2 Impacts to Groundwater

Water Use

Based on the assumptions listed above, approximately 400 wells per year would be hydraulically fractured in California (DOGGR 2015a, 2016, and 2018c). Most of the wells would be drilled in old producing areas in western Kern County where hydraulic fracturing maximizes recovery of oil from diatomite reservoirs. Based on the water consumption assumptions described above, the drilling and hydraulic fracturing of 400 wells would use up to an estimated 80.0 million gallons (246 acre-feet) of water per year. Hydraulic fracturing of an average of zero to four wells assumed in the Planning Area would consume 0.0 to 800,000 gallons (0.0 to 2.5 acre-feet). Over the 10-year planning period, these new wells on new leases in the Planning Area would be expected to use up to an estimated 8.0 million gallons (25 acre-feet) of water compared to an estimated 800 million gallons (2,455 acre-feet) consumed by 400 wells per year over 10 years, as assumed for all of California.

Estimated surface and groundwater use in Kern County is about 788.4 billion gallons (2,420,000 acre-feet) per year (USGS 2018a). Most of the water is used for irrigation. Maximum water consumption of four or fewer wells would be substantially smaller than the annual consumption of surface and groundwater in Kern County. The impact of water use for hydraulic fracturing of an average of zero to four wells per year would be negligible, in comparison.

Constituent Mixing and Handling

Mixing and handling of hydraulic fracturing fluids on well pads poses a potential threat to groundwater. Table 4.8 lists some of the commonly used constituents of fracturing fluids. The amounts and contents of fracturing fluids would be based on the downhole conditions to maximize the efficiency of the fracturing process.

Table 4.8
Typical Constituents of Hydraulic Fracturing Fluids

Constituent Type	Purpose	Chemical Types
Proppant	Maintains open fractures to allow gas and fluids to flow to the well bore.	Silica sand, sintered bauxite, zirconium oxide, ceramic beads
Acid	Cleans out cement and drilling mud from casing perforations prior to fracturing operations.	Hydrochloric acid (HCl), 3 percent to 28 percent
Breaker	Reduces the viscosity of the fluid in order to release proppant into fractures and enhance the recovery of the fracturing fluid.	Peroxydisulfates
Biocide	Inhibits growth of organisms that could produce gases (e.g., hydrogen sulfide). Also prevents the growth of bacteria, which can reduce the ability of the fluid to carry proppant into the fractures.	Gluteraldehyde; 2,2-dibromo-3-Nitrilopropionamide
Buffer/Ph Adjuster	Adjusts and controls the pH of the fluid in order to maximize the effectiveness of other additives such as crosslinkers.	Sodium or potassium carbonate; acetic acid

Table 4.8
Typical Constituents of Hydraulic Fracturing Fluids

Constituent Type	Purpose	Chemical Types
Clay Stabilizer	Prevents swelling and migration of formation clays, which could block pore spaces and thereby reduce permeability.	Salts (e.g., tetramethyl ammonium chloride; potassium chloride [KCl])
Corrosion Inhibitor	Reduces corrosion on steel tubing, well casings, tools, and tanks that store fracturing fluids that contain acid.	Methanol; ammonium bisulfate for oxygen scavengers
Cross Linker	Increases fracturing fluid viscosity, allowing the fluid to carry more proppant into the fractures.	Potassium hydroxide; borate salts
Friction Reducer	Allows fracture fluids to be injected at optimum rates and pressures by minimizing friction.	Sodium acrylate-acrylamide copolymer; polyacrylamide (PAM); petroleum distillates
Gelling Agent	Increases fracturing fluid viscosity, allowing the fluid to carry more proppant into the fractures.	Guar gum; petroleum distillates
Iron Control	Prevents the precipitation of metal oxides which could plug off the formation.	Citric acid
Scale Inhibitor	Prevents the precipitation of carbonates and sulfates (calcium carbonate, calcium sulfate, barium sulfate), which could plug off the formation.	Ammonium chloride; ethylene glycol
Solvent	Additive that is soluble in oil, water, and acid-based treatment fluids, used to control the wettability of contact surfaces or to prevent or break emulsions.	Various aromatic hydrocarbons
Surfactant	Reduces fracturing fluid surface tension, thereby aiding fluid recovery.	Methanol; isopropanol; ethoxylated alcohol

Sources: Revised from Long et al. 2015; New York State Department of Environmental Conservation 2011, Table 5.6.

The constituents listed in Table 4.8 make up a relatively small proportion of hydraulic fracturing fluid. Generally, water is the main constituent (90 to 97 percent by volume), with proppant the second largest (2 to 10 percent by volume), and chemicals and additives at 2 percent by volume (USEPA 2016).

Impacts to groundwater could result from leaks and spills of fluids from storage containers, transportation incidents, flow lines, and leaks from impoundments. The groundwater resources most likely to be affected are those contained within the Tulare formation and overlying alluvium on the west side of the San Joaquin Valley, and those contained within the Kern River Formation on the east side of the San Joaquin Valley. These resources are most likely to be affected because they are the shallowest in the Planning Area.

According to the United States Environmental Protection Agency (USEPA) (2016), spills of hydraulic fracturing fluids have stemmed primarily from equipment failure or human error and mainly involved storage containers. The potential to impact, groundwater "depends on the composition of the spilled fluid, spill characteristics, spill response activities, and the fate and transport of the spilled fluid" (USEPA

2016). Because of these factors, impacts to groundwater may not be readily apparent for a number of years.

Data collected by DOGGR (2015a, 2016, and 2018c) in California over the period from January 2014 to December 2017 indicate no spills or emergency responses involving fracturing fluids. USEPA data on hydraulic fracturing fluid spills indicate that impacts to groundwater may be rare, occurring only once out of 457 incidents studied by the USEPA (2015, 2016). In the study, the most common materials spilled were produced water and flowback fluid. Most of the spills (56 percent) were less than 1,000 gallons, and there were much fewer (5.3 percent) large volume incidents, i.e. greater than 20,000 gallons.

As discussed above in Section 4.8.2.1, protective measures to minimize the risk of contamination from accidental releases at oil and gas production and processing facilities would be implemented according to Spill Prevention, Control, and Countermeasure and emergency response plans. Lease stipulations, COAs, and company implemented BMPs also can be used to lessen the risk to groundwater, especially in areas where aquifers are considered vulnerable. Given the likely size and frequency of spills of hydraulic fracturing fluids and record of no spills over a period of three years, authorization of 40 or fewer wells is not likely to pose a risk to groundwater. The risk of impacts to groundwater due to spills of fracturing fluids from the completion of an average of zero to four wells per year would be negligible.

Injection of Hydraulic Fracturing Fluids

Injection of hydraulic fracturing fluids poses risks to groundwater. There are two major pathways through which fracturing fluids may impact groundwater: a breakdown in barriers designed to prevent leakage of fluids from the well, and migration of fractures outside of the target producing formation.

The containment of fluids in the well relies on the concept of well integrity, or maintaining physical barriers, operational standards, organizational procedures, and regulatory framework to prevent the migration of fluids out of the borehole, protect aquifers, and separate aquifers from hydrocarbon-bearing zones. Physical barriers include steel casing, cement, and blowout preventers. A type of physical barrier also includes drilling fluid, which, among other uses, provides a hydrostatic barrier to prevent the unintended release of formation fluids to the surface during drilling and completion. Operational standards can include the monitoring of pressures in well annuli (the spaces between strings of casing or the production casing and the drilled hole) and can provide indications of leakage through primary barriers such as cement sheaths and casing. Remedial measures can be implemented if monitoring indicates that there is a problem with well integrity. Organizational procedures involve a company's protocols for the reporting of failures or shortfalls in meeting standards. The regulatory framework involves state and federal rules and guidelines governing the drilling, completion, and operation of the wells.

Data collected by DOGGR (2015a, 2016, and 2018c) over the period from January 2014 to December 2017 indicate no loss of integrity in wells that had undergone hydraulic fracturing. New regulations regarding well integrity require the following actions before WST operations may be conducted (DOGGR 2015a):

- Require operators to conduct pressure testing before WST.
- DOGGR must evaluate cement-casing bond logs to determine if there is sufficient cement to prevent “significant migration of fluids, particularly under the increased pressures that occur during WST operations” (DOGGR 2015a).

The other major pathway that poses a risk to aquifers is the migration of fracturing fluids from the target zone. The geological conditions in the San Joaquin Basin with regard to aquifer salinity make it difficult to assess the risk to protected water resources (TDS less than 10,000 mg/L). Protected or useable aquifers (USDWs) are defined by the USEPA (2016) as "an aquifer or portion of an aquifer that:

- Supplies any public water system or that contains a sufficient quantity of groundwater to supply a public water system; and
- Currently supplies drinking water for human consumption; or
- Contains fewer than 10,000 mg/L total dissolved solids and is not an exempted aquifer."

Generally, the base of USDWs becomes deeper from northwest to southeast in the southern San Joaquin Basin (Gillespie et al. 2017). The eastern portion of the area near Bakersfield receives abundant recharge from the Sierra Nevada, resulting in lower salinity and better water quality at greater depths. Some oil zones produce water that is suitable for irrigation. On the west side, depths to the base of USDWs are variable, and in some cases higher salinity aquifers overlie fresher aquifers at relatively shallow depths (2,000 feet).

Because of concerns about oil and gas activities and potential impacts to protected groundwater, an interagency partnership called the California Oil, Gas, and Groundwater Program has been formed to study the problem. The United States Geological Survey is the technical lead supported by state and federal agencies, including BLM. The study will require several years and involves several activities in various locations, which include some of the study areas in this analysis. The activities include airborne magnetic surveys to measure salinities over large areas, direct sampling and analysis of groundwater samples, analysis of potential pathways, constructing three-dimensional geological models, and geochemical analysis (USGS 2018b). Products from this scientific effort will include publications documenting subsurface salinities in the Planning Area.

As information from the aforementioned study becomes available, authorizing officers will be able to better assess subsurface conditions during the APD process and provide COAs that would protect useable aquifers. DOGGR is also collecting information on fracture heights and lengths that would be helpful in assessing APDs.

New results from the DOGGR Program show that hydraulic fracturing of two adjacent wells in the Lost Hills Field resulted in a decrease in salinity of produced water. Geochemical conditions surrounding hydraulically fractured wells re-equilibrate to the geochemistry of the surrounding formation fairly rapidly (weeks to months). This rapid re-equilibration is due to the fact that very small volumes of fluid are injected compared to formation fluid volumes. Out-of-zone migration would have to reach protected resources before the transient conditions have re-equilibrated for fluids associated with hydraulic fracturing to cause an impact (McMahon et al. 2018).

Impacts to groundwater from loss of well integrity or out-of-zone migration of fracturing fluids from an average of zero to four wells would be negligible. If present trends continue, the drilling and hydraulic fracturing of up to 40 wells on new leases over the 10-year planning period would also have negligible impact.

Flowback Management and Disposal

Fluid that is produced after hydraulic fracturing operations is often referred to as flowback. Although it is possible to distinguish between flowback and produced water using geochemical analyses, these are typically not done during normal operations. The sampling frequency would need to be high during the first few days after hydraulic fracturing in order to observe the change in conditions. The USEPA considers produced water and flowback to be essentially the same (USEPA 2016). However, flowback is required to be treated separately per Senate Bill 4 regulation. It is typically maintained in segregated tanks prior to being cleaned-up and diluted to facilitate recycling. Because surface water is the largest source of hydraulic fracturing fluid in California (68 percent), these fluids are generally much fresher than the oil field formation waters into which they are injected (Pacific Institute 2016; Gillespie and Anderson 2017).

Management of flowback and disposal is a major activity in the hydraulic fracturing water cycle. Management mainly involves the temporary storage of waste fluids prior to injection or reuse. The risks and issues associated with surface spills and leaks during constituent mixing are similar for storage of flowback. Often, these fluids need to be temporarily stored prior to disposal, reinjection, or recycling. They can be stored either in tanks or in lined impoundments. If fluids cannot be recycled or re-injected for secondary recovery, they are disposed of by reinjection into a zone that has been permitted for that purpose. The main issues with disposal wells involve well integrity, as discussed above for production wells, and movement of disposed fluids out of the intended injection zone and potential impacts to USDWs.

The Underground Injection Control (UIC) Program is responsible for regulating the construction, operation, permitting, and closure of injection wells that place fluids underground for storage or disposal. Injection wells are divided into six classes under the UIC Program (USEPA 2018):

- Class I - Inject hazardous wastes, industrial non-hazardous liquids, or municipal wastewater beneath the lowermost USDW;
- Class II - Inject brines and other fluids associated with oil and gas production, and hydrocarbon storage;
- Class III- Inject fluids associated with solution mining of minerals beneath the lowermost USDW;
- Class IV - Inject hazardous or radioactive wastes into or above USDWs. These wells are banned unless authorized under a federal or state groundwater remediation project;
- Class V - All injection wells not included in Classes I-IV. In general, Class V wells inject non-hazardous fluids into or above USDWs and are typically shallow, onsite disposal systems. However, there are some deep Class V wells that inject below USDWs; and
- Class VI - Inject carbon dioxide for long-term storage, also known as geologic sequestration of carbon dioxide.

Class II wells are used for the injection of oil and gas fluid production waste, the injection of fluids to assist in the recovery of hydrocarbons, and the injection and retrieval of hydrocarbons at underground storage facilities. Class II wells are regulated by DOGGR (because USEPA has delegated that authority to DOGGR). Injection wells are subject to mechanical integrity testing and other regulatory requirements to ensure that disposed fluids are not leaking from the well or out of the zone of injection.

Over the period from January 1, 2014, to December 31, 2017, Well Stimulation Treatment Annual Reports indicate that nearly 100 percent of recovered flowback was disposed by injection into Class II injection wells. The volume of fluid was not disclosed (DOGGR 2015a, 2016, 2018c).

Impacts to groundwater due to spills of flowback fluids from the completion of an average of zero to four wells in any given year, or up to 40 wells over 10 years, would be negligible. Pursuant to the APD process, and throughout the life of a well, leaseholders must identify to BLM how and where produced water, including flowback, is to be disposed of. Class II well disposal can be the best environmental practice to dispose of produce water. UIC rules reduce the risk of impacts to USDWs. Information gained from the California Oil, Gas, and Groundwater Program should assist UIC regulators to assess Class II well APDs.

Impacts to groundwater from loss of disposal well integrity or out-of-zone migration of disposed fluids from an average of zero to four wells would be negligible. If present trends continue, the drilling and hydraulic fracturing of up to 40 wells on new leases over the 10-year planning period would also have negligible impact.

4.9 Livestock Grazing

Potential impacts to livestock grazing from all activities and programs except use of hydraulic fracturing in the oil and gas program are summarized in Section 4.13 of the 2012 Final EIS.

BLM has determined that the direct, indirect, and cumulative impacts to livestock grazing operations and opportunities from fluid mineral development within the Bakersfield Field Office were sufficiently analyzed in the 2012 Final EIS. In this analysis, fluid mineral development was deemed to have negligible effects on livestock grazing. The additional impacts associated with hydraulic fracturing would not change that analysis.

4.10 Minerals Management

Potential impacts to minerals management from all activities and programs except use of hydraulic fracturing in the oil and gas program are summarized in Section 4.14 of the 2012 Final EIS. Estimated impacts of hydraulic fracturing in the oil and gas program are provided below.

4.10.1 Methods of Analysis and Assumptions

In California, there are few studies that demonstrate a connection between earthquakes and hydraulic fracturing or between earthquakes and wastewater disposal from hydraulic fracturing. The impacts discussed in this section are estimated based on information from published federal, state, and scholarly work (see Section 3.10).

Impacts to leasable, solid, and saleable minerals are proportional to the amount of new surface disturbance that would result from each alternative.

The total acreage of all four supplemental hydraulic fracturing analysis areas that would potentially be impacted by hydraulic fracturing would be 416,515 acres (Table 4.3), as illustrated in Figure 4.1.

The following assumptions were used in this analysis:

- One hydraulically fractured well per well pad.
- Well pads would be 4 acres (Table 4.1).
- 0 to 40 hydraulically fractured wells could be installed over 10 years under new federal mineral leases.
- Federal mineral leases could be accessed from BLM lands or non-BLM lands, including other federal agencies, state, county, and private ownership.
- New hydraulically fractured wells on new federal mineral leases would occur within the supplemental hydraulic fracturing analysis areas.

4.10.2 Impact of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic fracturing in the context of their respective management situations. Therefore, the current supplemental analysis would not result in any substantive change to the estimated impacts to minerals management from fluid mineral management, as analyzed in Section 4.14 of the 2012 Final EIS.

4.10.3 Impacts Common to All Action Alternatives

Earthquakes are a frequent natural occurrence in California; however, they can also be induced by other causes such as underground mining, reservoir impoundment, and the injection and withdrawal of fluids as part of oil and gas production activities (NRC 2013). Earthquakes caused by these types of activities are called induced earthquakes.

There is little information on the correlation between hydraulic fracturing and wastewater disposal and induced earthquakes because it can be very difficult to distinguish California's frequent natural earthquakes from induced earthquakes (CCST 2015). In a global review of induced earthquake activity, Foulger et al. (2018) identified eight cases worldwide where earthquakes have been proposed to be associated with oil extraction. It is important to note that this is very few compared with the approximately 1,000,000 producing oil fields worldwide. Induced earthquakes in California were associated with removal of large volumes of oil and/or water.

4.10.3.1 Hydraulic Fracturing Induced Earthquakes

Foulger et al. (2018) did not identify any earthquakes caused by hydraulic fracturing in their study. Three cases of hydraulic fracturing–induced earthquakes in the United States have been reported (Holland 2013 [Oklahoma]; Friberg et al. 2014 [Ohio]), and only a few more worldwide (BC Oil and Gas Commission 2012, 2014; Green et al. 2012; Farahbod et al. 2015). The largest observed event attributed to hydraulic fracturing to date is a magnitude 3.8 earthquake that occurred in the Horn River Basin, British Columbia, in 2011 (BC Oil and Gas Commission 2012). The low magnitudes of earthquakes associated with hydraulic fracturing may be related to the short duration of hydraulic fracturing operations and the smaller volumes of injected and flowback water (CCST 2015). Additionally, most of the hydraulic fracturing in the Planning Area occurs in vertical wells at relatively shallow injection depths (CCST 2015).

For the following reasons, there would be negligible impacts related to hydraulic fracturing–induced earthquakes:

- No earthquakes have been known to be caused by hydraulic fracturing in California;
- Earthquake magnitudes associated with hydraulic fracturing are small (less than magnitude 3.8);
- Hydraulic fracturing operations are short in duration (approximately one day per well);
- Amounts of fluid injected during hydraulic fracturing are relatively small (approximately 100,000 gallons per well); and
- SB4 requires seismic monitoring during all hydraulic fracturing activities.

4.10.3.2 Wastewater Disposal Induced Earthquakes

Several cases of wastewater disposal–induced earthquakes in the United States have been reported (Frohlich et al. 2011, 2014; Frohlich 2012; Kim 2013; Keranen et al. 2014), associated with approximately 35,000 wastewater disposal wells active in the United States. Approximately 1.8 million hydraulic fracturing treatments involving over approximately 1 million wells have been conducted from 1947 to 2010 in the United States (Gallegos and Varela 2014), and there are currently approximately 80,000 active enhanced oil recovery wells in the United States (Weingarten et al. 2015) with few recent associated earthquakes (Gan and Frohlich 2013). Based on these and other studies, researchers have concluded that wastewater disposal is responsible for the majority of, and the most damaging, induced earthquakes associated with oil and gas development (Horton 2012; Keranen et al. 2013; Frohlich et al. 2014; Rubinstein et al. 2014). Increased fluid pressure is the probable driving mechanism for induced earthquakes, and wastewater disposal wells can raise fluid pressures higher over longer periods of time and over larger areas than hydraulic fracturing or enhanced oil recovery (Rubinstein and Mahani 2015).

The largest observed earthquake suspected to be related to wastewater disposal in the United States to date is a magnitude 5.7 event in 2011 near Prague, Oklahoma (Keranen et al. 2013; Sumy et al. 2014). The largest earthquake clearly linked to hydraulic fracturing wastewater injection is a magnitude 5.3 event that occurred in the Raton Basin of Colorado and New Mexico in 2011 (Rubinstein et al. 2014). To date, there have been no reported cases of induced seismicity associated with produced water injection or hydraulic fracturing wastewater in California (CCST 2015). Typical wastewater volumes in California from hydraulic fracturing are generally less than those associated with hydraulic fracturing operations in other parts of the country where induced earthquakes have occurred (CCST 2015).

Although unlikely, induced earthquakes associated with wastewater disposal wells related to hydraulically fractured wells would be possible under all Action Alternatives. Absent hydraulic fracturing, there is still a need to dispose of large volumes of briny produced water that comes out of oil wells with the oil. Continued use of disposal wells and the installation of additional disposal wells for wastewater associated with oil and gas development could result in additional earthquake activity. However, wastewater disposal volumes associated with hydraulic fracturing activities would be a very small component of all wastewater disposal and would be temporary (during hydraulic fracturing operations). Therefore, negligible impacts related to earthquake potential from oil and gas disposal wells associated with hydraulic fracturing alone would be expected. Adherence to the DOGGR UIC program regulations, including water disposal volumes, rates, and pressures, would further reduce potential induced earthquake activity.

4.10.4 Impacts of Alternative B

Under Alternative B, approximately 1,011,470 acres would be open to fluid mineral leasing, most of which would be subject to major constraints (both CSU – Protected Species and CSU – Sensitive Species). Up to approximately 210 acres of surface disturbance within the 416,515-acre supplemental hydraulic fracturing analysis areas could be impacted by hydraulic fracturing operations (Table 4.2). A CSU stipulation would be established, CSU – Existing Surface Use/Management, for the purpose of minimizing or eliminating conflict between fluid mineral development and existing surface use on both public lands and split estate overlying federal minerals, including risk to public health and safety, and social and economic impacts (e.g., noise and aesthetics). Additionally, a CSU stipulation, CSU – Defense, would be established for the purpose of minimizing or eliminating conflict between fluid mineral development and military base operations.

Short- and long-term disturbance associated with the construction and use of well pads, roads, pipelines, and other infrastructure associated with hydraulically fractured wells, would reduce lands available for other leasable, solid, or saleable mineral extraction, regardless of surface ownership. Up to 33.6 acres of BLM surface and up to 175 acres of non-BLM surface minerals could be impacted, depending on the placement of hydraulically fractured well pads and the presence of leasable, solid, or saleable minerals. Additionally, hydraulic fracturing operations could remove leasable, solid, or saleable minerals because of well pad, road, and pipeline construction.

4.10.5 Impacts of Alternative C

Under Alternative C, approximately 966,160 acres would be open to fluid mineral leasing, subject to major constraints (both CSU – Protected Species and CSU – Sensitive Species). A CSU stipulation would be established, CSU – Existing Surface Use/Management, for the purpose of minimizing or eliminating conflict between fluid mineral development and existing surface use on both public lands and split estate overlying federal minerals, including risk to public health and safety, and social and economic impacts (e.g., noise and aesthetics). Additionally, a CSU stipulation, CSU – Defense, would be established for the purpose of minimizing or eliminating conflict between fluid mineral development and military base operations.

Short- and long-term disturbance associated with the construction and use of well pads, roads, pipelines, and other infrastructure associated with hydraulically fractured wells, would reduce lands available for other leasable, solid, or saleable mineral extraction, regardless of surface ownership. Up to 33.6 acres of BLM surface and up to 175 acres of non-BLM surface minerals within the 416,515-acre supplemental hydraulic fracturing analysis areas could be impacted, depending on the placement of hydraulically fractured well pads and the presence of leasable, solid, or saleable minerals. Additionally, hydraulic fracturing operations could remove leasable, solid, or saleable minerals because of well pad, road, and pipeline construction.

4.10.6 Impacts of Alternative D

Under Alternative D, approximately 966,160 acres would be open to fluid mineral leasing, subject to major constraints (both CSU – Protected Species and CSU – Sensitive Species). A CSU stipulation would be established, CSU – Existing Surface Use/Management, for the purpose of minimizing or eliminating conflict between fluid mineral development and existing surface use on both public lands and split estate overlying federal minerals, including risk to public health and safety, and social and economic impacts (e.g., noise and aesthetics). Additionally, a CSU stipulation, CSU – Defense, would be established

for the purpose of minimizing or eliminating conflict between fluid mineral development and military base operations.

Short- and long-term disturbance associated with the construction and use of well pads, roads, pipelines, and other infrastructure associated with hydraulically fractured wells, would reduce lands available for other leasable, solid, or saleable mineral extraction, regardless of surface ownership. Up to 33.6 acres of BLM surface and up to 175 acres of non-BLM surface minerals (Figure 4.2) within the 416,515-acre supplemental hydraulic fracturing analysis areas could be impacted, depending on the placement of hydraulically fractured well pads and the presence of leasable, solid, or saleable minerals. Additionally, hydraulic fracturing operations could remove leasable, solid, or saleable minerals because of well pad, road, and pipeline construction.

4.10.7 Impacts of Alternative E

Under Alternative E, approximately 1,013,010 acres would be open to fluid mineral leasing, subject to major constraints (both CSU – Protected Species and CSU – Sensitive Species). A CSU stipulation would be established, CSU – Existing Surface Use/Management, for the purpose of minimizing or eliminating conflict between fluid mineral development and existing surface use on both public lands and split estate overlying federal minerals, including risk to public health and safety, and social and economic impacts (e.g., noise and aesthetics). Additionally, a CSU stipulation, CSU – Defense, would be established for the purpose of minimizing or eliminating conflict between fluid mineral development and military base operations.

Short- and long-term disturbance associated with the construction and use of well pads, roads, pipelines, and other infrastructure associated with hydraulically fractured wells, would reduce lands available for other leasable, solid, or saleable mineral extraction, regardless of surface ownership. Up to 33.6 acres of BLM surface and up to 175 acres of non-BLM surface minerals (Figure 4.2) within the 416,515-acre supplemental hydraulic fracturing analysis areas could be impacted, depending on the placement of hydraulically fractured well pads and the presence of leasable, solid, or saleable minerals. Additionally, hydraulic fracturing operations could remove leasable, solid, or saleable minerals because of well pad, road, and pipeline construction.

4.11 Areas of Critical Environmental Concern

Potential impacts to ACECs from all activities and programs except use of hydraulic fracturing in the oil and gas program are summarized in Section 4.17 of the 2012 Final EIS. Estimated impacts of hydraulic fracturing in the oil and gas program are provided below.

4.11.1 Methods of Analysis and Assumptions

Impacts to ACECs are proportional to the amount of new surface disturbance for each alternative (i.e., increased disturbance would result in a proportionate increase in adverse impacts to soils).

The acreage of each ACEC, and associated relevant and important values, within the four supplemental hydraulic fracturing analysis areas is shown in Table 4.11 and illustrated in Figure 4.11.

Table 4.11
ACECs Within Supplemental Hydraulic Fracturing Analysis Areas

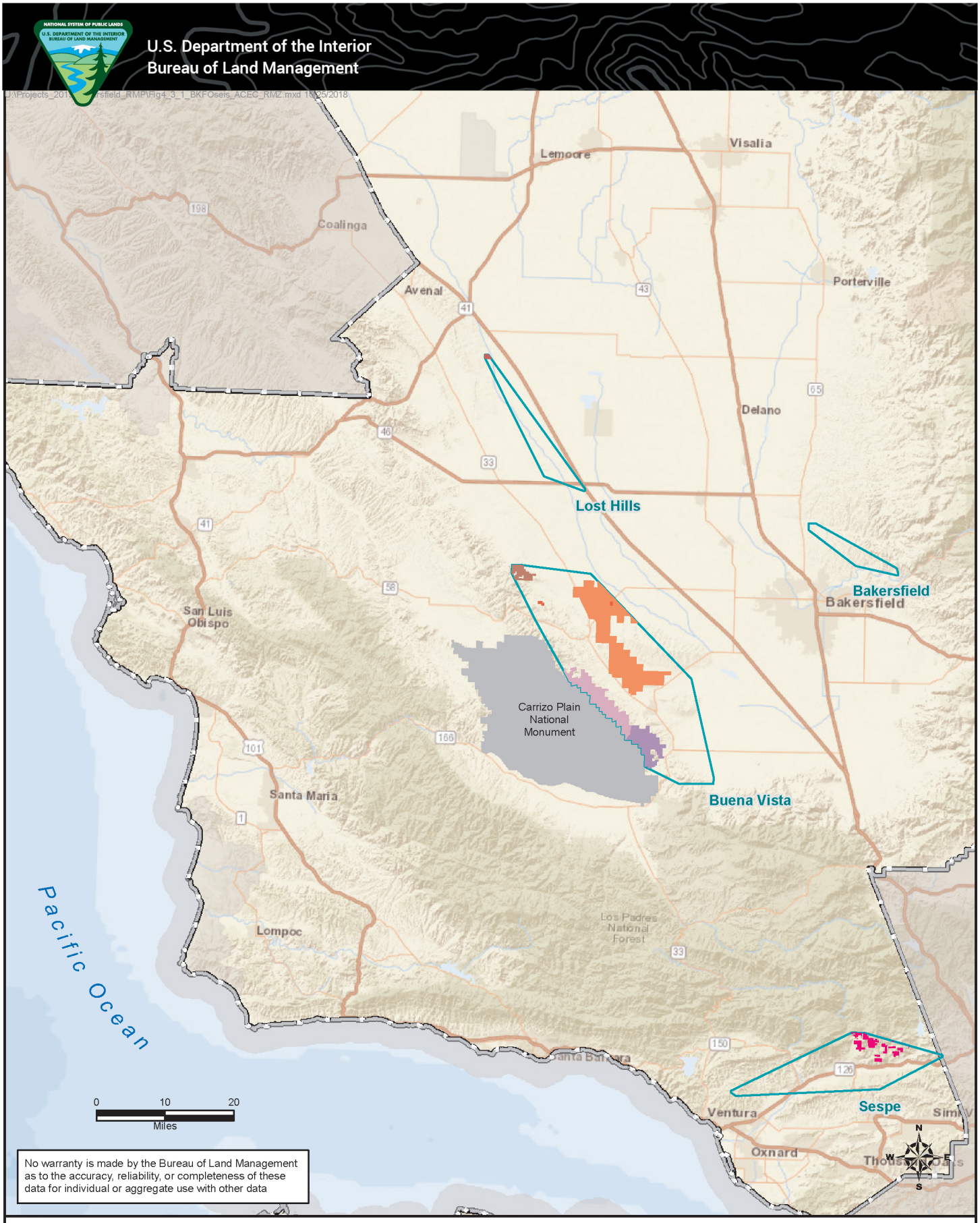
Analysis Area	Analysis Area (acres)	ACEC	ACEC (acres)	% of Analysis Area	Relevance and Important Values
Lost Hills	34,029	Kettleman Hills	223	0.7	Paleontological resources and T&E plant and animal species
Buena Vista	268,469	Chico Martinez	3,031	1.1	Paleontological and geologic resources
		Compensation Lands	203	0.1	T&E species
		Lokern-Buena Vista	42,792	15.9	T&E species and associated habitats
Bakersfield	17,557	NA	NA	NA	NA
Sespe	96,460	Hopper Mountain	3,815	4	California condor

Key:
ACEC = Area of Critical Environmental Concern
NA = not applicable
T&E = threatened or endangered

This analysis assumes that potential surface disturbance from hydraulically fractured wells, as identified in the supplemental analysis, would follow applicable surface use plans and restrictions, per land surface ownership. All applicable lease stipulations (Table 2.1, above, and Appendix G of the 2012 Final EIS), as well as appropriate BMPs listed in Appendix L of the 2012 Final EIS, would be implemented for all surface-disturbing activities on BLM-managed mineral estate.

Where hydraulically fractured wells would be located on non-BLM surface, constraints consistent with the rights granted by a lease on federal minerals may be imposed on the location of access roads, well sites, and facility sites or timing of geophysical exploration, well drilling, and other operations. These constraints include lease stipulations, BLM review and environmental analysis of proposed operations, Notices to Lessees, Onshore Orders, or regulations. In addition, and as applicable, protective measures, mitigation measures, and BMPs from SB4, Chapter 313, as well as Kern County Zoning Ordinance, Chapter 19.98 (Oil and Gas Production) (Kern County 2015) would apply to mitigate potential impacts. Wells on non-BLM surface would likely be subject to additional environmental impact analysis under CEQA.

It is important to note that impacts resulting from proposed surface-disturbing activities on BLM surface associated with a specific oil and gas development project, which may include hydraulic fracturing, will be evaluated in the future with site-specific NEPA analyses. Similarly, proposed surface-disturbing activities on non-BLM surface would be subject to environmental impact analysis evaluated by other federal agency-specific NEPA analyses, or under CEQA.



ACECs and RMZs in the SHF Analysis Areas
Bureau of Land Management
Bakersfield Field Office
DRAFT SEIS

Figure 4.11

4.11.2 Impacts of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic fracturing in the context of their respective management situations. Therefore, the current supplemental analysis would not result in any substantive change to the estimated impacts to ACECs from fluid mineral management, as analyzed in Section 4.17 of the 2012 Final EIS.

4.11.3 Impacts Common to All Action Alternatives

Impacts from Action Alternatives are described in the following sections.

4.11.4 Impacts of Alternative B

Under Alternative B, approximately 1,011,470 acres would be open to fluid mineral leasing. Up to approximately 209 acres of surface disturbance within the 416,515-acre supplemental hydraulic fracturing analysis areas could be impacted by hydraulic fracturing operations (Table 4.2). NSOs would be established for minimizing or eliminating adverse effects on unique or significant natural and cultural resources and protected species that are incompatible with fluid mineral development. This NSO would include ACECs.

Under Alternative B, a number of NSO and CSU stipulations would be established to protect relevant and important values (see Table 4.11) in ACECs, including the Compensation Lands, from adverse effects associated with fluid mineral development. These stipulations would provide protection from long-term ground-disturbing activities and additional protection to relevant and importance values in ACECs.

NSOs and CSUs would provide protection to ACECs from hydraulic fracturing operations. Therefore, negligible direct impacts would be expected. Some hydraulic fracturing operations could result in negligible indirect impacts. Operations in areas adjacent to ACECs could result in spills or leaks that would impact ACECs; dust and soil from operations could drift to adjacent ACECs, potentially impacting vegetation and habitat resources.

4.11.5 Impacts of Alternative C

Under Alternative C, approximately 966,160 acres would be open to fluid mineral leasing, subject to major stipulations (both CSU – Protected Species and CSU – Sensitive Species). Up to approximately 209 acres of surface disturbance within the 416,515-acre supplemental hydraulic fracturing analysis areas could be impacted by hydraulic fracturing operations (Table 4.2). Approximately 3,880 acres would also be subject to an NSO stipulation, and additional CSU stipulations may be applied to all new leases as determined appropriate and in conformance with the 2014 RMP. NSOs would be established for minimizing or eliminating adverse effects on unique or significant natural and cultural resources and protected species that are incompatible with fluid mineral development.

Approximately 203 acres of the Compensation Lands ACEC in the Buena Vista supplemental hydraulic fracturing analysis area would be closed to oil and gas leasing at the discretion of BLM, but NSO and CSU stipulations would not be established. Closure of these lands to oil and gas development would preclude hydraulic fracturing and reduce impacts to Compensation Lands ACEC.

NSOs and CSUs would protect ACECs from hydraulic fracturing operations. Therefore, negligible direct impacts would be expected. Some hydraulic fracturing operations could result in negligible indirect impacts. Operations in areas adjacent to ACECs could result in spills or leaks that would impact ACECs; dust and soil from operations could drift to adjacent ACECs, potentially impacting vegetation and habitat resources.

4.11.6 Impacts of Alternative D

Under Alternative D, approximately 966,160 acres would be open to fluid mineral leasing, subject to major stipulations (both CSU – Protected Species and CSU – Sensitive Species). Up to approximately 209 acres of surface disturbance within the 416,515-acre supplemental hydraulic fracturing analysis areas could be impacted by hydraulic fracturing operations (Table 4.2). NSOs would be established for minimizing or eliminating adverse effects on unique or significant natural and cultural resources and protected species that are incompatible with fluid mineral development. These NSOs would include ACECs.

A major stipulation, NSO – General, would be established that prohibits surface disturbance on the entire lease for the purpose of minimizing or eliminating adverse effects on unique or significant natural and cultural resources that are incompatible with fluid mineral development. A major stipulation, CSU – Sensitive Species, would be established for the purpose of minimizing or eliminating adverse effects associated with fluid mineral development on federal candidate, state-listed, and BLM-listed sensitive species.

NSOs and CSUs would provide protection to ACECs from hydraulic fracturing operations. Therefore, negligible direct impacts would be expected. Some hydraulic fracturing operations could result in negligible indirect impacts. Operations in areas adjacent to ACECs could result in spills or leaks that would impact ACECs; dust and soil from operations could drift to adjacent ACECs, potentially impacting vegetation and habitat resources.

4.11.7 Impacts of Alternative E

Under Alternative E, approximately 1,013,010 acres would be open to fluid mineral leasing, subject to major stipulations (both CSU – Protected Species and CSU – Sensitive Species). Of this, at least 3,590 acres would also be subject to an NSO stipulation. Additional CSU stipulations may be applied to all new leases in conjunction with the lease sale as determined appropriate and in conformance with the 2014 RMP. NSOs would be established for minimizing or eliminating adverse effects on unique or significant natural and cultural resources and protected species that are incompatible with fluid mineral development.

NSOs and CSUs would provide protection to ACECs from hydraulic fracturing operations. Therefore, negligible direct impacts would be expected. Some hydraulic fracturing operations could result in negligible indirect impacts. Operations in areas adjacent to ACECs could result in spills or leaks that would impact ACECs; dust and soil from operations could drift to adjacent ACECs, potentially impacting vegetation and habitat.

4.12 Social and Economic Resources

Potential impacts to areas of social and economic resources are summarized in Section 4.23 of the 2012 Final EIS.

No new and relevant information is needed to support this Draft Supplemental EIS, as the analysis of fluid mineral management under both the No Action and Action Alternatives accounted for a range of oil and gas production, which would include the potential for hydraulic fracturing.

4.12.1 Analysis Methods and Assumptions

Analysis methods follow those described in Section 4.23 of the 2012 Final EIS.

It is important to note that impacts resulting from proposed surface-disturbing activities on BLM surface associated with a specific oil and gas development project, which may include hydraulic fracturing, will be evaluated in the future with site-specific NEPA analyses. Similarly, proposed surface-disturbing activities on non-BLM surface would be subject to environmental impact analysis evaluated by other federal surface management agency-specific NEPA analyses, or under CEQA.

4.12.2 Impacts of Alternative A (No Action)

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic fracturing in the context of their respective management situations. Therefore, the current supplemental analysis would not result in any substantive change to the estimated impacts to social and economic resources from fluid mineral management, as analyzed in Section 4.23 of the 2012 Final EIS.

4.12.3 Impacts of Management Common to All Action Alternatives

Section 4.23.2 of the 2012 Final EIS addressed impacts to social and economic resources from management common to all Action Alternatives. The impacts associated with the Action Alternatives are the same regarding the economic implications of fluid mineral management decisions in the 2014 RMP, including hydraulic fracturing (Section 4.23.2.1), as well as regarding the social aspects of oil and gas development, which would also include hydraulic fracturing (Section 4.23.2.2).

Section 4.23.2.1 of the 2012 Final EIS considered a historic production of 15 to 19 million barrels of oil and 5 million thousand cubic feet (MCF) of gas. This production would result in approximately 2,871 total jobs (direct, indirect, and induced). Over the 10-year life of the 2014 RMP, 0 to 40 wells may be hydraulically fractured on new leases. Hydraulically fractured well pads would require a crew size of two to five workers for construction, similar to conventional wells. However, during a standard hydraulic fracturing operation, approximately 8 to 15 employees may be present on each shift, and additional personnel from the owner operator may be on site to observe and run ancillary equipment, as necessary. While no more than one shift typically is needed in a day, this may result in a few more workers than for a conventional well, which typically employs crews of approximately 12 workers. The differences in crew size would result in a negligible change to the number of workers considered as part of the economic impact analysis of fluid minerals conducted as part of the 2012 Final EIS.

Section 4.23.2.2 of the 2012 Final EIS addresses the social impacts of oil and gas production continuing within its historic range. As noted, employment would contribute to the quality of life for those

depending on the oil and gas industry and connected industries, and the additional number of workers would result in a negligible change. Air quality, traffic congestion, noise, and other concerns have been expressed by communities near potential oil and gas development locations. Communities in proximity to BLM surface within the Planning Area could experience increases in quality of life as a result of enhanced travel management decisions in the 2014 RMP. Other supplemental analyses did not reveal any new effects that would also impact social or economic values or uses, whether market or non-market. Due to the limited changes specifically associated with hydraulic fracturing (for which 0 to 40 wells on new leases are anticipated for the life of the 2014 RMP) in terms of employment, air quality, traffic congestion, noise, environmental justice, population, and housing, a negligible change would be expected as compared to the analysis conducted as part of the 2012 Final EIS.

4.13 Cumulative Impacts

This Draft Supplemental EIS follows the 2012 Final EIS format and organization for cumulative impacts. The cumulative impact analysis in the 2012 Final EIS complies with CEQ (1997) guidance that such analysis focus on meaningful impacts, not exhaustively analyze all possible cumulative impacts. Therefore, the 2012 Final EIS analyzed past, present, and future actions anticipated to have environmental impacts similar to the potential incremental impacts identified from future leasing and development management decisions in the 2014 RMP. This included impacts resulting in meaningful impacts to historically important resources or with a potential for violating legal standards or laws. It also includes other identified projects or actions in the Cumulative Impact Assessment Area (CIAA) that relate to the identified issues.

4.13.1 Methods of Analysis

The methods and assumptions used in the 2012 Final EIS cumulative impact analysis are described in Section 4.25 of the 2012 Final EIS. In general, the 2012 Final EIS addresses cumulative impacts by grouping resources by the issues addressed in the PRMP, described in Section 1.4.2 of the 2012 Final EIS. Cumulative impacts were considered in the context of:

- Baseline conditions described in Chapter 3 of the 2012 Final EIS;
- Estimated incremental impacts on individual resources described in Chapter 4 of the 2012 Final EIS;
- The actions and decisions described in the RFDS; and
- Factors from CEQ guidance for considering cumulative impacts under NEPA (CEQ 1997), as follows:
    - Does the affected resource have substantial value relative to legal protection and/or ecological, cultural, economic, or social importance?
    - Are reasonable foreseeable future actions anticipated to have environmental impacts similar to the incremental impacts identified for RMP alternatives?
    - Have any recent or ongoing NEPA analyses of similar actions in the geographic area identified important adverse or beneficial cumulative impact issues?
    - Has the impact to the resource been historically important, such that the importance of the resource is defined by past loss, past gain, or investments to restore resources?

Additional assumptions for the supplemental analysis of cumulative impacts include integration of all new and relevant information summarized in Section 1.4.1 of this Draft Supplemental EIS, as integrated into the impact analysis presented in Chapter 4.

For this supplemental analysis, incremental impacts discussed in prior sections of this chapter are considered cumulative to hydraulic fracturing that may be associated with the following actions:

- New oil and gas wells on existing leases;
- Operations of existing oil and gas wells on existing leases;
- Operations on existing oil and gas wells on private surface; and
- New oil and gas wells on new private leases.

4.13.2 Cumulative Impacts on Resource Related to Issue 1

Adequately address the need for access to and continued availability of, public lands for multiple recreational uses and open spaces.

The cumulative impacts on resources related to Issue 1 are fully described in Section 4.25.1 of the 2012 Final EIS. The supplemental analysis of hydraulic fracturing, based on fluid mineral management decisions in the PRMP, would not result in changes to this cumulative impact analysis.

4.13.3 Cumulative Impacts on Resource Related to Issue 2

Establish a balance between the extent of the travel network and the protection of natural and cultural resources including an appropriate allocation of routes to the various modes of transport.

The cumulative impacts on resources related to Issue 2 are fully described in Section 4.25.2 of the 2012 Final EIS. The supplemental analysis of hydraulic fracturing, based on fluid mineral management actions in the PRMP, would not result in changes to this cumulative impact analysis.

4.13.4 Cumulative Impacts on Resource Related to Issue 3

Ensure appropriate protection for Threatened and Endangered species, critical habitat, other biological resources, and cultural and paleontological resources in a multiple-use environment.

The cumulative impacts on resources related to Issue 3 are described in Section 4.25.3 of the 2012 Final EIS. The CIAA for these resources includes the entire Planning Area. Cumulative impacts estimated in the supplemental analysis of hydraulic fracturing, based on fluid mineral management actions in the PRMP, integrate consideration of additional protective measures to be applied to these resources. These include the Programmatic BO (USFWS 2017), as well as other surface management direction and guidance, including those mandated by PRC Section 3161 (b)(3)(A) and (B) of Chapter 1, Division 3 (the State's laws for the conservation of petroleum and gas) (SB4).

Alternative A

Alternative A would maintain the current management situation under the existing Caliente RMP (BLM 1997) and Hollister RMP (BLM 1984), as amended. These RMPs do not address potential hydraulic fracturing in the context of their respective management situations. Therefore, the current

supplemental analysis would not result in any substantive change to the estimated cumulative impacts, as analyzed in Section 4.25.3 of the 2012 Final EIS.

All Action Alternatives

As noted in Section 4.25.3 of the 2012 Final EIS, these four alternatives provide for compliance with legal preservation and protection mandates. They also continue to allow human activities that could contribute to the overall trends resulting in loss of natural and cultural resources. This cumulative contribution is minimal (anticipated at or about 18,000 acres of surface disturbance over the life of the plan) and confined in its extent (approximately 2 percent of the CIAA) and negligible compared to other impacts to these resources expected to occur across the Planning Area.

Many management decisions under these alternatives are designed to protect and preserve these resources on BLM surface, and some on federal mineral estate. These discretionary actions include designation of ACECs, application of Fluid Minerals leasing stipulations, implementation of BMPs and other mitigation measures (Appendix L of the 2012 Final EIS), implementation of conservation strategies, application of Central California Standards for Rangeland Health, as well as integration of prescriptive management of areas of ecological importance. Many of these actions, such as requirements mandated in SB4, would be conducted in collaboration with private, state, and federal land managers within the CIAA. Additional protections and restrictions on disturbance would be applied to T&E species and Designated Critical Habitat through mandated actions in the Programmatic BO (USFWS 2017).

BLM surface and federal mineral estate is a relatively small component of the CIAA. The cumulative benefits resulting from protective actions applied to this surface area may not be sufficient to prevent the significant loss (e.g., preclude species recovery of species or habitat, or the loss of eligible cultural resource) of these natural and cultural resources from all cumulative surface-disturbing activities, over time, throughout the Planning Area. This includes many special status species such as California condor and San Joaquin kit fox.

4.13.5 Cumulative Impacts on Resource Related to Issue 4

Continue to appropriately manage livestock grazing to provide for economic benefit, rural lifestyles and vegetation management while protecting other resources.

The cumulative impacts on livestock grazing and other resources related to Issue 4 are fully described in Section 4.25.4 of the 2012 Final EIS. As noted in Section 4.9 of this Draft Supplemental EIS, the direct, indirect, and cumulative impacts to livestock grazing operations, as well as opportunities from fluid mineral development within the Bakersfield Field Office, were deemed sufficiently analyzed in the 2012 Final EIS. Negligible impacts on livestock grazing were associated with fluid mineral development. Therefore, the additional impacts associated with hydraulic fracturing would not change that analysis.

4.13.6 Cumulative Impacts on Resource Related to Issue 5

Balance the demand for energy development (including oil and gas, wind, and solar energy) and other land use authorizations (such as road and transmission corridor rights-of-way) with other resource values.

The cumulative impacts on resources related to Issue 5 are described in Section 4.25.5 of the 2012 Final EIS. The supplemental analysis of hydraulic fracturing, based on fluid mineral management actions in the PRMP, is not expected to result in changes to this analysis.

4.13.7 Cumulative Impacts on Resource Related to Issue 6

Address the impacts of Climate Change on the management of public lands including strategies that will reduce impacts and incorporate appropriate monitoring.

GHGs are not quantified for conventional well development in the 2012 Final EIS and are therefore not quantified in the supplemental analysis for hydraulic fracturing. The GHG emissions associated with the additional four wells discussed in this Draft Supplemental EIS are discussed above on an additive basis, however, and are *de minimis*. Considered cumulatively, however, based on the fluid mineral management actions in the PRMP, hydraulic fracturing is a component of the analysis in the 2012 Final EIS.

4.14 Irretrievable or Irreversible Commitment of Resources

Irretrievable or irreversible commitment of resources is fully defined and described in Section 4.26 of the 2012 Final EIS. Results of the supplemental analysis conducted in this Draft Supplemental EIS would not change the results of the 2012 Final EIS assessment of these issues.

4.15 Unavoidable Adverse Impacts

Unavoidable adverse impacts are fully defined and described in Section 4.27 of the 2012 Final EIS. Results of the supplemental analysis conducted in this Draft Supplemental EIS would not change the results of the 2012 Final EIS assessment of these issues.

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5 Chapter Five

5.1 Introduction

This chapter describes and chronicles the public outreach and participation opportunities made available throughout the development of this Draft Supplemental EIS, and describes the consultation and coordination efforts with Tribes, government agencies, and other stakeholders that have occurred to date. It also includes a list of the agencies, organizations, and individuals who have prepared this document.

5.2 Public Scoping and Outreach

5.2.1 Scoping Process

"Scoping" is the term used in the CEQ regulations implementing NEPA (40 CFR, Part 1500 et seq.) to define the early and open process for determining the scope of issues to be addressed during NEPA project planning. The scoping process provides an avenue to involve the public in identifying significant issues related to potential land use management actions. It also helps identify any issues that are not significant and can therefore be eliminated from detailed analysis.

The scoping process is the method for determining the scope, focus, and content for a Supplemental EIS. Scoping helps to identify the methods of assessment, environmental effects, and mitigation measures to be analyzed, and eliminates from detailed study any issues that are not significant or relevant to the decision at hand. In the case of this Draft Supplemental EIS, it was used to determine whether changes are needed to the fluid mineral management decisions in the 2014 RMP under the range of alternatives assessed in the 2012 Final EIS. Therefore, the focus of the scoping process for the Draft Supplemental EIS was to identify new information related to environmental effects, methods of assessment, and mitigation measures.

Scoping also provides an opportunity for active participation from a variety of stakeholders, including proponents and opponents of a proposed action, and encourages the expression of thoughts and/or concerns during the decision-making process.

5.2.2 Notice of Intent

The NOI is the legal document notifying the public of BLM's intent to initiate the planning process and, in this case, to prepare a Supplemental EIS for a major federal action. The NOI is intended to invite the participation of the affected and interested agencies, organizations, and members of the public in determining the scope and significant issues to be addressed in the planning alternatives and analyzed in a Supplemental EIS.

The NOI identifies the purpose and need for the Supplemental EIS and provided information about a Supplemental EIS, preliminary planning issues and criteria, the scoping process, and contact information.

An NOI to prepare a Draft Supplemental EIS and potential amendment to the 2014 RMP was issued by the DOI on August 7, 2018, and published in the Federal Register on August 8, 2018 and also initiated a 30-day scoping period, which closed September 7, 2018.

5.2.3 Press Release and Public Outreach

On August 7, 2018, BLM Central California District distributed a press release to all television, radio, newspaper, magazine, independent, and blog media outlets within the jurisdiction of the Bakersfield Field Office announcing the beginning of the NEPA planning process and that the 30-day scoping period would begin on August 8. The BLM Central California District Public Affairs Officer called reporters and publishers at key media outlets to alert them of the press release.

The press release was also posted to the BLM California website and shared on the social media platforms Facebook, Twitter, and Flickr. This notice included information on the Planning Area, the type of planning documents that would be prepared, preliminary planning issues to be analyzed, where to find additional information online at the project website, the various ways the public could submit scoping comments, and whom to contact for more information. The press release was also emailed to a database of tribal members, stakeholders, and interested parties. The project ePlanning website was published to the public with postings of the Federal Register Notice, press release, Planning Area map and geographic information system data, and instructions for how to submit comments.

5.2.4 Scoping Meetings

No public scoping meetings were held.

5.2.5 Project Web Site

The BLM project number for this Draft Supplemental EIS is: **DOI-BLM-CA-C060-2018-0082-EIS**

The project website for this Draft Supplemental EIS is:

https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=renderDefaultPlanOrProjectSite&projectId=100601&dctmId=0b0003e8810ab8e2

The project website provides background information about the project, which includes a public involvement timeline and calendar, maps and photos, and copies of public information documents such as the NOI and Public Scoping Summary Report. The site also provides a link to the comment form for submitting comments about the project and on this document specifically. BLM continuously updates the website with information, documents, and announcements.

5.2.6 Project Contact Information

Scoping comments were obtained regarding the Draft Supplemental EIS via the following methods:

Email: *blm_ca_bkfo_oil_gas_update@blm.gov.*

Mail: Bakersfield Field Office, Bureau of Land Management, Attn: Bakersfield RMP Hydraulic Fracturing Analysis, 3801 Pegasus Drive, Bakersfield, CA 93308.

Website: *https://www.Federalregister.gov/documents/2018/08/08/2018-16957/notice-of-intent-for-potential-amendment-to-the-resource-management-plan-for-the-bakersfield-field*

Documents pertinent to this proposal were made available to be examined during regular business hours at:

Bureau of Land Management, Bakersfield Field Office
3801 Pegasus Drive, Bakersfield, CA 93308

5.2.7 Additional Outreach

BLM notified Congressional and State Legislature elected officials, and county representatives, upon initiation of this Draft Supplemental EIS process and upcoming public scoping period.

Due to intense and wide-spread media interest, BLM conducted several interviews with national, regional, and local journalists throughout the entire 30-day scoping period. The Bakersfield Field Office Manager fielded questions and provided background information. Numerous and varied news organizations carried several articles on the opening of the BLM planning effort, including E&E News, Oil & Gas Journal, Sacramento Bee, New Times San Luis Obispo, Santa Barbara Independent, Sierra Sun Times, Kern Valley Sun, KTVA-AM, KBAK-TV (CBS), and KBFX-TV (Fox) Eyewitness News.

5.3 Consultation and Coordination

The following subsections document BLM's consultation and coordination efforts during the preparation of this Draft Supplemental EIS.

5.3.1 Cooperating Agencies

A cooperating agency is any federal, state, or local government agency or Native American Tribe that enters into a formal agreement with the lead federal agency to help develop an environmental analysis. More specifically, cooperating agencies "work with the BLM, sharing knowledge and resources, to achieve desired outcomes for public lands and communities within statutory and regulatory frameworks" (BLM Land Use Planning Handbook H-1601-1; BLM 2005b).

No cooperating agencies have been named for this Draft Supplemental EIS process.

5.3.2 Native American Consultation

Native American Tribes have a unique legal and political relationship with the government of the United States. EO 13175 requires federal agencies to coordinate and consult on a government-to-government basis with sovereign Native American tribal governments whose interests may be directly and substantially affected by activities on federally administered lands. Other laws, regulations, DOI guidance, and EOs require consultation to identify the cultural values, religious beliefs, traditional practices, and legal rights of Native American people that could be affected by BLM actions on federal lands. These include the National Historic Preservation Act of 1966 (as amended), the American Indian Religious Freedom Act of 1978, the Native American Graves Protection and Repatriation Act, EO 13175 (2010), DOI Secretarial Order 3215 (DOI 2000), Secretarial Order 3317 with DOI Tribal Consultation Policy (2011), 512 Department Manual Chapter 2 (DOI 1995), BLM Handbook 1780-1 Improving and Sustaining BLM- Tribal Relations (BLM 2016), BLM Manual H-8160-1 (BLM 2005b), and EO 13007 Indian Sacred Sites. Consultation with Native American Tribes is also part of the NEPA scoping process and a requirement of FLPMA.

BLM sent three notification letters to the Native American Tribes listed in Table 5.1 on May 30, 2018, August 7, 2018, and September 21, 2018. BLM solicited the Tribes' opinions and/or concerns related to the potential impacts of hydraulic fracturing technology. The letters also invited the Tribes to initiate government-to-government consultation.

Table 5.1
Tribal Consultation

Tribe	Contacts
Big Sandy Rancheria Band of Western Mono Indians	Ms. Elizabeth Kipp, Chairperson
	Tom Zizzio, Tribal Administrator
	Ms. Hazel Earley, Environmental Program
Cold Springs Rancheria of Mono Indians	Ms. Carol Bill, Chairperson
	Mr. Raymond Gutteriez, Environmental Program
	Mr. Jared Alden, USEPA Manager
North Fork Rancheria of Mono Indians	Mr. Gary Walker, Chairperson
	Ms. Judy Elaine Fink, Vice Chairperson
	Mr. George Lopez, Cultural Resources
Picayune Rancheria of Chukchansi Indians	Ms. Jennifer Ruiz, Chairperson
Santa Ynez Band of Chumash Indians	Mr. Kenneth Kahn, Chairperson
	Mr. Bo Armenta, Chairperson, Elders Council
	Mr. Freddie Romero, Cultural Resources
	Mr. Sam Cohen, Tribal Attorney
	Ms. Karen Keever, Tribal Administrator
Table Mountain Rancheria	Ms. Leanne Walker-Grant, Chairperson
	Mr. Cliff Raley, Environmental Director
	Mr. Samuel Elizondo, Environmental Officer
	Mr. Bob Pennell, Cultural Resources
Tejon Indian Tribe	Mr. Octavio Escobedo, Chairperson
	Mr. Colin Rambo, THPO Technician
	Ms. Sandra Hernandez, Tribal Administration
Santa Rosa Rancheria Tachi Tribe	Mr. Reuben Barrios, Chairperson
	Mr. Greg Cuara, Cultural Resources
	Ms. Shana Powers, Cultural Resources Director
	Mr. Robert Jeff, Cultural Resources
Tule River Indian Tribe	Mr. Neil Peyron, Chairperson
	Ms. Kerri Vera, Environmental Program Director
Northern Chumash, Carrizo Plain Native American Advisory Committee, Chairman	Michael Khus Zarate
yak tityu	Mona Tucker, Chairperson

5.3.3 Special Status Species Consultation

Need for Section 7 consultation for this supplemental process has yet to be determined.

5.4 Results of Public Scoping

Scoping comments and responses provided by BLM are summarized in the Scoping Summary Report (BLM 2018), which is available to the public on the project website (see Section 5.2.5). The Scoping Summary Report outlines the scoping process in detail and provides a summary of public comments by affiliation and by topic. It also includes a copy of the press release, NOI, stakeholder list, and submissions and responses.

During the public scoping period, 8,399 comment submissions were received. Comments were received as emails, hard copy letters, and faxes. Of the scoping comment submissions, 6,708 submissions (79.5 percent) were attributed to one of 11 form emails/letters and 211 submissions (less than one percent) represented unique submissions. These submissions comprise a total of 779 unique, individual comments.

Independently, Congressman Salud Carbajal, 24th Congressional District, Santa Barbara District Office, also provided a website location for collection of public scoping comments. Approximately 374 comments were collected through a form posted on the website. Likewise, an additional 280 scoping comments were collected through a form on the Los Padres ForestWatch website. The Los Padres ForestWatch website comments were provided to Congressman Carbajal's office, which forwarded both sets of comments to BLM after the close of the public scoping period. Therefore, these scoping comments could not be included in the Public Scoping Summary Report. The commenters' contact information was uploaded to the project stakeholder list, for notification of upcoming public participation opportunities in the Supplemental EIS process.

The majority of comments received through Congressman Carbajal's website expressed opposition to hydraulic fracturing. A few of these commenters expressed support of expanded oil and gas exploration. Comments received from Los Padres ForestWatch were similar in format to *Form Letter 5,* as discussed and summarized in the Scoping Summary Report (BLM 2018). Issues discussed in the preponderance of these comments included concerns regarding hydraulic fracturing and hazardous materials, public health and safety, air quality, seismicity, renewable resources, water, climate change, wildlife, special status species, socioeconomics, and cultural resources.

5.5 List of Preparers

An interdisciplinary team of resource specialists from BLM and specialists from independent, third-party consulting firms prepared this document. Under guidance and direction from BLM, the team prepared alternatives, collected data for the analyses, assessed potential effects from the alternatives, and prepared the other chapters of this document.

Table 5.2
List of Preparers

Name	Discipline
BLM, Bakersfield Field Office	
Carly Summers	Project Manager, Administrative Record
Tiera Arbogast	Assistant Project Manager, Air Resources, Soil Resources
John Hodge	Assistant Field Manager, Minerals
Jeromy Caldwell	Assistant Field Manager, Resources Division
Jeff Prude	Oil and Gas
Sarah Bullock	Wildlife Ecology
CJ Chase	Wildlife Ecology
Romina Copado	Geographic Information Systems
Kimberly Taylor (via USGS)	Water Resources
Tamara Whitley	Cultural Resources, Native American Values, Paleontological Resources
Stewart Allen	Social and Economic Resources
Brien Chartier	Visual Resources
Karen Doran	Livestock Grazing
BLM California State Office	
Jim Scrivner	State Office Coordinator, Minerals
Elizabeth Meyer-Shields	State Office Coordinator, Resources
Melissa Harris	State Office Coordinator
Sandra McGinnis	Resources Branch Chief
Serena Baker	Public Affairs Specialist
Leroy Mohorich	Technical Review Team
Amy Fesnock	Technical Review Team
Christina Lund	Technical Review Team
Tony Overly	Technical Review Team
James Barnes	Technical Review Team
Jim Weigand	Technical Review Team
John Granada	Technical Review Team
Richard Alire	Technical Review Team
BLM National Operations Center	
Craig Nicholls	Air Resources
Paul Summers	Water Resources
Contractor, Ecology and Environment, Inc.	
Maureen O'Shea-Stone	Project Manager
Jennifer Jackson	Deputy Project Manager
Susan Serreze	Soil Resources, ACECs, Minerals Management – Fluid Minerals
Scott Severs	Biological Resources & Special Status Species
Noreen Roster	Biological Resources & Special Status Species

Table 5.2
List of Preparers

Name	Discipline
Susan Nordstrom	Visual Resources
Bruce Wattle	Air Resources
Ted Hoefer	Cultural Resources, Native American Values, Paleontological Resources
Leslie Kirchler-Owen	Social and Economic Resources
Bonnie Gibson	Cultural Resources, Project Record, CORES, Public Scoping
Chris Jessen	Geographic Information Systems
Amy Cook	Technical Editor
Hilary Hoffman	Technical Editor
Pat Mooney	Word Processing
Jan Brick	Section 508 Compliance
Jackie Antonio	CORES System Support
Contractor, WRB Consultants, LLC	
Bill Berg	Water Resources

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6 Chapter Six

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Appendix A
Cultural Resources Site and Isolated Find Information for Sites Recorded Since 2012, Located within the Hydraulic Fracturing Analysis Areas

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Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
CA-KER-2730	Object	Historic	capped wellhead identified as Wallace and Crail # 10
Unknown	Object	Historic	concrete pad adjacent to a modern pumpjack
Unknown	Object	Historic	capped wellhead identified as Wallace and Crail # 18
Unknown	Object	Historic	capped wellhead Wallaca and Crail # 6 and a few pieces of historic debris
Unknown	Object	Historic	capped wellhead Wallace and Crail # 1 and very lightly density, diffuse debris scatter
Unknown	Object	Historic	capped wellhead Wallace and Crail # 3 and a few pieces historic debris
Unknown	Object	Historic	single capped wellhead
Unknown	Object	Historic	capped wellhead Balboa #27 and a partial concrete foundation
Unknown	Object	Historic	utility pole, electrical box and the round bottom of a storage tank
Unknown	Object	Historic	cold-rolled, galvanized, riveted steel pipe
Unknown	Object	Historic	capped wellhead Wallace and Crail #2 and a few pieces of historic debris
CA-KER-10207	Site	Prehistoric	Lithic scatter
CA-KER-10208	Site	Prehistoric	Lithic scatter
CA-KER-10209	Site	Prehistoric	2 groundstone artifacts, 1 sandstone metate, and 1 miscellaneous piece of groundstone with slight use wear
CA-KER-10210	Site	Multicomponent	Prehistoric lithic scatter of projectile point and flakes. Historic refuse scatter of corrugated metal, galvanized steel, brick lined furnace, conveyor belt, electrical equiment, milled lumber, and glass fragments
CA-KER-10211	Site	Historic	Trash scatter
CA-KER-10430	Site	Historic	Brick scatter
CA-KER-10431	Site	Historic	Trash scatter of household and oilfield related debris. Glass, brick, metal fragments, wire nails, and milled lumber.
CA-KER-10432	Site	Historic	Trash scatter of cans, glass, earthen ware, oilfield related debris, metal, nails, auto parts
CA-KER-10436	Site	Historic	abandoned oil well with 2 features, a backdirt pile amd a sparse hisotric debris scatter and measures 165ft.
CA-KER-10441	Site	Historic	2 features and assoc. artifacts that are likely remains of a boiler for a steam driven oil extraction pumping unit from first half of 20th cent.
CA-KER-10442	Site	Historic	4 concrete footing foundations and a metal retaining wall in an area measuring 55ft
CA-KER-1206	Site	Prehistoric	BRMs, 1 chert flake, and 1 hammerstone
CA-KER-1984	Site	Historic	Well recently abandoned.
CA-KER-1995	Site	Historic	Original survey: historic-era material including glass, ceramic fragments; unidentified calcined bone fragments, one clam shell fragment; and a variety of metal objects. No chert or other prehistoric artifacts at the site
CA-KER-1996	Site	Historic	Originally recorded by Conway and Jenkins (1981); site consists of concrete pad, large retaining pond, 2 circular pits, debris scatter, red brick concentration, roads, and assoc. piping.
CA-KER-2195	Site	Historic	a refuse scatter with two concentrations of broken and melted glass with some cans and other misc. refuse in a wash and covering a 50-x-15-ft. area
CA-KER-2549	Site	Historic	Site has been destroyed ASM was not able to relocate site. Originally recorded in 1989 by R. Billman as 4 tank foundations.
CA-KER-2549	Site	Historic	An abandoned historic oil well
CA-KER-2582	Site	Historic	historic oil extraction site, MURVALE #10,

Table A-1
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Site Number	Resource Type	Age	Site Description
CA-KER-2729	Site	Historic	capped wellhead wallace & crail #9, concrete foundations and a small, light density debris scatter
CA-KER-2804	Site	Historic	Trash scatter: brick, metal debris, milled wood planks, glass fragments, slag and an intact vertical pipe.
CA-KER-2805	Site	Prehistoric	Lithic scatter
CA-KER-2806	Site	Prehistoric	Lithic scatter with 2 grey chert cores and 28 chert flakes
CA-KER-2914	Site	Historic	Historic oil derrick #24 concrete footing. Site originally recorded in 1990, updated in 2011 & 2014.
CA-KER-3200	Site	Historic	Trash scatter of brick, brick slag, industrial artifacts, and a metal wellhead sign.
CA-KER-3281	Site	Historic	Artifacts noted include early firebrick fragments, cobalt and oxidized glass fragments, abalone shell, and other artifacts
CA-KER-3363	Site	Historic	originally recorded by D. Kayser (1992) as a large oil field industrial/domestic complex with multiple industrial foundations and refuse deposits. it is likely this site has now been subsumed into CA-KER-7926H, exact location remains unknown
CA-KER-4023	Site	Historic	abandoned railroad grade of the Sunset Railway, first recorded in 1994 by David Scott and Bruce Steidl.
CA-KER-4202	Site	Historic	consists of capped wellhead Midnorth #4, concrete foundation pedestals, wooden foundation feature and a light density background scatter of industrial and household debris situated on a gently sloping alluvial fan.
CA-KER-4202	Site	Historic	1913 oil well site with protruding pipe, associated concrete pad with machinery pedestals, nails, bricks, cables
CA-KER-4297	Site	Historic	remains of oil well Sunset 18B #306. Metal debris and a concrete block. Originally recorded 1994 by Gardner, McQueen and Switalski. Also see CRIR 615
CA-KER-4298	Site	Historic	consists of historic concrete foundation, brick foundation, wooden beams wrapped in metal casing, tank remains, concrete rubble pile and background scatter of industrial debris situated within the Maricopa Flat.
CA-KER-4298	Site	Historic	Oil field site with steel-reinforced concrete foundation and pedestals, probably remains of a heater or boiler house
CA-KER-4299	Site	Historic	Capped Oil well Maricopa S #42-F. Originally orded 12/16/1994
CA-KER-4300	Site	Historic	consists of capped wellhead Pacific #3 and metal identifying sign located in Kern County, California.
CA-KER-4301	Site	Historic	originally recorded by R. Parr, J. Gardner, C. McQueen and H. Switalski (1994) as capped wellhead Pacific #2 and an identifying metal sign located in Kern County, California. Updated by ASM
CA-KER-4307	Site	Historic	historic capped wellhead Annex #3-A, a fairly diffuse industrial and household related refuse scatter. During the current investigation the capped wellhead remains, but the concrete pad and pedestals appear destroyed.
CA-KER-4309	Site	Historic	originally recorded by R. Parr, J. Gardner, C. McQueen and H. Switalski (1994) as the foundation remains of a tank farm that included two circular concrete tank pads, one wooden tank pad foundation and a concrete footing with machine mount pedestal.
CA-KER-4310	Site	Historic	consists of a series of brick foundations, a depression, brick scatter and refuse scatter. The site was originally recorded as part of CA-KER-2369H/P-15-002369 by Jackson and Pruett in 1988
CA-KER-4312	Site	Historic	originally recorded by R. Parr, J. Gardner, C. McQueen and H. Switalski (1994) as capped wellhead Midnorth #10 and a light density debris scatter of red bricks, milled wood, glass and metal fragments
CA-KER-4313	Site	Historic	originally recorded as the location of well Midnorth #7 located in Kern County, California
CA-KER-4314	Site	Historic	originally recorded by R. Parr, J. Gardner, C. McQueen and H. Switalski (1994) as capped wellhead Midnorth #3 a light density historic debris scatter and a concrete pad with machine mount pedestals

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
CA-KER-4315	Site	Historic	originally recorded by R. Parr, J. Gardner, C. McQueen and H. Switalski (1994) as capped wellhead Midnorth #1 and a metal identification sign.
CA-KER-4367	Site	Historic	originally recorded by R. Parr, J. Gardner, C. McQueen and H. Switalski (1994) as a capped wellhead Midnorth #16, several concrete pads and machine mount pedestals and a light density historic refuse scatter.
CA-KER-4522	Site	Prehistoric	originally described as a hearth feature eroding out of a cut bank. ASM found presence of fragmentary fire affected sandstone; site eroding.
CA-KER-4523	Site	Prehistoric	diffuse scatter of fire-affected rock
CA-KER-5097	Site	Historic	site of Well 45, originally recorded by R. Schiffman in 1997, and updated in 2009 by C. Davis & W. Sprague of Pacific Legacy; described as an ΓÇ£[a]ctive oil well. Originally bull wheel configuration. Poor condition..."
CA-KER-5224	Site	Historic	Historic oil well with associated debris. Concrete machine mount.
CA-KER-5224	Site	Historic	historic oil well and associated debris.
CA-KER-5226	Site	Historic	Light historic scatter of glass, lumber, and other oil-field related debris a tank pad that once housed four tanks
CA-KER-5227	Site	Prehistoric	two concentrations of fire affected rocks
CA-KER-5273	Site	Historic	Historic well pad, boiler pads, trash scatter.
CA-KER-5273	Site	Historic	historic well pad, two boiler pads, and a trash scatter
CA-KER-5274	Site	Historic	Update; historic refuse scatter
CA-KER-5705	Site	Historic	remains of a gas absorption plant
CA-KER-5706	Site	Historic	concrete foundation
CA-KER-5708	Site	Historic	concrete pad and historic refuse scatter
CA-KER-5866	Site	Historic	capped wellhead and associated foundations
CA-KER-5974	Site	Historic	Seven loci of various oil-production related features, structural remains, and debris deposits in relatively close proximity with a continuous debris scatter extending between them.
CA-KER-6325	Site	Historic	3 concrete footings, amethyst glass fragments, machinery parts, boiler glass fragments, and an abandoned well
CA-KER-6338	Site	Historic	historic refuse scatter
CA-KER-659	Site	Prehistoric	hearth feature and associated mano; site not found during survey
CA-KER-773	Site	Historic	Update: former location of barn, houses, and bunk houses relocated to CA-KER-774
CA-KER-781	Site	Historic	Possible line cabin or homestead site
CA-KER-7925	Site	Historic	originally recorded by C. Millington and L. Hoffman (2009) as a trashdump of 1920s historic refuse and two small concrete foundations
CA-KER-7926	Site	Historic	consists of a large oil production complex situated within the Maricopa Flat; 9 additional features and 4 additional concentrations, as well as an extensive light density historic background scatter that continues beyond the site boundaries
CA-KER-7927	Site	Historic	originally recorded by C. Millington and V. Austerman (2009) as a concrete-lined pit and low-density scatter of industrial debris. ASM revealed the existence of a much larger historic refuse scatter of primarily household debris.
CA-KER-7928	Site	Historic	originally recorded by C. Millington and V. Austerman (2009) as a large, debris scatter of household and industrial refuse and seven features.

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
CA-KER-7930	Site	Historic	historic refuse scatter situated on a gently sloping plain within the Maricopa Flat. Located at 590 ft.
CA-KER-7931	Site	Historic	historic refuse scatter situated on a gently undulating plain within the Maricopa Flat. Located at 590- ft
CA-KER-7940	Site	Historic	historic refuse scatter located in Kern County, California; Revisited by ASM. Recorded by V. Austerman and L. Hoffman (2009) as a mix of household and industrial debris and two concrete foundations
CA-KER-805	Site	Historic	update; historic period oil production locale originally recorded in 1977 by MacGrerry. site compossed of multiple feature types: structural foundations, storage tanks, pipeline, various scatters.
CA-KER-8316	Site	Historic	Oil well with concrete pad and wooden platform.
CA-KER-8317	Site	Historic	Abandoned oil well
CA-KER-843	Site	Prehistoric	4 distinctly concentrated lithic scatters, including cores, flakes and angular shatter and 9 other similar lithic artifacts, no formal/diagnostic tools were observed. most likely represents an assay-quarry workshop
CA-KER-8477	Site	Historic	Remains of an oil derrick foundation, pump jack foundation, associated debris.
CA-KER-8484	Site	Historic	site consists of an artifact and brick scatter near a standing pipe of unknown function at the northern edge of a wash, covering an area of about 40-x-18-m
CA-KER-8485	Site	Historic	site is a very small sparse artifact scatter in a shallow wash in an area of about 11-x-10-m
CA-KER-8487	Site	Historic	site consists of a wellhead and concrete jack line foundation, a spill area, associated refuse deposits in the wellhead area and also to the east, and other structural and mount remains to the north and northwestUpdate 9/27/2013: NRHP EVAL
CA-KER-8488	Site	Historic	site consists of a complex of foundations, footings, brick concentrations, and artifact scatter covering an area of about 85 x 35-m, and lying just north of a dirt road
CA-KER-8489	Site	Historic	large site consists of an abandoned wellhead with a large associated artifact scatter extending across a hillside to the northeast of the well
CA-KER-8501	Site	Historic	debris scatter
CA-KER-8506	Site	Historic	Update: 4 concentrated refuse scatters: brick concrete, asphalt, and metal, sump
CA-KER-8516	Site	Historic	site includes abandoned well (marked TO1?) and two associated brick concentrations; there are very few other artifacts in the area, including in the area of the wellhead itself
CA-KER-8518	Site	Historic	site consists of a dense brick deposit with some associated artifacts, and a single circular concrete and brick-lined subsurface feature with wood inside
CA-KER-8519	Site	Historic	site consists of abandoned Well #52, a sparse artifact scatter, and a fairly extensive linear array of bricks and brick fragments eroding out along what was possibly a former berm.
CA-KER-8526	Site	Historic	light density brick scatter & concrete foundation
CA-KER-8534	Site	Historic	light density debris scatter
CA-KER-8535	Site	Historic	historic debris scatter
CA-KER-8536	Site	Historic	historic homestead
CA-KER-8537	Site	Historic	refuse scatter
CA-KER-8540	Site	Multicomponent	Update; multiple component site consisting of a light scatter of lithic debitage and shell fragments overlaid by a small historic trash component

Table A-1
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Site Number	Resource Type	Age	Site Description
CA-KER-8541	Site	Historic	light density, dispersed brick scatter of ~100 red and tan fire affected bricks and some historic trash
CA-KER-8542	Site	Historic	refuse scatter and wellhead
CA-KER-8544	Site	Historic	large hisotric refuse scatter
CA-KER-8545	Site	Historic	small refuse scatter
CA-KER-8559	Site	Historic	refuse scatter
CA-KER-8561	Site	Historic	collapsed wooden structure
CA-KER-8562	Site	Historic	discrete brick scatter with two in-situ concrete and brick foundation footings and two fragmented concrete foundation footings
CA-KER-8568	Site	Historic	site consists of an abandoned well head with associated brick concentrations and artifacts
CA-KER-8570	Site	Historic	two light density tin can scatters
CA-KER-8572	Site	Multicomponent	light density and shell scatter overlaid with a dispersed hisotric trash
CA-KER-8573	Site	Historic	moderate density scatter of red and tan bricks, metal debris and an open, exposed well shaft at the base of the Buena Vista hills
CA-KER-8575	Site	Historic	two brick concentrations
CA-KER-8756	Site	Historic	P-15-01 0038 is a historic site associated with early-twentieth century oil development
CA-KER-8932	Site	Historic	Capped well head, wooden derrick pad, concrete pad with concrete machine mounts, and an unidentified concrete foundation. Originally recorded in 2009 and updated in 2012 & 2013
CA-KER-8947	Site	Historic	Present at the site are a capped well head, four derrick leg footings, numerous concrete pedestals, and a metal-lined pit to the north of the leg footings.
CA-KER-8949	Site	Historic	possible historic residence or oil production-related building site covering a 80-x-55-m
CA-KER-8951	Site	Historic	mixed historic/recent domestic and construction refuse scatter.
CA-KER-8953	Site	Historic	Unknown
CA-KER-8961	Site	Historic	2014 Update: Oil well with concrete foundation, wooden derrick componenets, and associated refuse scatter
CA-KER-8965	Site	Historic	site consists of an abandoned wellhead and associated artifact scatter covering an area of about 80-x-55-m, and lying just 75-m north of Midway Road
CA-KER-9077	Site	Historic	6 prospect trenches located on eastern slope of a small hill; Update 8/21/2013: location not a cultural resource as defined by OHP and BLM guidelines.
CA-KER-9270	Site	Historic	Refuse scatter of porcelain fragments, wire nails, sheet metal, amethyst, brown and colorless glass, lumber, and brick.
CA-KER-9271	Site	Historic	Brick and glass scatter
CA-KER-9272	Site	Historic	Refuse scatter of bricks, glass fragments, wood, sheet metal, metal scrap, and ceramic fragments.
CA-KER-9273	Site	Historic	Brick scatter with metal and glass fragments
CA-KER-9274	Site	Historic	Brick scatter
CA-KER-9275	Site	Historic	Glass scatter including amethyst, brown glass, and wire nails.
CA-KER-9276	Site	Historic	Refuse scatter of fire affected brick, wire nails, and metal fragments.
CA-KER-9277	Site	Historic	Refuse scatter of various colored glass fragments, milled wood, wire nails, brick, scrap metal, and jar fragments.
CA-KER-9278	Site	Historic	Brick scatter

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
CA-KER-9279	Site	Historic	Brick scatter
CA-KER-9280	Site	Historic	Brick scatter
CA-KER-9281	Site	Historic	Brick scatter
CA-KER-9282	Site	Historic	Brick scatter. Bricks are fragmented and fire affected.
CA-KER-9283	Site	Historic	Refuse scatter of brick and glass.
CA-KER-9284	Site	Historic	Brick scatter
CA-KER-9288	Site	Historic	Refuse scatter: bottle and window glass, ceramics, dishware, tin cans, nails, metal machine parts, and bricks.
CA-KER-9289	Site	Historic	Scatter of fire affected brick
CA-KER-9290	Site	Historic	Refuse scatter of structural debris including brick, machine parts, nails, lumber, and glass
CA-KER-9291	Site	Historic	Oil derrick and associated refuse scatter of nails, lumber, machine parks, metal and ceramic fragments, tin cans, and aethyst glass.
CA-KER-9292	Site	Historic	Refuse scatter of various colored glass fragments, ceramic fragments,, wire nails, shotgun shell fragmnets, wire fragments, and abalone shell fragments.
CA-KER-9294	Site	Historic	Refuse scatter: variety of colored glass, mettal comb, wire nails, and metal bottle caps.
CA-KER-9295	Site	Historic	Refuse scatter: various colored glass fragments, ceramic fragments, and metal fragments.
CA-KER-9296	Site	Historic	Refuse scatter: various colored glass, ceramic fragments, and a sanitary can.
CA-KER-9297	Site	Historic	Refuse scatter: various colored glass fragments, ceramic fragments, wire nails, and tin can fragments.
CA-KER-9298	Site	Historic	Refuse scatter: Colorless and amethyst glass fragments, colorless intact jars, ceramic plate fragments, tin can fragments, and gas can.
CA-KER-9299	Site	Historic	Refuse scatter: Amethyst glass fragments, lumber, and wire nails.
CA-KER-9301	Site	Prehistoric	small discrete concentration of hundreds of small Anodonia sp. shell fragments
CA-KER-9302H	Site	Historic	moderate refuse scatter
CA-KER-9303	Site	Historic	small scatter of red/tan fire bricks
CA-KER-9304	Site	Historic	foundational remains of a historic wooden or steel oil derrick
CA-KER-9305	Site	Historic	late nineteenth to early twentieth century refuse scatter
CA-KER-9306	Site	Historic	diffuse refuse scatter
CA-KER-9307	Site	Historic	foundational remains of a wooden or steel oil derrick
CA-KER-9308	Site	Historic	small structural scatter
CA-KER-9309	Site	Historic	refuse scatter
CA-KER-9310	Site	Historic	refuse scatter that includes structural, domestic, transportation, and indefinite use items
CA-KER-9311	Site	Historic	large diffuse refuse scatter
CA-KER-9316	Site	Historic	light density brick scatter comprising two small concentrations
CA-KER-9317	Site	Historic	large early 20th century moderately dense brick scatter
CA-KER-9319	Site	Historic	small, sparse brick scatter
CA-KER-9320	Site	Historic	wooden foundation structure and a brick, glass, and ceramic scatter
CA-KER-9322	Site	Historic	foundational remains of a historic wooden or steel oil derrick and the remains of a steam boiler foundation

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
CA-KER-9323	Site	Historic	functional remains of a historic wooden or steel oil derrick
CA-KER-9324	Site	Historic	light density small brick scatter
CA-KER-9325	Site	Historic	capped wellhead and a moderate density scatter
CA-KER-9326	Site	Historic	foundational remains of a historic or steel oil derrick and associated trash scatter
CA-KER-9327	Site	Historic	foundational remains of a historic wooden or steel oil derrick
CA-KER-9328	Site	Historic	foundational remains of a historic wooden or steel oil derrick
CA-KER-9329	Site	Historic	moderately dense red brick scatter
CA-KER-9330	Site	Historic	foundational remains of a historic [wooden/steel] oil derrick
CA-KER-9331	Site	Historic	foundational remains of a historic wooden or steel oil derrick
CA-KER-9332	Site	Historic	moderately dense brick scatter
CA-KER-9333	Site	Historic	foundational remains of a historic wooden or steel oil derrick
CA-KER-9334	Site	Historic	foundational remains of unknown oil-industry-related machinery
CA-KER-9335	Site	Historic	small discrete brick scatter
CA-KER-9336	Site	Historic	foundational remains of a historic wooden or steel oil derrick
CA-KER-9337	Site	Historic	moderate brick scatter consisting of red and tan bricks
CA-KER-9339	Site	Historic	historic brick concentration
CA-KER-9340	Site	Historic	small, discrete scatter of structural debris
CA-KER-9341	Site	Historic	a small, discrete historic refuse scatter
CA-KER-9342	Site	Historic	dense to moderately dense mid-twentieth century refuse scatter
CA-KER-9343	Site	Historic	moderate density structural debris scatter
CA-KER-9344	Site	Historic	historic structural debris scatter
CA-KER-9345	Site	Historic	moderate density refuse scatter
CA-KER-9346	Site	Historic	scatter of structural debris
CA-KER-9347	Site	Historic	small, sparse refuse scatter
CA-KER-9348	Site	Historic	small artifact scatter
CA-KER-9349	Site	Historic	historic artifact scatter
CA-KER-9350	Site	Historic	foundation remains for a steam boiler
CA-KER-9351	Site	Historic	brick scatter
CA-KER-9352	Site	Historic	sparse to moderately dense brick scatter
CA-KER-9353	Site	Historic	moderately dense artifact scatter
CA-KER-9356	Site	Historic	Four concrete footings - probably for a oil derrick.
CA-KER-9357	Site	Historic	Steam boiler foundation, concentration of fire bricks, capped wellhead
CA-KER-9358	Site	Historic	Four foundation footings - probably for a oil derrick.
CA-KER-9359	Site	Historic	Four concrete foundations footings - probably for a oil derrick.
CA-KER-9360	Site	Historic	Four concrete foundation footings - probably for a oil derrick.
CA-KER-9361	Site	Historic	capped wellhead #1, a concrete machine foundation and small brick concentration

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
CA-KER-9362	Site	Historic	Four foundation footings probably footings for an oil derrick
CA-KER-9363	Site	Historic	Four concrete foundation footings probably a derrick foundation
CA-KER-9364	Site	Historic	Four concrete foundation footings probably a derrick foundation
CA-KER-9365	Site	Historic	Light density brick scatter & metal machine parts.
CA-KER-9366	Site	Historic	eight stacked rock wall features. The alignments are unmortared
CA-KER-9421	Site	Historic	Abandoned Sunset Railway. (See also: P-15-004024, CA-KER-4023H)
CA-KER-9453	Site	Historic	a metal wellhead casing filled with cement and 7 concrete footings
CA-KER-9454	Site	Historic	4 concrete footing foundations flush with the ground
CA-KER-9455	Site	Historic	4 sqaure concrete footing foundations level with the ground.
CA-KER-9456	Site	Historic	structural debris scatter
CA-KER-9457	Site	Historic	4 roughly circular depressions associated with a small scatter of firebricks
CA-KER-9458	Site	Historic	structural debris
CA-KER-9459	Site	Historic	structural debris scatter
CA-KER-9460	Site	Historic	moderate structural debris scatter and 3 small depressions
CA-KER-9462	Site	Historic	structural debris scatter
CA-KER-9463	Site	Historic	diffuse, moderately sparse structural debris scatter
CA-KER-9464	Site	Historic	structural debris scatter
CA-KER-9465	Site	Historic	small refuse scatter
CA-KER-9466	Site	Historic	remains of a concrete jack line foundation; rectangular conrete pad and 2 small raised rectangular footings.
CA-KER-9467	Site	Historic	concrete boiler foundation and scatter of red fire-affected bricks
CA-KER-9469	Site	Historic	brick scatter
CA-KER-9470	Site	Historic	small refuse scatter
CA-KER-9471	Site	Historic	structural debris scatter
CA-KER-9472	Site	Historic	concrete jack line foundation
CA-KER-9508	Site	Historic	historic brick scatter that consists of structural debris including unmarked firebricks, brick fragments, wire, wire nails and brick slag.
CA-KER-9530	Site	Historic	Remnants of historic oil derrick associated with "Maricopa-Wellington 1"
CA-KER-9531	Site	Historic	Oil extraction facility. Abandoned wellhead "2." Brick boiler box
CA-KER-9532	Site	Historic	Sparce refuse scatter
CA-KER-9533	Site	Historic	Four concrete foundation footings - probably the foundation for an oil derrick
CA-KER-9534	Site	Historic	Two concrete foundation footings probably oil derrick foundations
CA-KER-9535	Site	Historic	Historic refuse
CA-KER-9536	Site	Historic	A concentration of industrial artifacts.
CA-KER-9537	Site	Historic	Capped wellhead "J-2.," industrial artifacts, remains of a metal tank.
CA-KER-9538	Site	Historic	historic site consists of three discrete concentrations, a single feature and a large, diffuse background scatter of historic debris.

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
CA-KER-9539	Site	Historic	historic site consists of a large, diffuse trash scatter with two concentrations and a single brick feature.
CA-KER-9540	Site	Historic	historic site consists of a moderate density debris scatter made up primarily of structural items such as unmarked fire bricks, brick fragments, aqua boiler watch glass and wood lathes.
CA-KER-9541	Site	Historic	historic site consists of a light density historic refuse scatter with heat altered debris including domestic, structural and indeterminate items.
CA-KER-9542	Site	Historic	site is a large, slightly diffuse, and highly fragmented debris scatter characterized by four discrete concentrations and three features.
CA-KER-9543	Site	Historic	a historic site that contains a small concentration of red and tan firebricks and an oiled road that travels through the site.
CA-KER-9544	Site	Historic	historic site is a sparse refuse scatter with one discrete concentration containing structural and indeterminate artifacts adjacent to a blown out barbwire fence line
CA-KER-9545	Site	Historic	historic trash scatter characterized by three distinct artifact concentrations
CA-KER-9546	Site	Historic	historic shed located in a wide, shallow roughly north/south oriented, low area within the Maricopa Flat
CA-KER-9547	Site	Historic	historic refuse scatter located on a nearly level plain within the Maricopa Flat with a northern aspect
CA-KER-9548	Site	Historic	consists of 4 historic features and a historic refuse scatter situated on the eastern bank of a shallow, narrow dry drainage with a northern aspect
CA-KER-9549	Site	Historic	historic debris scatter situated on a gentle slope east of several low, rolling foothills with a western aspect
CA-KER-9550	Site	Historic	historic structural debris scatter situated on a nearly level plain east of a series of rolling hills within Maricopa Flat with a northwest aspect
CA-KER-9551	Site	Historic	consists of two concrete foundations and a light density historic debris scatter situated on a gently sloping plain within Maricopa Flat.
CA-KER-9552	Site	Historic	consists of capped oil well #1A, concrete foundation pedestals, a semi-buried wooden frame and a historic debris scatter situated on the eastern slope of a low hill within the Maricopa Flat
CA-KER-9553	Site	Historic	light density, highly fragmented historic refuse scatter located on a nearly level plain in an area of high soil disturbance within the Maricopa Flat
CA-KER-9554	Site	Historic	historic site consists of capped wellhead ΓÇ£3TTCO,ΓÇ¥ a wood-lined square pit of unknown function, several large wooden boards, and a light density debris scatter situated in an area of hardened oil sands
CA-KER-9555	Site	Historic	historic site is a linear feature of embedded red fire bricks located along the side slope of a roughly north/south trending low hill within the Maricopa flat
CA-KER-9556	Site	Historic	large historic scatter of structural debris characterized by two discrete concentrations, mortared brick foundation, a brick boiler or heater foundation, and two concrete pads
CA-KER-9557	Site	Historic	historic site consisting of a light density structural debris scatter and several concrete machine mount foundations
CA-KER-9558	Site	Historic	large diffuse historic structural and household debris scatter with a single concentration near the center of the site and an excavated pipeline that runs east/west through the site, crossing under an overgrown dirt road.
CA-KER-9559	Site	Historic	light density historic debris scatter of household and industrial debris

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
CA-KER-9560	Site	Historic	consists of two distinct concentrations of historic debris wih a light density industrial artifact background scatter
CA-KER-9561	Site	Historic	historic debris scatter with a corresponding brick scatter and structural artifacts surrounding several concrete foundation features
CA-KER-9562	Site	Historic	historic site consisting of a light density, industrial background scatter extending beyond the site boundaries and throughout the survey area.
CA-KER-9565	Site	Historic	historic light to moderate density refuse scatter consisting of industrial, domestic, personal and indeterminate artifacts
CA-KER-9584	Site	Historic	historic, highly fragmented structural debris scatter that consists of a concentration of 15+ red firebricks, brick fragments, brick slag, wood lathes, metal pipe, metal debris and concrete chunks.
CA-KER-9614	Site	Historic	site is a wooden pumping rig at Well #52; includes wooden rig apparatus and an adjacent wooden platform, still largely intact, covering an 18-x-10-m area; it lies just north of a dirt road.
CA-KER-9615	Site	Historic	site consists of an extensive series of foundations, wall remains, landscaping trees, and associated debris covering an area of about 325 x 140 m.
CA-KER-9616	Site	Historic	small, sparse artifact scatter that has been disturbed by the construction of a large new rig pad to the north
CA-KER-9617	Site	Historic	site consists of five aligned pits surrounded by bricks, brick fragments, and brick dust, as well as some vitrified material in an area of about 25 x 16 m
CA-KER-9618	Site	Historic	site consists of a large concrete foundation structure with a brick concentration upslope to the east, covering an 36-x-18-m area.
CA-KER-9619	Site	Historic	site consists of five aligned pits surrounded by bricks, brick fragments, and brick dust, as well as some vitrified material and bricks still in alignment in an area of about 25 x 10 m
CA-KER-9621	Site	Historic	updated by Stantecbrick scatter with berms and a wooden subsurface box structure associated with abandoned Well #10. The site covers an area of approximately 85 x 30 m.
CA-KER-9625	Site	Historic	site consists of abandoned well #81 and an associated artifact scatter
CA-KER-9626	Site	Historic	site contains highly fragmented, sparse historic refuse on a flat rise just north of Well #12
CA-KER-9627	Site	Historic	site consists of an abandoned well head (Well #63) with associated brick concentrations and artifact scatter
CA-KER-9628	Site	Historic	site consists of a substantial brick deposit that has been cut by road construction. It is set on a hillside and covers an area of about 40 x 22 m
CA-KER-9629	Site	Historic	site consists of abandoned Well #32 and an associated artifact scatter
CA-KER-9630	Site	Historic	site consists of abandoned Well #33 and an associated sparse artifact scatter
CA-KER-9638	Site	Historic	site consists of an abandoned wellhead and associated debris covering an area of about 40 x 7-m, and lying just south of Broad Creek
CA-KER-9639	Site	Historic	site consists two artifact pits that lie very close together, one to the north and the other to the south in an area of about 16-x-11-m, and lying about 20-m south of a dirt road
CA-KER-9640	Site	Historic	site consists of two dense brick concentrations with an associated artifact scatter covering an area of about 55-x-30-m, and lying just north of a dirt road
CA-KER-9641	Site	Historic	area contains a concentration of bricks, brick fragments, and brick dust with some fragmentary artifacts in an area of about 42-x-34-m

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Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
CA-KER-9641	Site	Historic	small concentration of structural debris surrounding 4 depressions
CA-KER-9642	Site	Historic	site consists of an abandoned wellhead (#83 or 23?) and an associated artifact scatter covering an area of about 105-x-45-m
CA-KER-9643	Site	Historic	site is a brick scatter site with a likely associated small refuse deposit in an adjacent shallow wash covering an area of about 60-x-25-m
CA-KER-9644	Site	Historic	site consists of an abandoned wellhead (Well #6) with an associated sparse artifact scatter and a brick concentration area to the west covering an area of about 70-x-25-m
CA-KER-9765	Site	Historic	Earthen sump, concrete foundation with wooden support beams, can scatter, milled lumber, concrete footings. remnants of wooden cable spool.
CA-KER-9766	Site	Historic	Abandonmed oil well, concrete foundation, refuse scatter of brick, cans, nails, lumber, and cable
CA-KER-9767	Site	Historic	Abandoned well head with concrete footings, large foundation, remnants of wooden flume, circular pad, refuse scatter of brick, amethyst glass, nails, cable, boiler watch fragments, and milled lumber
CA-KER-9768	Site	Historic	Refuse scatter of amethyst glass, machine cut bone fragments, and cans
CA-KER-9769	Site	Historic	concrete foundations, corrugated metal structure, refuse scatter of milled lumber and brick, can, nails, glass
CA-KER-9770	Site	Historic	Refuse scatter of ceramic fragments, amethyst glass, cans, and nails
CA-KER-9784	Site	Historic	Foundation remains of oil derrick and dry sump.
CA-KER-9784	Site	Historic	Foundation remains of historic oil derrick
CA-KER-9785	Site	Historic	Foundation remains of oil derric and associated intact bull wheel
CA-KER-9786	Site	Historic	Trash scatter of bottles, cans, and ceramics.
Unknown	Site	Historic	Unknown
Unknown	Site	Historic	2 oil derrick foundations, burnt and unburnt brick, open well, metal fragments, and can scatter
Unknown	Site	Historic	trough-like feature
Unknown	Site	Historic	sparse artifact scatter
Unknown	Site	Historic	historic period artifact scatter
Unknown	Site	Historic	segment of Sunset Railroad
Unknown	Site	Historic	two large and one small brick concentrations with some associated oil-related refuse
Unknown	Site	Historic	Brick Scatter
Unknown	Site	Historic	a capped well head (#3C Boston), several concrete features, a sump, and an artifact scatter
Unknown	Site	Historic	A single large brick concentration with a small amount of associated oil-related refuse. Also in association were 7-in.-diameter metal pipes protruding from the ground and a pair of small concrete support pads.
Unknown	Site	Historic	originally recorded in 2005 as an historic well, comprised of remains of Mays Well #2; site update
Unknown	Site	Historic	Concrete features, L-shaped berm, and associated refuse
Unknown	Site	Historic	historic era refuse scatter
Unknown	Site	Historic	small, discrete brick scatter
Unknown	Site	Historic	Update; pump/sump/furnace complex
Unknown	Site	Historic	moderate concentration of mainly structural debris

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
Unknown	Site	Historic	debris scatter
Unknown	Site	Historic	collapsed wooden culvert and light density refuse scatter
Unknown	Site	Historic	capped wellhead and associated foundations
Unknown	Site	Historic	capped wellhead Wallace and Crail # 13
Unknown	Site	Historic	capped wellhead Wallace and Crail #1
Unknown	Site	Historic	capped wellhead Wallace and Crail # 6
Unknown	Site	Historic	capped wellhead Wallace & Crail #16, wooden shut off box, semi-subterranean metal tank, associated concrete foundations, and a light density debris scatter
Unknown	Site	Historic	capped wellhead Balboa #49. associated concrete foundations and a light density debris scatter
Unknown	Site	Historic	site not relocated during survey; historic light density debris scatter
Unknown	Site	Historic	capped wellhead Balboa #52, associated concrete foundations and a light density debris scatter
Unknown	Site	Historic	moderate density structural debris
Unknown	Site	Historic	foundations of a wooden or steel oil derrick and capped wellhead
Unknown	Site	Historic	foundation for a steel or wooden oil derrick and capped wellhead
Unknown	Site	Historic	capped wellhead Wallace and Crail # 7 and associated foundations
Unknown	Site	Historic	capped wellhead Balboa # 7 associated concrete foundations, and a light density debris scatter
Unknown	Site	Historic	sign post for historic wellhead Balboa # 69
Unknown	Site	Historic	concrete pad, concrete circular tank foundation, two square sunken wood lined pits, pipe and small debris scatter
Unknown	Site	Historic	capped wellhead Balboa #53, associated concrete foundations, and a light density debris scatter
Unknown	Site	Historic	jack line and tank foundation associated with wellhead Balboa #54
Unknown	Site	Historic	light density scatter
Unknown	Site	Historic	capped wellhead Balboa # 6 associated concrete foundations and a light density debris scatter
Unknown	Site	Historic	capped wellhead Balboa #18, associated concrete foundations and a light density debris scatter
Unknown	Site	Historic	capped wellhead Balboa #19, associated collapsed wooden staircase, metal framed water tank foundation, and a historic debris scatter
Unknown	Site	Historic	jack line foundation
Unknown	Site	Historic	capped wellhead Wallace & Crail #12, associated concrete foundations and a light density historic debris scatter
Unknown	Site	Historic	capped wellhead Balboa #42 and associated concrete foundations
Unknown	Site	Historic	historic conrete jack line foundation
Unknown	Site	Historic	concrete foundations for a steel or wooden oil derrick
Unknown	Site	Historic	debris scatter
Unknown	Site	Historic	site not relocated; orig. described as location of historic wellhead Balboa #78
Unknown	Site	Historic	foundation remains of Balboa# 1
Unknown	Site	Historic	capped wellhead Wallace & Crail #14, associated concrete foundations and a light density debris scatter
Unknown	Site	Historic	capped wellhead Wallace & Crail #15, associated concrete foundations and a light density debris scatter

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
Unknown	Site	Historic	site not relocated during survey; orig. described as a concrete pad adjacent to a modern pumpjack and a metal sign "Oakland 58"
Unknown	Site	Historic	historic wellhead Balboa #59; no features or artifacts observed
Unknown	Site	Historic	location of historic wellhead Balboa #63
Unknown	Site	Historic	small concentration of metal barrel hoops
Unknown	Site	Historic	abandoned capped oil wellhead
Unknown	Site	Historic	Concrete jack line foundation. Originally designated P-15-009267 but later separated and recorded as its own site by ASM in 2012 and updated in 2014
Unknown	Site	Historic	2014 Update: benchmark
Unknown	Site	Historic	2014 Update: Benchmark
Unknown	Site	Historic	Earthen berm/sump, refuse scatter of glass and cans.
Unknown	Site	Historic	Unknown
Unknown	Site	Historic	concrete footings well#2-14D
Unknown	Site	Historic	light domestic scatter
Unknown	Site	Historic	four concrete oil derrick foundations
Unknown	Site	Historic	well pad
Unknown	Site	Historic	abandoned well complex, roads, brick scatter
Unknown	Site	Historic	electric distribution line
Unknown	Site	Historic	abandoned well 21-11D
Unknown	Site	Historic	abandoned well 13-11D
Unknown	Site	Historic	abandoned well 11-11D
Unknown	Site	Historic	small, dense brick scatter
Unknown	Site	Historic	inactive well 30-10D
Unknown	Site	Historic	inactive well 28-10D
Unknown	Site	Historic	small refuse deposit
Unknown	Site	Historic	inactive well 531-15D
Unknown	Site	Historic	abandoned well 68-15D, refuse deposit
Unknown	Site	Historic	brick and refuse deposit
Unknown	Site	Historic	abandoned well 35-15D
Unknown	Site	Historic	abandoned well 99-15D
Unknown	Site	Historic	abandoned well 38-15D
Unknown	Site	Historic	inactive well 3-1-15D
Unknown	Site	Historic	abandoned well 72-15D
Unknown	Site	Historic	abandoned well 3-2-15D
Unknown	Site	Historic	abandoned well 501-15D
Unknown	Site	Historic	abandoned well 1-1-15D

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
Unknown	Site	Historic	inactive well 16-10D
Unknown	Site	Historic	inactive well 111-10D
Unknown	Site	Historic	inactive well 506-10D
Unknown	Site	Historic	abandoned well 1-16D
Unknown	Site	Historic	oil exploration complex with four wells
Unknown	Site	Historic	abandoned well 4-16D
Unknown	Site	Historic	wooden valve box
Unknown	Site	Historic	brick scatter, foundations
Unknown	Site	Historic	sparse firebrick scatter and reddened soil
Unknown	Site	Historic	historic trash scatter that includes solarized glass fragments, household ceramic fragments, & a dispersed church key opened & cone-top can scatter
Unknown	Site	Historic	historic trash scatter
Unknown	Site	Historic	California aqueduct
Unknown	Site	Historic	Oil well pump jack
Unknown	Site	Historic	Debris. Site of oil well, pump jack.
Unknown	Site	Historic	Oil well pump jack
Unknown	Site	Historic	tank battery & assoc. features that appear on the 1951 Maricopa CA quad
Unknown	Site	Historic	remains of Midway Northern No. 1 oil well
Unknown	Site	Historic	oil wells and associated infrastructure
Unknown	Site	Historic	oil wells and associated infrastructure
Unknown	Site	Historic	Trash scatter and concrete block with 2 metal plates
Unknown	Site	Historic	Prospect and mining claim marker
Unknown	Site	Historic	3 Oil tanks
Unknown	Site	Historic	Glass scatter and shallow round depression
Unknown	Site	Historic	Abandoned oil well, partially buried lumber pad, 3 exposed lumber beams, sump, and sparse refuse scatter
Unknown	Site	Historic	mound of weathered crude oil and drilling mud
Unknown	Site	Historic	concrete remains of a plugged and abadoned well
Unknown	Site	Historic	oil tanks
Unknown	Site	Historic	brick concentration
Unknown	Site	Historic	small early 20th century scatter of red and tan fire affected bricks
Unknown	Site	Historic	Unknown
Unknown	Site	Historic	Unknown
Unknown	Site	Historic	Unknown
Unknown	Site	Historic	Unknown
Unknown	Site	Historic	Unknown
Unknown	Site	Historic	small historic brick scatter

Table A-1
Historic and Archaeological Sites

Site Number	Resource Type	Age	Site Description
Unknown	Site	Historic	Update: small historic brick and milled lumber scatter with capped well #30
Unknown	Site	Historic	historic oil well foundation for a wooden or steel derrick #320
Unknown	Site	Historic	small brick scatter
Unknown	Site	Historic	two capped wellheads and a small brick scatter
Unknown	Site	Prehistoric	site not located during current study. Originally recorded as a prehistoric lithic scatter
Unknown	Site	Prehistoric	low-density, prehistoric lithic scatter includes a core, flakes, and angular shatter made of white/grey Temblor chert, totaling about a half-dozen specimens.
Unknown	Site	Prehistoric	single rainbow-colored secondary chert flake
Unknown	Site	Prehistoric	This is a paleontological site consisting of eroding shell midden located near the bottom of a drainage and its surrounding hillsides.
Unknown	Site	Prehistoric	quarry site with natual deposit of chert
CA-KER-2050	Structure	Historic	AH02 (Foundations/structure pads); AH04 (Privies/dumps/trash scatters); AH07 (Roads/trails/railroad grades); HP39 (Other) - Culvert
CA-KER-9285	Structure	Historic	Jack line foundation and associated debris scatter of wire nails, iron pipe fittings, and headlight glass
CA-KER-9286	Structure	Historic	Jack line foundation
CA-KER-9287	Structure	Historic	Jack line foundation
CA-KER-9293	Structure	Historic	Oil derrick: 2 foundations
CA-KER-9300	Structure	Historic	wooden or steel oil derrick
CA-KER-9318	Structure	Historic	remnants of a wooden or steel derrick
Unknown	Structure	Historic	5 storage tanks
Unknown	Structure	Historic	Cattle trough with float valve and water spigot
Unknown	Structure	Historic	HP11 (Engineering structure) - Transmission line

Table A-2
Isolated Finds

Resource Name	Resource Type	Age	Description
10Z-Iso 1	Isolate	Historic	Prince Albert tobacco can
10Z-Iso 3	Isolate	Prehistoric	one core and one white debitage, chalcedony
10Z-Iso 5	Isolate	Historic	Prince Albert tobacco can
27-AB-ISO1	Isolate	Historic	Unknown
27-AB-ISO2	Isolate	Historic	Unknown
27-AB-ISO3	Isolate	Historic	Unknown
29-AB-ISO1	Isolate	Historic	Unknown
BA-ISO-1	Isolate	Historic	an amethyst glass bottle with a single
BA-ISO-2	Isolate	Prehistoric	mottled gray-beige-white CCS core approx. 5-6 flake removals
Buick-Iso-01	Isolate	Historic	Unknown
CAI-1	Isolate	Prehistoric	Unknown
CAI-2	Isolate	Prehistoric	Unknown
CAI-3	Isolate	Prehistoric	Unknown
CAIH-1	Isolate	Historic	Unknown
CM-ISO-1	Isolate	Historic	Two firebricks with "PCP/EXCELSIOR" and "EMSCO/ROYAL D.P."
CM-ISO-2	Isolate	Prehistoric	Chryptochrystalline stage 2 biface
ESA-McNaughton-005H	Isolate	Historic	Mining claim marker with wooden posts
ESA-McNaughton-006H	Isolate	Historic	Refuse scatter of colorless and amber glass bottles.
IF-CM-01	Isolate	Prehistoric	Isolate flake
IF-GFC-01	Isolate	Prehistoric	isolate biface
IF-KER-415	Isolate	Prehistoric	Unknown
ISO-1	Isolate	Historic	10 oz colorless Sun Crest bottle with an Anchor Hocking makers mark
ISO-2	Isolate	Prehistoric	primary chert flake
ISO-FL-1	Isolate	Historic	Prince Albert Pocket tobacco tin
Isolate 1	Isolate	Historic	Unknown
Isolate 1 (Steam Generator)	Isolate	Historic	Steam generator rsting on a wooden plank foundation. 3 concrete pads, steel pipes and railings, electrical panel.
Isolate 2	Isolate	Historic	Unknown
Isolate 2 (Historic Marker1)	Isolate	Historic	Historic marker: lumber post near small pile of granite cobbles.
Isolate 3	Isolate	Historic	Unknown

Table A-2
Isolated Finds

Resource Name	Resource Type	Age	Description
Isolate 3 (Historic Marker 2)	Isolate	Historic	Historic marker: lumber post near small pile of granite cobbles
Isolate 4 (Tank Setting)	Isolate	Historic	2 steel tank rings with gravel pad, electrical panel, sump, and concrete pad
Isolate 5 (Granite Mano)	Isolate	Prehistoric	Unifacial granite mano
Isolate 6 (Granite Grinding Slab)	Isolate	Prehistoric	Granite grinding slab
Isolate 7 (Unknown Aerial Marker)	Isolate	Historic	Unknown aerial marker. "X" shaped scar in ground surface
Isolate Find #2	Isolate	Prehistoric	Chert core fragment
I-TC-1	Isolate	Prehistoric	Metate
I-TC-4	Isolate	Historic	wood framework and adjacent timbers.
LH-ISO-02	Isolate	Historic	two fragments of glazed tile
Milk glass and clear glass bottle	Isolate	Historic	Milk glass and clear glass bottle
p-15-009291	Isolate	Prehistoric	Sandstone flake
P-15-010947	Isolate	Unknown	Unknown
P-15-015021	Isolate	Unknown	Unknown
P-15-015498	Isolate	Unknown	Unknown
P-15-015508	Isolate	Unknown	Unknown
P-15-18744	Isolate	Prehistoric	Cryptocrystalline biface thinning flake
P-15-18745	Isolate	Prehistoric	Quartzite core
P-15-18766	Isolate	Prehistoric	Secondary quartzite flake
P-40-38311	Isolate	Prehistoric	Granitic hand stone
P-40-38312	Isolate	Prehistoric	Quartzite core
P-40-38313	Isolate	Prehistoric	Ground stone fragment
P-40-38314	Isolate	Prehistoric	Tabular chert core
P-40-38315	Isolate	Prehistoric	Chert biface fragment
P-40-38316	Isolate	Prehistoric	tertiary grey chert flake
PL-AERA-GWL-ISO-01	Isolate	Historic	Brick scatter
PL-MOC-ISO-002	Isolate	Historic	1930 survey marker
PL-MOC-ISO-003	Isolate	Historic	1930 survey marker
PL-MOC-ISO-004	Isolate	Historic	1928 survey marker
PL-RL-2625-05-01-ISO-003	Isolate	Historic	two Church-key opened, rusted, 12 oz, flat top steel beverage cans
PL-RL-2625-05-01-ISO-004	Isolate	Historic	double-ended wrench

Table A-2
Isolated Finds

Resource Name	Resource Type	Age	Description
PL-RL-2625-05-ISO-005	Isolate	Historic	aluminum pull-tab Schlitz beer can
PL-S-03H	Isolate	Historic	galvanized steel tank
PL-S-06H	Isolate	Historic	Anchor Hocking brown glass bottle
PL-S-07H	Isolate	Historic	steel pipeline
PL-S-08H	Isolate	Historic	7 ft deep pit and surrounding berm
Victory-2	Isolate	Historic	Earthen berm and wooden flume
Victory-7	Isolate	Historic	Benchmark/survey marker
Victory-8	Isolate	Historic	Earthen berm/sump