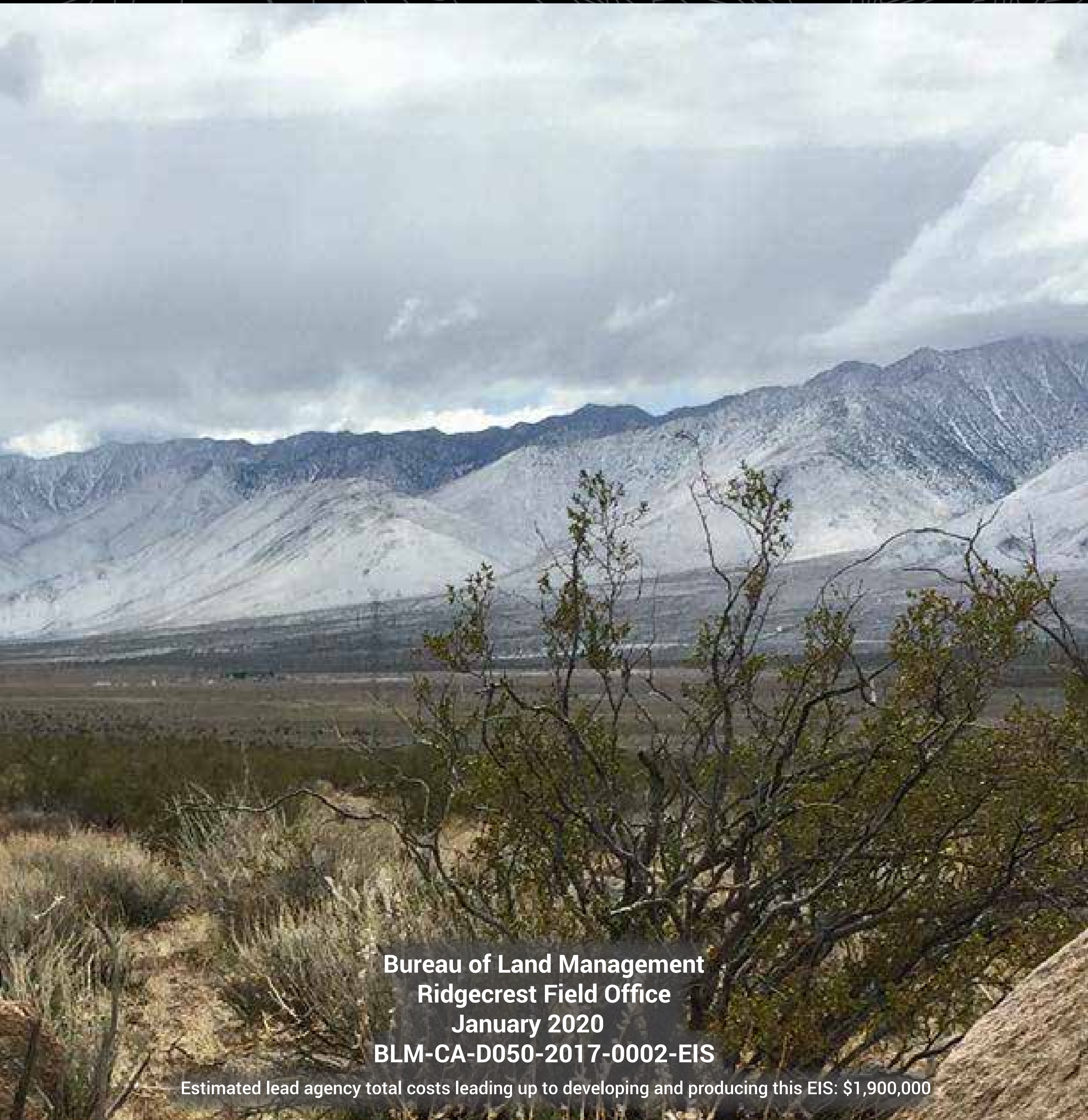
U.S. Department of the Interior
Bureau of Land Management

Haiwee Geothermal Leasing Area

Final Environmental Impact Statement and Proposed Amendment to the California Desert Conservation Area Plan



Bureau of Land Management
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HAIWEE GEOTHERMAL LEASING AREA

FINAL ENVIRONMENTAL IMPACT STATEMENT

AND

FINAL PROPOSED AMENDMENT TO THE CALIFORNIA DESERT CONSERVATION AREA PLAN

Prepared for and under the Direction of

Bureau of Land Management
Ridgecrest Field Office

January 2020

BLM-CA-D050-2017-0002-EIS
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BLM MISSION STATEMENT

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

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EXECUTIVE SUMMARY

Introduction

The United States Department of the Interior, Bureau of Land Management (BLM) has prepared this Final Environmental Impact Statement (FEIS) and Final Proposed Amendment (PA) to the California Desert Conservation Area (CDCA) Plan to establish a management framework and assess the potential environmental impacts of opening for lease approximately 22,805 acres of federal mineral estate for geothermal energy exploration and development. The project area, referred to as the Haiwee Geothermal Leasing Area (HGLA), is located in southwestern Inyo County, California. The HGLA is located east of the Inyo National Forest, west of the China Lake Naval Air Weapons Station (NAWS), south of the South Haiwee Reservoir, and north of Little Lake. The BLM has the delegated authority to issue geothermal leases on federal mineral estate; specifically, these federal mineral resources administered by the BLM.

Following the publication of the HGLA Draft Environmental Impact Statement (DEIS) (BLM 2012), supplemental analysis of water consumption for dual-flash and binary geothermal plant technologies was completed in response to public comments received on the DEIS/PA (Argonne 2016). Additionally, in 2016 the Desert Renewable Energy Conservation Plan (DRECP) Land Use Plan Amendment (LUPA) Record of Decision (ROD) was approved, changing the underlying land use management in the HGLA planning area. The FEIS/PA updated the analysis of Alternatives as required by the National Environmental Policy Act (NEPA) to reflect the CDCA Plan, as amended by the DRECP, including the designation of Special Recreation Management Areas (SRMAs), National Conservation Lands (NCL), which include Areas of Critical Environmental Concern (ACECs) and California Desert National Conservation Lands (CDNCL), and Development Focus Areas (DFAs) within the HGLA. The ACECs and CDNCLs are listed together throughout this document because these land use designations are collocated with each other across the entire HGLA (see Vicinity Map in Appendix L). Conservation Management Actions (CMAs) for each designation would dictate activities proposed within these areas and would be limited to the more restrictive land use designation CMA.

BLM issues geothermal leases for the potential development of a facility to convert geothermal energy into electric power. The BLM is authorized to enter into these leases as the manager of the geothermal resources included in the federal mineral estate. Lessees are granted exclusive rights to future exploration, production and use ofgeothermal resources within the lease area subject to existing laws, regulations, formal orders, and the terms, conditions and stipulations of the lease or included as conditions of approval in permits. Lease issuance alone does not authorize any ground-disturbing activities. To explore for or develop geothermal resources, site-specific approval is required for any planned activities. Such approval could only be acquired following site and project specific compliance with the NEPA.

Purpose of and Need for Action

The BLM is proposing to amend the CDCA Plan, as amended by the DRECP, to establish a management framework for appropriate exploration and development of geothermal resources, based upon evaluation of the various social considerations, land uses, environmental resources, and land allocations within the HGLA. The BLM is also reviewing three pending lease applications for approximately 4,460 acres of federal lands to facilitate appropriate exploration and development of geothermal resources in the HGLA.

The purpose of the action is to determine whether and, if so, how to amend the CDCA Plan to facilitate appropriate exploration and development of geothermal resources within the HGLA, based upon evaluation of the various social, land use, and environmental resources within the HGLA and in light of the establishment of DFAs, ACECs, CDNCLs and SRMAs. The purpose is also to decide whether to approve (or deny) the three pending lease applications for approximately 4,460 acres of federal lands within the proposed HGLA and, if so, under what terms, conditions, and stipulations.

The BLM identified the need to allocate a broader area of designated lands (see Figures L3 and L4, Appendix L) as available or unavailable for geothermal leasing based on the interest from industry in developing the resource, which is demonstrated by the three pending lease applications. This need was accompanied by the need to consider appropriate constraints, stipulations, Best Management Practices (BMPs), and procedures to conserve resources and other uses that may be proposed for consideration by the BLM in the future.

The need also arises from policy directives and congressional direction regarding (1) development of clean renewable energy, (2) meet the increasing energy demands of the nation, (3) reducing reliance on foreign energy imports, (4) reduce greenhouse gas emissions, and (5) improving national security.

Decisions to be made by the BLM involve those relative to the amendment of the CDCA, and the three specific geothermal lease applications.

Plan amendment:

To determine the availability or suitability of lands within the HGLA for geothermal leasing, exploration, and development in areas not already designated as such in the CDCA, as amended (DFAs). The HGLA is located within lands that are currently managed as DFA, ACEC/CDNCL, and/or SRMA. The land use allocations identified in the CDCA Plan, as amended govern the type and degree of land-use action allowed within the allocation area. Land use actions and resource-management activities on public lands within these areas should meet the established guidelines. Geothermal development is an allowable use within DFAs but may still require stipulations to avoid resource conflicts above those identified in the CDCA Plan, as amended. ACECs/CDNCLs located within the HGLA have been established based on special resource values. Stipulations required for geothermal development will focus on protection of those values should a decision be made to allow geothermal development in these areas.

Geothermal lease application:

To approve or approve with modification or stipulations the three existing noncompetitive federal geothermal lease applications (CACA 43998, CACA 43993, and CACA 44082) consistent with the terms and conditions of the current CDCA Plan, as amended. Subsequent proposals for development of those leases would be assessed under future NEPA compliance documents.

This FEIS/PA analyzes approving the proposed plan amendment and the three pending noncompetitive geothermal lease applications.

Document Scope and Leasing Area

This FEIS/PA analyzes the potential environmental, social, and economic effects of several alternatives. The document has been prepared in accordance with NEPA, Council on Environmental Quality's (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations [CFR] parts 1500-1508), the Department's regulations for implementing NEPA (43 CFR Part 46), and the Federal Land Policy and Management Act (FLPMA, Public Law 109-58) and its implementing regulations.

The BLM released the HGLA DEIS and Draft CDCA PA for public review and comment in 2012 and identified a Preferred Alternative that would allow geothermal leasing, exploration, and development throughout the entire HGLA, but with the requirement of no surface occupancy (NSO) in sensitive areas (Alternative C). The DEIS Preferred Alternative would have amended the CDCA to identify the HGLA as suitable and available for geothermal leasing. The Preferred Alternative would have also authorized all pending leases CACA-043998, CACA-044082, and CACA-043993 within the HGLA subject to certain stipulations to protect sensitive resources.

The BLM distributed the DEIS/PA for the HGLA for public and agency review and comment between May 4, and August 3, 2012. The BLM announced public meetings in Lone Pine and Ridgecrest to assist the public in preparing comments on the DEIS/PA. Public meetings were held on June 13, in Lone Pine, California, and June 14, in

Ridgecrest, California. The BLM received 15 comment letters from agencies, organizations, and individuals/businesses during the comment period. The BLM distributed the DSEIS for public review and comment between May 3 and August 1, 2019. The BLM received 7 comment letters from agencies, organizations and individuals during the comment period. All substantive comments on the DEIS and DSEIS/PA have been addressed in this FEIS/PA (see Appendix Z).

The HGLA consists of an estimated 22,805 acres of BLM administered public lands and approximately 1,572 acres of mineral estate where the surface lands are not federally owned (split-estate); this area also includes the area subject to three pending noncompetitive geothermal lease applications for approximately 4,460 acres of BLM administered public lands. The legal description for the lands considered for geothermal leasing are included in Appendix I.

This document will inform BLM's decision regarding suitability of lands within the HGLA relative to geothermal leasing and land allocations established as part of the DRECP LUPA (i.e., ACECs/CDNCLs), and to identify specific stipulations to protect resources that may not have been addressed in the CDCA Plan, as amended. This document does not allow or authorize any ground disturbing activities, but provides a basis for streamlining the environmental review of future geothermal energy projects within the HGLA.

Scoping

The Notice of Intent (NOI) for the HGLA was published in the Federal Register on September 11, 2009. The NOI announced that the leasing of public lands will require an amendment to the CDCA Plan. Scoping documents were sent to members of the public listed on the BLM's mailing list as well as to organizations, groups, and individuals requesting copies of the materials.

The BLM conducted four public scoping meetings between October 13 and October 20, 2009, in Lone Pine, Bishop, Ridgecrest, and Death Valley, California. During the scoping process, BLM received 14 comment letters and numerous verbal comments at the scoping meetings (see Appendix H). Comments were made by members of the public, Native American Tribes, interest groups, and agency representatives. These comments related to geothermal development impacts on air quality, water resources in Rose Valley, endangered species, recreation, agriculture, water well owners, population and housing in Inyo County, spiritually important Native American Sites, and the Coso Hot Springs. Additional comments related to potential land management plan conflicts, suggestions of alternatives, the potential need for an upgrade of transmission lines or substation construction, the preservation of geothermal reservoirs, potential wastewater and heat and emission hazards to the public, noise generation levels, and transportation of construction materials and workforce. Comments also included inquiries about the cumulative impacts of other geothermal projects in close proximity to the Haiwee area and the conformance of the project with the CDCA Plan, the Northern and Eastern Mojave Plan, and the West Mojave Plan.

Other than maintenance of existing utility rights-of-way, there has been very little activity within the HGLA since the publishing of the DEIS/PA in 2012. Therefore, the BLM considers comments submitted on the DEIS/PA are still considered relevant today, as are the issues considered in the DEIS/PA.

Alternatives

A total of three Action alternatives (Alternatives A, B and C), as well as one No Action alternative (Alternative D) evaluated in this FEIS/PA, as follows:

<u>Alternative A (Preferred Alternative)</u>: Allow geothermal leasing, exploration and development throughout the entire HGLA; amend the CDCA Plan to have the HGLA identified as available for geothermal leasing, exploration and development; and authorize three pending leases within the HGLA, subject to certain stipulations to protect sensitive resources. The CDNCL, as well as the Ayers Rock, Rose Spring, Mohave Ground Squirrel and Sierra Canyon ACEC Special Unit Management Plans would be amended to allow for surface occupancy within the HGLA.

***Alternative B*: Allow geothermal leasing, exploration, and development throughout the entire HGLA, but with No Surface Occupancy (NSO) stipulation in sensitive areas; amend the CDCA Plan to have the HGLA identified as available for geothermal leasing, exploration and development; and authorize three pending leases within the HGLA, subject to certain stipulations to protect sensitive resources.**

***Alternative C*: The HGLA would remain under the current management as specified by the CDCA Plan as amended; authorize only those portions of the three pending leases in the HGLA located within the DFA; and deny those portions of the pending lease applications located within the ACEC/NCL areas.**

***Alternative D (No Action)*: The area would not be designated as available for geothermal leasing, exploration and development and would remain under current management as specified in the CDCA Plan, as amended. Any proposed geothermal facilities in the DFA would be allowed by the CDCA Plan, as amended. The current pending lease applications would be neither denied nor authorized and would be processed under the current land use plan. Any geothermal leasing, exploration or development proposed within ACEC/NCL areas would not be allowed.**

Reasonably Foreseeable Development Scenario

Following guidance in BLM Handbook H-1624-1, *Planning for Fluid Mineral Resources*, a Reasonable Foreseeable Development (RFD) is project management activities and actions, including developments, which are likely to occur in the planning area over the life of the plan (i.e., generally 15 to 20 years or whatever has been determined to be the planning horizon or timeframe for the Resource Management Plan (RMP) assuming continuation of existing management. The fluid minerals specialist focuses attention on projecting fluid minerals leasing, exploration, development, production and abandonment activities. The description of existing fluid minerals practices and information on existing leases and related exploration and development activities as well as the potential for development in the planning area provides the basis for projecting the RFD under existing management. The level of detail necessary for describing the reasonably foreseeably development scenario is basically a function of: the amount of geologic data available regarding fluid mineral potential; and the nature or level of resource conflicts or controversies, i.e., planning issues or management concerns involving fluid mineral leasing and development.

The BLM has prepared a RFD scenario as a basis for analyzing environmental impacts resulting from potential future leasing and development of federal geothermal resources within the HGLA. There is currently no direct data on which to base the RFD scenario, such as known temperature gradient wells or deep exploration wells within the HGLA. Most of the HGLA, however, is within the Coso Known Geothermal Resource Area (KGRA). The KGRA recognizes the potential for a geothermal resource largely due to related geologic features and structures. The Coso geothermal field is also within the KGRA and located approximately three miles southeast of the easternmost boundary of the HGLA. The Coso field is used as an analog for evaluation of geothermal resource potential within the HGLA. The Coso geothermal field is located on the China Lake Naval Air Weapons Station (NAWS) in proximity to the project area. The Coso geothermal field currently produces approximately 200 megawatts (MW) of electricity from a total of nine 30 MW geothermal turbine/generators. The Coso field is located in an area of relatively recent volcanic activity. This volcanic activity included intrusion of magma to shallow depths, thereby providing an accessible heat source for the geothermal field. The HGLA likely has a similar resource. The RFD remained unchanged from the DEIS/PA, the DSEIS/PA, and this FEIS/PA.

For the purpose of the RFD, it was assumed that the productive areas will be less prolific than in the Coso geothermal field, the resource will be deeper, and more wells will be required per MW than in the Coso geothermal field. The RFD assumes that two 30 MW power plants would be constructed, each of which would operate for 30 years. A total of 15 production wells and seven injection wells would be drilled over the 30-year operational life period in order to maintain the 30 MW of net production at each power plant. It was assumed that the RFD scenario could occur on any land within the HGLA, regardless of surface or mineral ownership. Total disturbance on BLM land from the two plants was estimated to be 376 acres during construction and then 257 acres during operation.

As a result of public comments on the DEIS/PA regarding water consumption estimates included in the DEIS/PA, the BLM consulted with Argonne National Laboratory. Water consumption estimates used to determine potential impacts of the RFD in the DEIS are reasonable and supported by the modelling effort conducted by Argonne National Laboratory after the publication of the DEIS/PA. Additional discussion is provided in Section 4.6.1 of this FEIS/PA.

Environmental Consequences

Designating lands for geothermal leasing potential, amending the CDCA Plan to allow for leasing and development, and authorizing geothermal leases do not result in any direct impacts as defined by CEQ regulations, which state that such effects "are caused by the action and occur at the same time and place" (40 CFR Part 1508.8). It is reasonably foreseeable that impacts could occur if the BLM issues geothermal leases, and those impacts would not occur until BLM authorized development following a lease issuance. Therefore, the analysis in this Environmental Impact Statement addresses both direct and indirect impacts for the entire HGLA based on the RFD scenario. Additional site specific analysis would be conducted during the permitting review process for subsequent proposed exploration, drilling, and utilization activities. General impacts from a proposed exploration, drilling, or utilization action could potentially occur to the following resources and uses:

- **Air Quality and Climate**: Short-term increase in air emissions associated with construction of the geothermal power plants. Minimal emissions are associated with operation of a geothermal power plant and therefore such development and operation are likely to have a beneficial impact in reducing emissions and greenhouse gases on a more regional level.
- **Noise**: Minor short term impacts in proximity of drilling and other activities in addition to minor long term impacts associated with operations.
- **Topography, Geology, Seismicity**: Minimal impacts to geology, including 376 acres of surface disturbance, and a local minor seismicity hazard associated with injection wells.
- **Soils**: Disturbance of 376 acres expected from the RFD would include compaction, but is less than two percent of the HGLA. This would go along with some minor long-term loss of soils.
- **Water Resources**: Short-term and potential long-term impacts during exploration and development activities.
- **Biological Resources**: Long-term loss of vegetation and habitat associated with roads and other surface disturbance. This could impact several special-status species such as the Mohave ground squirrel and the desert tortoise.
- **Cultural Resources**: Impacts would be minor or negligible due to the ability to redesign or modify projects to avoid adverse effects.
- **Paleontology**: No adverse impacts would be expected due to the low probability of occurrence.
- **Visual Resources**: Variable long-term impacts during utilization from the presence of power plants and associated infrastructure such as wells, access roads, pipelines, and power lines. Short-term impacts during exploration and development. Variability ranges from low to high impacts based on proposed project location and visibility.
- **Lands and Realty**: Impacts would be low based on recognition of existing use classifications and prior existing rights.
- **Public Health and Safety**: Impacts are expected to be low based on BLM lease conditions and applicable requirements.
- **Energy and Mineral Resources**: Potential for impacts is considered low, since geothermal development is not incompatible with mining operations.

- **Wild Horses and Burros**: There is a low expectation of impacts due to adherence with applicable laws, regulations, and requirements.
- **Grazing**: Impacts are considered low and limited to the loss of lands available for other uses (376 acres expected from the RFD). There are two grazing allotments present in the HGLA with each having only about three to four percent of their respective allotment found within the HGLA.
- **Recreation**: Short term impacts from construction and long term impacts in the immediate vicinity of any development facilities would be low overall. It would include loss of acreage, road use conflicts, and visual impacts, but would be offset by potentially better access through new road construction.
- **Special Designations**: The potential for impacts is considered low due to consideration of current regulations and requirements.
- **Traffic / Transportation**: Impacts to traffic and transportation would be considered low since any expected increase in traffic would be a negligible increase in the regional traffic flow.
- **Socioeconomics**: Potential impacts include an increase in employment, economic benefits, and public revenue. Other potential impacts such as the decrease in available housing and public services, which are expected to be low and short-term.

Many of the ground disturbing impacts associated with resources identified above can be appropriately mitigated or avoided through site specific BMPs, stipulations, and siting designs. These would also be identified during analysis performed for the evaluation of specific proposed leasing and development actions.

Cumulative effects associated with geothermal development would be minor in nature, mainly due to the limited number of other past, present and reasonably foreseeable projects within the planning area. Other energy developments have been analyzed in detail in the Cumulative Effects section of Chapter 4.

Organization of this Document

This document has been modified from the original DEIS/PA for brevity. Much of the background information (e.g., purpose and need, authorizations, applicable laws, plans and standards, certain resource baseline conditions, previous consultation/coordination and public outreach) as discussed in the DEIS/PA remains applicable to this FEIS/PA, and is summarized and referenced accordingly, or included in the Appendices. Chapter 1 provides an introduction, discussion of the purpose and need for action, and information about the programs and policies that relate to the purpose and need. Chapter 2 presents the proposed action and a reasonable range of alternatives, information on the phases of geothermal resource development, and describes BLM's reasonably foreseeable development scenario. Chapter 3 describes existing environmental conditions of the HGLA and vicinity. Chapter 4 evaluates the potential direct, indirect, and cumulative impacts of the proposed action and alternatives. There are 24 appendices included in this FEIS/PA.

Chapter 1 Introduction and Purpose and Need

1.1 NEED FOR A SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

On May 10, 2012, the Bureau of Land Management (BLM) released the proposed Haiwee Geothermal Lease Area (HGLA) Draft Environmental Impact Statement (DEIS) and Draft Plan Amendment (PA) to the California Desert Conservation Area Plan of 1980 as amended (CDCA) for public review and comment (BLM 2012), identifying a Preferred Alternative that would allow geothermal leasing, exploration, and development throughout the entire HGLA, but with a no surface occupancy (NSO) lease stipulation required in sensitive areas (Alternative C). The Preferred Alternative would have amended the CDCA Plan to have the HGLA identified as suitable and available for geothermal leasing, and would have authorized pending leases CACA-043998, CACA-044082, and CACA-043993 within the HGLA. Public meetings were held in Lone Pine, California and Ridgecrest, California in June 2012 to provide the public an opportunity to give their input on the DEIS/PA and Preferred Alternative. The BLM received 15 comment letters from agencies, organizations, and individuals/businesses during the comment period.

As a result of a review of the substantive public comments received, the BLM decided to conduct a more detailed study to validate the projected water use by geothermal facilities should they be allowed in the HGLA. Argonne National Laboratories conducted the study and provided BLM a report in January 2016. Additionally, new land use designations approved with the DRECP amendment to the CDCA Plan in September of 2016 required modifications of the alternatives and analyses within the DEIS/PA. Based on these two developments, the BLM prepared a Draft Supplemental Environmental Impact Statement (DSEIS) and PA. The DSEIS/PA was published on May 3, 2019. Comments were received on the DSEIS through the end of the 90-day comment period ending on August 1, 2019.

Public comments on the DSEIS/PA are addressed in this Final Environmental Impact Statement (FEIS) and PA. A total of seven comment letters and correspondences were received by the BLM. Section 5.5 of this FEIS/PA summarizes the comments received, and responses to comments are included in Appendix Z along with the original letters in their entirety.

This FEIS/PA describes the revised Alternatives from the DEIS/PA and identifies direct, indirect, and cumulative impacts. The FEIS/PA Reasonably Foreseeable Development scenario (RFD) is identical to the RFD described in the DEIS/PA, but additional information is provided to further support the assumptions included as part of the RFD. This FEIS/PA also incorporates by reference the 2012 DEIS/PA where baseline data, analysis, mitigation measures, and stipulations remain unchanged. Detailed discussions or additional information are typically provided only where they differ from the 2012 DEIS/PA. Important information and data is retained from the DEIS/PA where appropriate.

For this FEIS/PA, much of the content from the DEIS remains applicable. For all sections, associated content from the DEIS/PA was summarized and references made to the DEIS/PA.

1.2 PROJECT OVERVIEW

1.2.1 Introduction

As discussed in the DEIS/PA, the BLM is evaluating alternatives for geothermal leasing on approximately 22,805 acres of BLM-administered public lands and subsurface mineral estate. Within the HGLA, approximately 21,233 acres are BLM-managed lands; the remaining 1,572 acres are split-estate where the BLM manages only the subsurface mineral rights and the surface is privately owned. The HGLA is in southwestern Inyo County, California, east of the Inyo National Forest, west of the China Lake NAWS, and south of the South Haiwee Reservoir (see Figures L- 1, L-2, and L-3, Appendix L). The legal description for the HGLA lands is included in Appendix I.

There are currently three pending noncompetitive geothermal lease applications covering about 4,460 acres of BLM-administered public lands in this area (see Figure L-3, Appendix L), and these remain included in the alternatives and analysis as discussed in Section 1.1.1 of the DEIS/PA. These applications have been serialized as CACA 43998 (1,280 acres), CACA 43993 (2,540 acres), and CACA 44082 (640 acres), and potential issuance of leases related to these pending applications have been incorporated into the revised alternatives and remain unchanged.

1.3 BLMPURPOSE AND NEED FOR THE PROPOSED ACTION

1.3.1 Purpose of Action and Need for the Action

The purpose of the action remains unchanged from the DEIS/PA, in that the purpose is to consider the role of geothermal in providing a reliable energy source and to respond to an increased interest in geothermal leasing opportunities on federal lands (see Section 1.2 of the DEIS/PA).

The 2012 DEIS/PA stated need for action includes making a leasing decision for each of the three applications to grant, deny, or grant with modifications. The BLM identified approximately 18,000 acres of BLM-administered lands that may have potential to contain geothermal resources located within the HGLA, and adjacent to the three pending leases. On September 14, 2016, BLM signed the Record of Decision (ROD) for the Desert Renewable Energy Conservation Plan (DRECP) Land Use Plan Amendment (LUPA) which designated portions of the HGLA as Development Focus Area (DFA), Area of Critical Environmental Concern (ACEC) / California Desert National Conservation Lands (CDNCL), and or Special Recreation Management Area (SRMA), thus addressing some of the original need related to the lands outside of the three leasing application areas. As a result, the specific need for action has changed since the release of the DEIS/PA, yet the overarching need of the action remains to allocate specific lands in the HGLA as available to geothermal leasing.

Additionally, there is a current need for the BLM to respond to an increasing interest in geothermal leasing opportunities on federal land and the need for having specific stipulations, mitigation measures, and best management practices (BMPs) identified for geothermal resource development that were not addressed in the recent DRECP LUPA. In reviewing the three pending lease applications, which were submitted prior to the passage of the Energy Policy Act of 2005 and continue to be part of the backlog of geothermal lease applications, the BLM identified the need to allocate a broader area of designated lands (see Figures L3 and L4, Appendix L) as available or unavailable for geothermal leasing. This need is accompanied by the need to consider appropriate constraints, stipulations, BMPs, and procedures to conserve resources and other uses that may be proposed for consideration by the BLM in the future.

1.3.1.1 Amend the CDCA Plan

The HGLA is located on land currently designated as DFA, SRMA, or ACEC/CDNCL under the CDCA Plan, as amended. ACEC/CDNCL allocations and Conservation Management Actions (CMAs) may not specifically address potential restrictions or required stipulations necessary to protect sensitive resources that may be impacted by the development of geothermal resources within the HGLA, and ACECs have not been designated as suitable and available for geothermal development in the DRECP LUPA. Similarly, geothermal development may not be allowed or may be restricted in DFAs, should site specific analysis determine sensitive resources may need protection. DFAs have been designated as being suitable for renewable energy development in the DRECP LUPA.

Therefore, the BLM must determine if portions of the HGLA not currently designated as available for geothermal leasing should be designated as available, and whether or not to amend the CDCA Plan to make these areas within the HGLA available for geothermal leasing with standard terms and conditions.

Standard terms and conditions include different types of biological conservation strategies, such as CMAs and monitoring and adaptive management, as identified in the CDCA Plan, as amended. A plan amendment would be made by the BLM that would include a determination of allowing geothermal exploration and development within the entire HGLA, as well as, allowing surface occupancy within the ACECs/CDNCLs within the HGLA. Subsequent geothermal leasing and facility development proposed within the HGLA would not require a site-specific plan amendment but would require compliance with the National Environmental Policy Act (NEPA) prior to any ground disturbing activity.

Executive Orders, Secretarial Orders, and Federal or State Land Management Policies

Executive Orders, Secretarial Orders, and Federal or Land Management Laws, Plans and Policies are discussed in the 2012 DEIS/PA. Since the publication of the 2012 DEIS/PA, Executive Orders and Secretarial Orders that pertain to this project include, but are not limited to:

- Executive Order 13783, dated March 28, 2017, which promotes "clean and safe development of our Nation's vast energy resources, while at the same time avoiding regulatory burdens that unnecessarily encumber energy production, constrain economic growth, and prevent job creation."
- Executive Order 13807 (August 15, 2017) and Secretary's Order 3355 (August 31, 2017), which established policy to prioritize infrastructure projects and streamline the environmental review process.

1.3.2 Decisions to be Made

Decisions to be made by the BLM are related to the amendment of the CDCA Plan, as amended, and the three specific geothermal lease applications.

Plan Amendment: To determine the availability of lands within the HGLA for geothermal leasing, exploration, and development in areas not already designated as such in the CDCA Plan, as amended (DFAs). The HGLA is located on land that is currently managed as DFA, ACEC/CDNCL, and/or SRMA. The land use allocations identified in the CDCA Plan, as amended govern the type and degree of land-use action allowed within the allocation area. Land use actions and resource-management activities on public lands within these areas should meet the established guidelines. Geothermal development is an allowable use within DFAs, but may still require stipulations to avoid resource conflicts above those identified in the CDCA Plan, as amended. ACECs/CDNCLs located within the HGLA have been established based on special resource values. Stipulations required for geothermal development will focus on protection of those special resource values should a decision be made to allow geothermal development in these areas.

Geothermal Lease Application: To approve or approve with modification or stipulations the three existing noncompetitive federal geothermal lease applications (CACA 43998, CACA 43993, and CACA 44082) consistent with the terms and conditions of the CDCA Plan, as amended. Subsequent proposals for development of those leases would be assessed for site specific NEPA compliance.

It should be noted that this FEIS/PA analyzes approving the proposed plan amendment and the three pending noncompetitive geothermal lease applications.

1.3.2.1 BLM Authorizations and Regulatory Framework

Authorizations and regulatory framework that grants the BLM the authority to lease federal lands for geothermal development remain largely unchanged as described in Section 1.3 of the 2012 DEIS/PA. Other applicable authorities, plans, and programs are hereby incorporated as described in the 2012 DEIS/PA.

Chapter 2 Alternatives Including the Proposed Action

2.1 INTRODUCTION

The Alternatives analyzed in this FEIS/PA differ from those detailed in the 2012 DEIS/PA primarily in the geographical location of areas identified as available for geothermal development, and the location of sensitive resources that may be subject to certain stipulations established to protect sensitive resources or no-surface occupancy (NSO).

The RFD scenario as previously described in Section 2.2.4 of the DEIS/PA and presented in Appendix B of this FEIS/PA is the basis to identify potential impacts associated with each of the Action Alternatives (A, B, or C). Appendix B also includes assumed disturbance areas as previously discussed in the DEIS/PA. As the name implies, the level and type of development anticipated in the RFD is a reasonable projection of what could eventually occur if the HGLA is opened to geothermal leasing. It was not intended to be a "maximum-development" scenario; however it is biased towards the higher end of expected development in order to ensure all adverse impacts are identified.

All three Action Alternatives identified will allow geothermal leasing and development within all or part of the HGLA. The No Action Alternative (Alternative D) is required under NEPA and Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508) and would neither approve nor deny the pending leases. The leases would be processed under the CDCA Plan, as amended and with additional NEPA compliance documentation. Refer to Appendix M for detailed mapping of the Action Alternatives.

Some elements of the alternatives are shared among or between the Action Alternatives. Groundwater extraction for consumptive use is restricted by stipulation for Alternatives A and B. Consumptive water use within HGLA would be prohibited unless allowed by exemption under stipulation SA-HGLA-10 as detailed in Appendix K as described in each alternative below. Measures designed to protect Mohave ground squirrel, desert tortoise habitat and groundwater, as well as other resource protection measures; including certain stipulations and BMPs described in Appendix A and Appendix K, would apply to all three Action Alternatives to varying degrees. No changes in off-highway vehicle (OHV) route designations will be made under the alternatives. However, if in the future, the BLM receives additional proposals for exploration or development, changes in route designations may be proposed. Such proposed project specific changes would be considered as part of subsequent NEPA compliance documentation prepared for the proposed exploration or development project. Applicable lease stipulations, mitigation measures, and best management practices are detailed Appendix A and Appendix K. Figure L-4, Appendix L provides additional context for understanding the alternatives being proposed. Figure L-5, Appendix L illustrates the spatial relationship between the Coso Known Geothermal Resource Area and the HGLA.

2.2 ALTERNATIVES

2.2.1 Alternative A (Preferred Alternative): Allow Geothermal Leasing in the Entire HGLA

Allow geothermal leasing, exploration and development throughout the entire HGLA; amend the CDCA Plan to have the HGLA identified as available for geothermal leasing, exploration and development; and authorize three pending leases within the HGLA, subject to certain stipulations to protect sensitive resources. The Ayers Rock, Rose Spring, Mohave Ground Squirrel, and Sierra Canyon ACEC Special Unit Management Plans would be amended to allow for surface occupancy within the HGLA.

Geothermal leasing, exploration, and development would be allowed on all BLM administered public lands within the proposed HGLA, including ACECs/CDNCLs and SRMAs (see Figure M-1, Appendix M). The three pending non-competitive geothermal lease applications located within the HGLA would be authorized. Approval of a site-specific Geothermal Drilling Permit (GDP), Plan of Operations (POO), or Plan of Development (POD) would be required for these leases before ground-disturbing activities could occur. The CDCA Plan would be amended to classify all lands within the HGLA as available for geothermal leasing, exploration, and development, including ACECs and SRMAs. The Ayers Rock, Rose Spring, Mohave Ground Squirrel, and Sierra Canyon ACEC Special Unit Management Plans would be amended to allow for surface occupancy within the HGLA.

Groundwater extraction for consumptive use during exploration, development and plant operations may be allowed for some leases. Special Administrative Stipulation SA-HGLA-10 (see Appendix K) will be attached to any geothermal leases issued within the HGLA. Groundwater extraction for consumptive use may be subject to other requirements or restrictions which will be determined on a project- or activity-specific basis.

2.2.2 Alternative B: Allow Geothermal Leasing in the Entire HGLA with No Surface Occupancy in Sensitive Areas

Allow geothermal leasing, exploration, and development throughout the entire HGLA, but with NSO lease stipulation required in sensitive areas; amend the CDCA Plan to have the entire HGLA identified as available for geothermal leasing; and authorize three pending leases within the HGLA, subject to certain stipulations to protect sensitive resources.

This alternative would be similar to Alternative A except the CDCA Plan would be amended to designate lands within ACECs and SRMAs, as available for geothermal leasing, exploration, and development, with the requirement that any geothermal lease issued subsequent to the ROD include the stipulation of No Surface Occupancy (NSO-HGLA-1) protecting the defined sensitive resources area (see Figure M-2, Appendix M). Consumptive water use within HGLA would be prohibited unless allowed by exemption under stipulation SA-HGLA-10 as detailed in Appendix K.

2.2.3 Alternative C: HGLA Remains in Current Management, Authorize Pending Leases Outside of Sensitive Areas

The HGLA would remain under the current management as specified by the CDCA Plan, as amended; authorize portions of three pending leases within the HGLA in areas established as DFA; and deny portions of pending lease applications within ACECs.

This alternative would not change the current management of the BLM-administered public lands within the HGLA. The area identified as available for geothermal leasing, exploration, and development would reflect the location of the DFA within the HGLA boundary. All other areas within the HGLA (ACECs and SRMAs) would have no specific availability for geothermal leasing, exploration, and development, and would be subject to CMAs. The DFA would remain available for geothermal leasing exploration, and development with surface occupancy allowed (see Figure M-3, Appendix M).

The pending geothermal leases would be denied where they overlap ACECs and SRMAs (outside of the DFA). No lands or subsurface estate within the defined sensitive resources area would be authorized for geothermal leasing, exploration, or development. Consumptive water use within HGLA would be prohibited unless allowed by exemption under stipulation SA-HGLA-10 as detailed in Appendix K.

2.2.4 Alternative D: No Action

The area would not be designated as available for geothermal leasing, exploration and development and would remain under current management as specified in the CDCA Plan, as amended. Any proposed geothermal facilities in the DFA would be under the CDCA Plan, as amended. The current pending lease applications would be neither denied nor authorized and would be processed in conformance with the CDCA Plan, as amended. Any geothermal leasing, exploration or development proposed within ACEC/CDNCL areas would <u>not</u> be allowed.

The No Action Alternative (Alternative D) is required under NEPA and CEQ regulations (40 CFR Parts 1500-1508) and would neither approve nor deny the pending leases. Under Alternative D, the pending non-competitive geothermal leases may be processed in accordance with the CDCA Plan, as amended, with additional NEPA compliance documentation. The area identified as available for geothermal leasing, exploration, and development would reflect the location of the DFA within the HGLA boundary as currently managed. All other areas within the HGLA (ACEC/CDNCL and SRMA) would have no specific designation for geothermal leasing, exploration, and development (see Figure M-4, Appendix M).

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED

The BLM has evaluated alternative geothermal technologies, other power generation technologies, and energy conservation and demand side management for the DEIS/PA, and this FEIS/PA. These are discussed in detail in the 2012 DEIS/PA in the following sections:

- Alternative Technologies for Power Generation, including solar, wind, hydroelectric, solid waste, biofuels, nuclear, and fossil fuels – Section 2.4.1.
- Energy Conservation and Demand Side Management – Section 2.4.2.
- Alternative Geothermal Technologies – Section 2.4.3. Additional discussion below in Section 2.3.1 provides information that has been updated from the DEIS/PA.

2.3.1 Alternative Geothermal Technologies

In response to comments on the DEIS/PA, several assumptions inherent to the overall analysis have been clarified (see RFD scenario Section 2.2.1). The three technologies (flash, dual-flash and binary) that are considered in the RFD scenario are all covered by the water-use stipulation contained in SA-HGLA-10. With regard to water use, the dual-flash design utilizing wet-cooling represents a conservative scenario. The dry steam power plant was eliminated because dry steam reservoirs are rare and not anticipated to occur in the HGLA. Although the other technologies are not anticipated to be used, the analysis based on the RFD scenario is expected to cover impacts that might result from their use after appropriate NEPA analysis is completed.

2.3.1.1 Binary Plant

A binary geothermal power plant utilizes comparatively low-temperature (less than 360 degrees Fahrenheit [°F]) hydrothermal resources. The geothermal fluid (which can be either hot water, steam, or a mixture of the two) heats a “working fluid” (such as isopentane or isobutene) that boils at a lower temperature than water. The two liquids are kept completely separate through the use of a heat exchanger, which transfers the heat energy from the geothermal water to the working fluid. When heated, the working fluid vaporizes into gas, and like steam, the force of the expanding gas turns the steam turbines that power the generators. All the process water is injected back into the underground geothermal reservoir.

The binary plant design was eliminated from further specific analysis because it utilizes lower temperature geothermal resources than those anticipated to occur within the HGLA. Analysis assumptions have been clarified to state that binary process geothermal facilities are considered to have relatively equivalent impacts within the RFD scenario when compared to flash or dual-flash technologies. The eventual footprint such facilities might have is not expected to greatly differ on an acre of disturbance per megawatt basis. This is also demonstrated in the small difference in life-cycle water use between these two technologies, where differences in ancillary systems can create relatively large differences in water use.

2.3.1.2 Dry Steam Plant

Dry steam power plants are relatively simple and require only steam and condensate injection piping and minimal steam cleaning devices. They utilize steam produced directly from geothermal reservoirs to run the turbines that power the generator. No separation is necessary because wells only produce steam. Dry steam reservoirs, however, are rare and are not anticipated to be used within the HGLA.

2.3.1.3 Dry Cooling System

The HGLA is located in an area of scarce water resources. As an alternative to the proposed use of wet cooling towers, the BLM considered air-cooled or dry cooling towers for steam condensation. The efficiency of power generation for air-cooled systems is affected by the difference between the temperature of the fluid exiting the turbine and the temperature of the cooling medium.

The HGLA is located in the high desert and, during the summer months, energy demands in the surrounding area increase due to higher ambient air temperatures and extensive use of air conditioners by businesses and residents. The high temperatures would pose a problem with cooling the power plant, and overall efficiency would decrease during times of greatest need, therefore, air-cooling was eliminated from further analysis because it is not feasible given the anticipated high temperatures expected in the HGLA.

2.3.2 Previous Alternatives Considered in the DEIS

Two alternatives considered in the DEIS/PA were eliminated from consideration. These include DEIS/PA Alternative B and Alternative D.

2.3.2.1 DEIS Alternative B:

Make the entire HGLA unavailable to geothermal leasing, exploration, and development; amend the CDCA Plan to designate all lands within the HGLA as unavailable and unsuitable for geothermal leasing, exploration, and development; and deny authorization of all pending leases within the HGLA.

This alternative would be inconsistent with the intent of the CDCA, as amended because it would prohibit the development of geothermal energy facilities in the DFA created by the DRECP amendment, while allowing other renewable energy projects. No new information has become available since the September 14, 2016 signing of the ROD for the DRECP LUPA to suggest BLM should analyze making the existing DFA unavailable or unsuitable for geothermal leasing. Furthermore, this alternative does not meet the purpose and need of potentially allocating a broader area of lands as available for geothermal leasing. Therefore, this alternative has been eliminated.

2.3.2.2 DEIS Alternative D:

Make sensitive resource areas within the HGLA unavailable to geothermal leasing, exploration, and development; amend the CDCA Plan to have only those areas not designated as sensitive resource areas within the HGLA as suitable and available for geothermal leasing; amend the CDCA Plan to identify areas designated on BLM HGLA maps has having sensitive resources or habitats as unavailable and unsuitable for geothermal leasing, exploration, and development; modify lease parcels to contain only areas identified as available and suitable; and authorize only those portions of the pending lease applications within the HGLA that are not within designated sensitive resource areas, subject to certain stipulations to protect sensitive resources and for the unitization of development.

The sensitive resource areas identified in the DEIS/PA fall primarily within the DFA established in the DRECP LUPA. The recent DRECP planning process included updated information regarding sensitive areas within the HGLA, which differ from those areas identified in the 2012 DEIS/PA. Given that the DRECP contains the most-current depiction of sensitive areas, which differ from the original DEIS, it is not necessary or appropriate to incorporate an analysis of the sensitive areas from the DEIS/PA, as they were superseded by the more-recent DRECP data. Therefore, this alternative has been eliminated.

2.3.3 Alternative Sites

Alternative sites were not considered because alternative sites would not meet the purpose of and need for this action which is to evaluate the HGLA for the potential to lease the area for geothermal exploration and development. This alternative has been eliminated from further consideration.

2.4 LEASE STIPULATIONS, MITIGATION MEASURES, BEST MANAGEMENT PRACTICES, AND PROCEDURES

2.4.1 Lease Stipulations

Lease stipulations are detailed in Appendix K and are enforceable requirements or constraints that would be applied to any geothermal lease that may be authorized under the action alternatives. These stipulations, in some cases, have been updated for the FEIS. In particular, the following unique stipulation has been developed to prevent long term impacts to surface or groundwater supplies in the HGLA: Administrative Stipulation SA-HGLA-10 will be attached to any geothermal leases issued within the HGLA. Groundwater extraction for consumptive use may have other requirements or restrictions to be determined on a project- or activity-specific basis.

Lease Stipulation SA-HGLA-10 has been updated in the FEIS and removes SA-HGLA-10a, 10b, and 10c listed in the 2012 DEIS/PA. This is because 10a, 10b, and 10c are duplicative of the rest of the SA-HGLA-10 which requires expressed approval of the Authorized Officer for groundwater extraction for consumptive use prior to project activities. Further, stipulations developed and adopted in the Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (PEIS), October 2008, along with Standard Stipulations on Form 3200-24a, are hereby adopted for this FEIS/PA. Lease stipulations and procedures for the HGLA will be applied as outlined in the PEIS (BLM 2008a). Additionally, the DRECP amendment CMA-23 also requires similar limits and studies in relation to the use of water in the area of the HGLA.

2.4.2 BMPs and Mitigation Measures

BMPs and Mitigation Measures are applicable to all alternatives, and are detailed in Appendix A.

Chapter 3 Affected Environment

This chapter describes the affected environment and existing conditions of the physical, biological, cultural, and socioeconomic resources that have the potential to be affected by activities related to the alternatives discussed in Chapter 2; identifies areas that have changed from the 2012 DEIS/PA (BLM 2012), and provides a summary and references to applicable resource discussions in the DEIS/PA. Additional information and detailed changes from the DEIS/PA regarding affected resources is documented in technical reports and supplemental information found in the Appendices. Where baseline data remains unchanged from the DEIS/PA, references to the applicable sections are provided, with important discussions preserved and summarized as appropriate for critical resources.

3.1 INTRODUCTION AND OVERVIEW

3.1.1 GEOGRAPHIC SETTING

The geographical setting of the HGLA remains unchanged from the DEIS/PA encompassing 38 sections as described in Section 3.1.1 of the DEIS/PA and is provided in Figures L-1 and L-2, Appendix L of this FEIS/PA.

3.2 AIR QUALITY AND CLIMATE

3.2.1 APPLICABLE REGULATIONS, PLANS, POLICIES/MANAGEMENT GOALS

As described in Section 3.2.1 of the DEIS, the Clean Air Act (CAA) establishes air quality planning processes and requires areas in nonattainment of a National Ambient Air Quality Standard (NAAQS) to develop a State Implementation Plan (SIP) that details how the state will attain the standard within mandated time frames. The requirements and compliance dates for attainment are based on the severity of the nonattainment classification of the area. The national and state ambient air quality standards are shown in Table 3.2-1 of the DEIS.

Federal Regulations – Federal regulations related to air quality and climate remain unchanged as previously described in the DEIS/PA. Refer to Section 3.2.1 of the DEIS/PA for detailed discussion.

Bureau of Land Management – *California Desert Conservation Area Plan, as Amended:* Under the CDCA Plan, as amended by the DRECP LUPA, areas are managed to protect their air quality and visibility in accordance with Class II objectives of Part C of the CAA Amendments, unless designated another class by the state of California as a result of recommendations developed by any BLM air quality management plan. These Class II objectives include, among others, attainment and maintenance of the NAAQS and protection of visibility within the CDCA.

Management of air resources under the CDCA Plan as amended by the DRECP LUPA includes the following goals:

- Encourage maintenance of air quality as needed for Department of Defense operations.
- Ensure that proposed major stationary sources are located at optimum locations to minimize future air quality degradation in the CDCA.
- Establish an active BLM program for cooperating with the California Air Resources Board (CARB) and all other regional and local agencies responsible for air quality in the CDCA, in the implementation of the air-quality management plan.
- Coordinate and fully support state and local government air quality planning efforts, conducting in-house planning to minimize air pollution sources on public lands, and implementing field studies to determine impact of BLM management activities and those from external sources on BLM lands.
- Integrate the CAA into the BLM planning efforts.
- Develop an air-quality management plan for BLM lands in the CDCA.
- Actively participate in hearings and proceedings for siting major stationary sources in the CDCA. Minimize emissions from these sources and select a most suitable site for the overall air-quality benefit of the CDCA, if it exists.

- Actively participate in the preparation of State Implementation Plans and other air quality management plans developed by air management authorities in the CDCA.

In the land use planning process, after establishing desired outcomes, the BLM identifies allowable uses and management actions that are anticipated to achieve the goals and objectives. In the DRECP LUPA, allowable uses and management actions are referred to as CMAs. LUPA-wide CMAs for Air Resources (LUPA-AIR-1 through LUPA-AIR-5) are detailed in the DRECP, Section II.4.2.1.2 (BLM 2016).

The climate change adaptation opportunities for Rose Spring and Mohave Ground Squirrel ACECs and East Sierra SRMA states: protect biodiversity and manage for resilience (protect climate refugia and provide for migration corridors).

State Regulations - The California Air Resources Board (CARB) has oversight over air quality, including greenhouse gas emissions, in the state of California. Regulation of individual stationary sources and area sources has been delegated to local air pollution control agencies, while the California Energy Commission (CEC) is responsible for licensing thermal power plants of 50 megawatts or greater capacity, in addition to related facilities including transmission lines, fuel supply lines, and water pipelines. Additional discussion related to regulation of criteria pollutants, greenhouse gasses, and air toxics by CARB is provided in Section 3.2.1 of the DEIS/PA.

Clean Energy and Pollution Reduction Act SB 350 (October 15, 2015) established the most recent clean energy, clean air, and greenhouse gas reductions goals for 2030. The Act aims to reduce production of greenhouse gases in California to 40 percent below 1990 levels by 2030 and to 80 percent below 1990 levels by 2050. The California Air Resources Board is in the process of establish greenhouse gas emission tars to achieve SB 350 goals.

Regional Regulations - The HGLA is located in the jurisdiction of the Great Basin Unified Air Pollution Control District (GBUAPCD). The GBUAPCD is responsible for regulating stationary and area sources of air emissions in the HGLA. Additional discussion related to local air quality regulations are detailed in Section 3.2.1 of the DEIS/PA.

The GBUAPCD published the 2010 Particulate Matter Less Than 10 Microns (PM_{10}) Maintenance Plan and Redesignation Request for the Coso Junction Planning Area to become a maintenance attainment area for the PM_{10} NAAQS. The United States Environmental Protection Agency (USEPA) approved the redesignation on September 3, 2010. This document guides actions to protect PM_{10} air quality in the project area.

The GBUAPCD prepared a revised 2018 version of the *Exceptional Events Mitigation Plan for the Coso Junction PM10 Planning Area* designed to address the infrequent but significant occurrences of windblown dust resulting from silt deposits in Rose Valley in the aftermath of flash floods through the valley.

Resource Overview - Air quality is defined by ambient air concentrations of specific pollutants determined by the USEPA to be of concern with respect to the health and welfare of the general public. Ambient air quality and pollutant (criteria and toxic) emission definitions and their sources are provided in Section 3.2.1 of the DEIS/PA.

Greenhouse Gas Emissions (GHG) - On a national level, federal agencies have received direction regarding climate change and GHG emissions via Executive Order (EO) 13783 Promoting Energy Independence and Promoting Economic Growth (March 28, 2017). Additional discussion related to state-specific standards, potential GHG emissions effects, and BLM GHG guidance is provided in Section 3.2.1 of the DEIS/PA.

3.2.1.1 Compliance with National Ambient Air Quality Standards (NAAQS)

The Great Basin Valleys Air Basin (GBVAB) is considered an unclassified/attainment area for the NAAQS for the following criteria pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), fine particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). In the area of the HGLA, the Owens Valley is classified as a serious nonattainment area for the NAAQS for suspended particulate matter less than or equal to 10 microns in diameter (PM_{10}), and the Coso Junction area is classified as a maintenance area for the NAAQS for PM_{10}.

The USEPA lowered the 8-hour ozone standard in 2015 from 0.075 parts per million (ppm) to 0.070 ppm, the California Ambient Air Quality Standard (CAAQS) for 8-hour ozone. The GBVAB is considered an unclassified/attainment area for the California Ambient Air Quality Standards (CAAQS) for CO, NO_2, $PM_{2.5}$, and SO_2. Inyo County is considered an unclassified area for the 1-hour CAAQS for ozone and a nonattainment areas for the 8-hour CAAQS for ozone. The air basin is a nonattainment area for the CAAQS for PM_{10}. Table 3.2-4 in the DEIS/PA shows Inyo County attainment status for the CAAQS and NAAQS.

3.2.2 Affected Environment and Existing Conditions

The HGLA is located within the GBVAB, which encompasses Alpine, Mono, and Inyo Counties. The GBUAPCD administers oversight of the air quality in the GBVAB. Details regarding the GBUAPCD are provided in Section 3.2.3 of the DEIS/PA. Table N-2 in Appendix N provides a summary of background air quality representative of the HGLA. The climate of the HGLA remains essentially unchanged from the DEIS/PA as described in Section 3.2.2. Revisions based on recent data are provided below.

The Western Regional Climate Center (WRCC) 16, archives weather data for the western United States. Data is available for the Haiwee Reservoir Area, located on the north side of the study area, for the period since May 1, 1923. Data through June 6, 2016 was used in preparation of this FEIS. The Haiwee weather station monitors temperature and precipitation (including snowfall). Monthly average temperatures and precipitation for the HGLA are summarized in Table L-1 of Appendix N.

The mean annual temperature for the Haiwee monitoring station is 59.7ºF with a standard deviation of 0.98ºF. The long-term trend in temperatures at the Haiwee monitoring station is down about one degree since the 1920s (60.6ºF). An analysis of the Haiwee temperature data from 1924 (first year with complete data) to 2016 shows that the five-year mean temperature has increased over the last 10 years and is currently above the long-term mean temperature by 1.6ºF.

The mean precipitation for the Haiwee monitoring station is 6.5 inches. The precipitation has ranged between 17.27 and 1.75 with a standard deviation of 3.58 inches. The data show that the precipitation is not equally distributed throughout each month of the year and falls mostly in the winter cool season. The average annual rainfall from 2012 to 2016 was 3.2 inches, which is 51 percent below normal. The average annual rainfall from 2006 to 2016 was 4.98 inches, which is 23 percent below normal.

Hot springs, mud pots, mud volcanoes, and fumaroles are common in the area, and they naturally vent emissions of that contain pollutants. The project area was also formerly part of the Coso quicksilver mining district (Ross and Yates 1943), but mining cinnabar to extract mercury (quicksilver) from around springs and fumaroles was short-lived. Mercury and hydrogen sulfide are concerns for industrial pollutant emissions at the four existing Coso geothermal operations nearby and are being addressed to meet California air quality standards. Treatment facilities remove hydrogen sulfide using the LO-CAT® process and remove mercury with a sulfide, activated carbon media upstream from geothermal fluids to prevent these pollutants from entering the atmosphere. Carbon dioxide and water vapor are vented to the atmosphere. Another challenge for geothermal power production has been silica in the geothermal fluid. Fine particulate silica when airborne can trigger health problems for people working in the vicinity. Scientists at the Department of Energy's Brookhaven National Laboratory developed a process to extract silica from geothermal fluids to produce commercial-grade silica in lieu of waste material.

3.3 NOISE

3.3.1 Applicable Regulations, Plans, Policies/Management Goals

The CDCA Plan and the DRECP LUPA do not have any specific formal management goals for noise, but the DRECP LUPA refers to noise relevant to activities that may impact Focus or BLM Special Status Species (see Section 4.7, Biological Resources). Section 3.3.1 of the DEIS/PA details Applicable regulations, plans, policies and management goals related to noise. No changes have occurred between the publication of DEIS/PA and this document.

3.3.2 Affected Environment and Existing Conditions

The affected environment remains unchanged from the DEIS/PA. Section 3.3.2 of the DEIS/PA provide details regarding HGLA affected environment. No changes have occurred between the publication of DEIS and this document. The existing conditions remain unchanged from the DEIS/PA. Section 3.3.3 of the DEIS/PA provide details regarding the existing conditions in the HGLA study area. Ambient noise levels in the HGLA and vicinity are generally low and representative of remote desert areas. No changes have occurred between the publication of the DEIS/PA and this document.

3.4 TOPOGRAPHY, GEOLOGY, AND SEISMICITY

3.4.1 Applicable Regulations, Plans, Policies/Management Goals

The FLPMA and the CDCA Plan, as amended, contains most of the relevant resource management approaches, policies and management goals addressing these resources as detailed in Section 3.4.1 of the DEIS/PA. The Plan's general goals for Geology-Energy-Minerals (G-E-M) resources remain applicable to the FEIS alternatives. The DRECP LUPA does not amend existing goals and objectives in the pre-DRECP LUPA land use plans, it adds to them. The DRECP LUPA adds the following goals and objectives:

- Support the national need for a reliable and sustainable domestic mineral and energy supply.
- California's infrastructure, commerce, and economic well-being.

The Soil, Water, and Air Resource Objective for Ayers Rock, Mohave Ground Squirrel, and Sierra Canyons ACECs and East Sierra SRMA states: soils exhibit functional biological and physical characteristics that are appropriate to soil type, climate, and landform.

3.4.2 Affected Environment and Existing Conditions

3.4.2.1 Topography

As described in Section 3.4.2.1 of the DEIS/PA, the surface elevation of Rose Valley ranges from 3,200 feet to 3,750 feet. The HGLA is divided nearly equally between the low-lying valley and the higher elevation of the Coso Range. At its lowest point to the south, the HGLA lies 3,300 feet above sea level. The HGLA extends west to 4,200 feet in the Sierra Nevada foothills, and to above 5,700 feet in the Coso Range to the east. To the north of the HGLA, the Coso Range elevations reach 6,085 feet, and valley elevations average nearly 3,700 feet.

3.4.2.2 Regional and Local Geology

As described in Section 3.4.2.2 of the DEIS/PA, the HGLA is located at the transition between the extensional Basin and Range geomorphic province and the Eastern California Shear Zone. Geologic units in the vicinity are shown in Figure 3.4-1 of the DEIS/PA. Regional and local geology remains unchanged from the DEIS/PA.

3.4.2.3 Tectonic and Seismic Setting

As described in Section 3.4.2.3 of the DEIS/PA, the HGLA is located in a tectonically active transitional zone between the normal faulting extension characteristic of the Basin and Range Province to the north and east, and the north and west-southwest oriented strike-slip faulting of the eastern California right lateral shear zone, represented by the Garlock fault to the south. Earthquakes are generated as a result of the tectonic stress, and the region in which the HGLA is located is one of the most seismically active in California. The tectonic and seismic setting of the HGLA remains unchanged from the DEIS/PA.

3.4.2.4 Seismicity-Earthquakes

As described in Section 3.4.2.3 of the DEIS/PA, seismic activity in the form of micro-earthquakes can be induced by geothermal production (Feng and Lees 1998). However, given the natural background of seismicity, it is difficult to associate specific events with geothermal activities. In addition, conventional geothermal technologies that use natural convective hydrothermal resources regularly inject fluids into geothermal reservoir to maintain reservoir pressure, and this activity does not cause an increase of fluid volume in the reservoir. As a result, these activities are typically not of concern for causing seismic events which may cause damage at the surface. Induced seismicity (IS) risk is increased when Enhanced Geothermal Systems, where man-made subsurface reservoirs are created and there is insufficient permeability or fluid saturation, are used as a means of generating electricity. Injection using conventional geothermal technology can also induce micro earthquakes at Coso of low magnitude (M) (M=0.3-2.6). The magnitudes of earthquakes may correlate with the volume of injected fluid, but there is debate as to whether injected volume is the key factor that limits earthquake magnitude or whether it is controlled by the size of the fault and its geographical relationship to the stress site (McGar et al. 2015). The BLM has developed draft evaluation guidance available for use to determine seismic risk related to geothermal development.

An Induced Seismicity (IS) Screening Worksheet and accompanying guidance document may be used by the BLM to evaluate IS risk of a proposed project. The IS Screening Worksheet and guidance document, developed by the National Renewable Energy Laboratory, guides the user through 11 questions related to the overall proposal, geothermal project technical details, historic local seismicity, and proximity to faults and population centers. Based on the answers to these questions, the worksheet has four possible outcomes: 1) Resolve issues with operator, screening may continue; 2) *Low seismic risk:* Initial screening passed, proceed with next steps in permitting process. Additional IS protocol implementation may still be required by the applicant; 3) *Medium seismic risk:* The BLM field office can proceed with additional IS risk evaluation after involving the State Office Geothermal Program Lead. The geothermal program lead may recommend consulting with industry or academic seismic experts or seek additional seismic expertise (i.e., BLM State Office, state or federal geological survey, academia, or industry) to determine if the project can safely be executed; and 4) *High seismic risk:* The BLM Field Office should not proceed until first contacting the State Office Geothermal Program Lead. The Geothermal Program Lead will perform in-depth review of IS risk (likely in consultation with industry or academic seismic experts).

3.5 SOILS

3.5.1 Applicable Regulations, Plans, Policies / Management Goals

The CDCA Plan’s goals potentially applicable to soils are similar to those stated for geology and minerals resources above. See Section 3.5.1 of the DEIS/PA for more detail.

The DRECP LUPA does not amend existing goals and objectives in the pre-DRECP LUPA land use plans, including the relevant CDCA standards and guidelines listed in the Livestock Grazing CMAs, it adds to them. The DRECP LUPA adds the following goals:

- Avoid accelerated rates of soil erosion and resulting losses of habitat and soil productivity.
- Where soils currently exhibit functional biological and physical characteristics that are appropriate to soil type, climate, and landform, minimize disturbance that could compromise these characteristics.
- Maintain important soil ecosystem processes (e.g., nutrient cycling, carbon sequestration) and prepare for and/or respond to significant disturbances to the environment (e.g., floods, contamination) resulting from the interactions between human-caused soil disturbance and a changing climate.

The Soil, Water, and Air Resource Objective for Ayers Rock, Mohave Ground Squirrel, and Sierra Canyons ACECs and East Sierra SRMA states: soils exhibit functional biological and physical characteristics that are appropriate to soil type, climate, and landform.

The Code of Federal Regulations (43 CFR Parts 4180.2(e) and (f)) further specifies that, at a minimum, soils must be managed to maintain vegetative cover, soil moisture, and permeability rates appropriate for the soils, climate, and landforms found at their location.

3.5.2 Affected Environment and Existing Conditions

As stated in Section 3.5.2 of the DEIS/PA, soils data are not available for the entire HGLA. The Soils Technical Report previously prepared for the Coso Geothermal Study Area (Rockwell International 1980) provides soils data for 63 percent of the HGLA, but does not include the northern portion of the HGLA. It is likely that the soils in this area are similar to the soils included in the Soils Technical Report due to geologic and landform similarity. Additionally, a general description of the soils surrounding the Haiwee Reservoir is provided in the "Draft Progress Report: Total Maximum Daily Load for Copper for the Haiwee Reservoir" prepared by the California State Water Quality Control Board, Lahontan Regional Water Quality Control Board (LRWQCB) (LRWQCB 2001), and summarized in Section 3.5.2.1 of the DEIS/PA. No changes in Haiwee Reservoir or Coso Area soil types have occurred between the publication of the DEIS/PA and this document.

3.6 WATER RESOURCES

3.6.1 Applicable Regulations, Plans, Policies/Management Goals

Federal: Federal laws and regulations detailed in the DEIS/PA that are applicable to surface and groundwater development at the HGLA and in Rose Valley have been revised and are summarized below:

- Clean Water Act (CWA) Section 401: Water Quality Certification requirements for federally permitted activities like construction that may result in discharges to surface waters and wetlands.
- CWA Section 402: National Pollutant Discharge Elimination System permit program for point source discharges, including storm water. In California, the Storm water Program is administered by the California Regional Water Quality Control Boards.
- CWA Section 404: Permit program for controlling discharges of dredge or fill materials into surface waters and wetlands. The U.S. Army Corps of Engineers implements its provisions. Section 404 permits are also subject to CWA Section 401 water quality certification through a Regional Water Quality Control Board. Renewable energy development would be subject to Section 404 permitting if the project scope includes discharge of dredged or fill material into waters of the U.S.
- EO 11990 Protection of Wetlands: Directs all federal agencies to minimize the destruction, loss, or degradation of wetlands.
- EO 11988 Floodplain Management: Requires federal agencies to avoid, to the extent possible, both long- and short-term adverse impacts from the occupancy and modification of floodplains, and to avoid both direct and indirect support of floodplain development wherever there is a practical alternative.

The applicable resource management approaches under the FLPMA state:

> "… responding to national priority needs for resource use and development, both today and in the future, including such paramount priorities as energy development and transmission, without compromising the basic desert resources of soil, air, water, and vegetation, or public values such as wildlife, cultural resources, or magnificent desert scenery."

BLM: Guidelines for the protection of water quality and wetland resources are in the CDCA Plan. Once a specific project and area is defined; the water resources program requires the analysis of various activities impacts on water resources, including the collection of sufficient data to conduct adequate analysis and the formulation of recommendations for avoiding or mitigating impacts on surface and groundwater.

BLM management plans and goals which are potentially applicable to development at the HGLA include the following:

- Water resources including wetlands and riparian areas will be protected and managed in accordance with all federal regulations, legislative and Secretarial direction, and BLM Manual 6740: *Wetland Riparian Area Protection and Management* (BLM 1979).
- The Vegetation Plan Element of the CDCA Plan also addresses wetlands such as seeps and springs, riparian zones, among others. Wetland-riparian areas are to be considered in all proposed land use actions where appropriate and legally possible. Steps are to be taken to ensure their unique characteristics and ecological requirements are managed in accordance with legislative, Executive, and Secretarial directions. To the extent possible all actions are to avoid adverse impacts to wetland and riparian areas.
- The CDCA Water Resources Program requires the analysis of water resources impacts of various activities, including the collection of sufficient data to conduct adequate analysis and the formulation of recommendations for avoiding or mitigating impacts.
- Comply with state and federal non-degradation policies, CWA, and wetland and riparian area protection guidelines.
- Areas designated wetland or riparian will be managed to minimize degradation of and enhance both surface and groundwater resources as specified in the CDCA Plan, except for instances of short-term degradation caused by water development projects.
- The soil, water, and air objective for Ayers Rock, Mohave Ground Squirrel, and Sierra Canyons ACECs and East Sierra SRMA states: soils exhibit functional biological and physical characteristics that are appropriate to soil type, climate, and landform.

The DRECP LUPA does not amend existing goals and objectives in the pre-DRECP LUPA land use plans, including the relevant CDCA standards and guidelines listed in the CMAs section of the Livestock Grazing section, but adds to them. The DRECP LUPA adds the following goals and objectives:

- Surface Water Resources Goal – Ensure that any surface waters continue to perform key hydrologic and biogeochemical functions that may affect water quantity or quality.
- Groundwater Resources Goal – Manage the use of groundwater to avoid the creation or exacerbation of overdraft conditions and the potential to cause negative impacts to aquifers, groundwater dependent habitats, or surface water.

In the land use planning process, after establishing desired outcomes, the BLM identifies allowable uses and management actions that are anticipated to achieve the goals and objectives. In the DRECP LUPA, allowable uses and management actions are referred to as CMAs. A general description of DRECP LUPA-Wide CMAs for Water Resources (LUPA-SW-1 through LUPA-SW-32) is included in Section II.4.2.1.11 (BLM 2016).

CMA NLCS-SW-1 applies to all California Desert National Conservation Lands identified under Public Law (PL) 111-11 in the CDCA.

ACECs and SRMA: The soil, water, and air objective for Ayers Rock, Mohave Ground Squirrel, and Sierra Canyons ACECs and East Sierra SRMA states: soils exhibit functional biological and physical characteristics that are appropriate to soil type, climate, and landform.

A key surface water resource in the vicinity of the HGLA is the Coso Hot Springs. Although located more than 10 miles east-southeast from the HGLA, the Coso Hot Springs are addressed in this analysis as a result of their high cultural importance and their listing on the National Register of Historic Places. The Coso Hot Springs are 1.25 miles east-northeast of the Coso geothermal field. If a connection between the hot springs and the Coso geothermal reservoir exists, it is complex and not understood.

State: A number of state laws and regulations are potentially applicable to surface and groundwater development at the HGLA and in Rose Valley as indicated below:

- California Fish and Game Code, Sections 1600-1616, as Amended: The California Department of Fish and

Wildlife regulates activities that would divert or obstruct the natural flow or otherwise substantially change the bed, channel, or bank of any river, stream, or lake, or that would deposit or dispose of debris, waste, or other material where it may pass into any river, stream, or lake that supports fish or wildlife. This jurisdiction also applies to riparian habitats associated with watercourses.

- California Fish and Game Code, Sections 5650-5656, as Amended: These codes state that it is unlawful to deposit in, permit to pass into, or place where it can pass into waters of the state any substance that is deleterious to fish, plant life, mammals, or bird life.
- Porter-Cologne Water Quality Control Act, as Amended: This law gives broad authority to the State Water Resources Control Board (SWRCB) and the state's nine Regional Water Quality Control Boards (RWQCBs) to establish water quality standards and discharge prohibitions, issue waste discharge requirements, and implement provisions of the federal CWA.
- State Water Resources Control Board/Lahontan Regional Water Quality Control Board (LRWQCB). The HGLA lies within the jurisdiction of the LRWQCB which administers the Water Quality Control Plan (Basin Plan) for protection of beneficial uses of surface and groundwater of this part of the state.

  State Water Resources Control Board Resolution 88-63 "Adoption of Policy Entitled "Sources of Drinking Water"

  > "All surface and ground waters of the State are considered to be suitable, or potentially suitable, for municipal or domestic water supply and should be so designated by the Regional Boards with the exception of: …
  >
  > 3. Ground water where:
  >
  > The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 Code of Federal Regulations, Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR, Section 261.3"

- Executive Department State of California Executive Order W-59-93: Established state policy guidelines with two primary goals for wetlands conservation: to ensure no overall net loss and to achieve a long-term net gain in the quantity, quality, and permanence of wetland acreage in the state.
- The Inyo County's Water Department's Groundwater Sustainability Agency (GSA) is responsible for the implementation of the State's Sustainable Groundwater Management Act and does the following:
  - Establishes a definition of "sustainable groundwater management."
  - Requires that a Groundwater Sustainability Plan be adopted for the most important groundwater basins in California.
  - Establishes a timetable for adoption of Groundwater Sustainability Plans.
  - Empowers local agencies to manage basins sustainably.
  - Establishes basic requirements for Groundwater Sustainability Plans.
  - Provides for limited state role.
  - Requires governments and water agencies of high and medium priority basins to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge.

Local: At the local level the Inyo County General Plan (Inyo County 2001), as amended, Conservation and Open Space Element, identifies goals and policies relevant to hydrology and water quality. Goals and policies from the Inyo County General Plan include:

- WR-1-Provide an adequate and high-quality water supply to all users within the County. Its corresponding regulatory Compliance Policy states:
    - WR-1.1: The County shall review development proposals to ensure adequate water is available to accommodate projected growth, and that water resources are used with conservation and efficiency in mind.
    - WR-1.4: Continue the review of development proposals and existing uses to the requirements of the CWA, LRWQCB, and local ordinances to reduce polluted runoff from entering surface waters.
- WR-2-Protect and preserve water resources for the maintenance, enhancement, and restoration of environmental resources.
    - Policy WR-2.1: Encourage and support the restoration of degraded surface water and groundwater resources.
- WR-3-Protect and restore environmental resources from the effects of export and withdrawal of water resources. Corresponding policy.
    - WR-3.2: The County shall manage the groundwater resources within the County through ordinances, project approvals and agreements, ensure adequate, safe and economically viable groundwater supply for existing and future development within the County, protect existing groundwater users, maintain and enhance the natural environment, protect the overall economy of the County, and protect groundwater and surface water quality and quantity.

The Inyo-Mono Integrated Regional Water Management Program members consist of a collaborative body made up of public, private and not-for-profit entities, including Inyo and Mono counties, the town of Mammoth Lakes, tribes, water districts, and community service districts. The group consists of 32 voting members. The mission of the Inyo Mono Regional Water Management Group is to "To research, identify, prioritize, and act on regional water issues, and related social and economic issues, so as to protect and enhance our environment and economy." The Inyo County General Plan Annual Progress Report for 2016 provided an update on Inyo-Mono Integrated Regional Water Management Plan projects including pumping, sewer systems, drinking water, and recycled water projects (Inyo County Water Department 2017).

Inyo County Code, Chapter 18.77 "Regulation of Water Transfers Undertaken Pursuant to Water Code Section 1810, Sales of Surface Water of Groundwater by the City of Los Angeles, and the Transfer or Transport of Water from Groundwater Basins Located in Whole or Part Within" establishes the framework for surface and groundwater regulation within the county, and requires that any person who proposes to transfer or transport surface or groundwater must first apply for and obtain a conditional use permit (CUP) from the Inyo County Planning

Commission. The CUP is processed in the same manner as other CUP applications submitted to the county. However, the Inyo County Water Department and the Inyo County Water Commission (Water Commission), through the CUP process, evaluates hydrogeological and related environmental impacts, and based on its evaluation, identifies and develops mitigation measures, proposed project conditions, the monitoring, groundwater management and/or reporting program, and proposed findings. The Water Commission then submits its recommendations to the county planning commission. A CUP is approved only if the Inyo County Planning Commission, in consideration of the recommendations submitted by the Water Commission, finds that the proposed water transfer to be undertaken (subject to proposed conditions to be placed upon the transfer) will not unreasonably affect the overall economy of Inyo County and will not unreasonably (significantly) affect the environment of Inyo County based on California's Environmental Quality Act (CEQA) impact criteria.

3.6.2 Affected Environment and Existing Conditions

3.6.2.1 Surface Water Resources

As discussed in the DEIS/PA, the HGLA is located within the Indian Wells-Searles Valleys Watershed (Hydrologic Unit Code [HUC] 18090205) in the Rose Valley basin on the east side of the Sierra Nevada, with the HGLA area containing five sub- watersheds. The majority of the HGLA area falls within the Haiwee Creek sub-watershed (HUC 180902050304) and Fire Canyon-Rose Valley sub-watershed (HUC 180902050305). According to data collected from 1923 to 2016 at the Haiwee Reservoir by the WRCC, the average annual maximum temperature is 73.2°F, and the average annual minimum temperature is 46.1°F. Average total annual precipitation is 6.5 inches and average total annual snowfall is 4.9 inches (WRCC 2016). Details regarding surface water resources of the HGLA can be located in Section 3.6.2.1 of the DEIS/PA.

Flooding: The proximity to steep mountains makes the comparatively flat terrain Rose Valley subject to flash flooding. Flash flooding through the valley occurred five times from 2013 through 2017 (GBUAPCD 2018).

Surface Water Quality: In addition to the Porter-Cologne Water Quality Act of 1969 (CA Water Code § 13140-13143) mentioned above, the Water Quality Control Plan for the Lahontan Region sets standards for surface waters in the region of the HGLA (LRWQCB 2016). These standards consist of designated beneficial uses for surface water, numeric and narrative objectives necessary to support beneficial uses, and the state's anti-degradation policy. Detailed information on surface water quality can be found in the DEIS/PA (page 3-37).

Wetlands: Table 3.6-2 in the DEIS/PA provides National Wetland Inventory identified features in the vicinity of HGLA. Additional details regarding wetlands in the HGLA area are provided in Section 3.6.2.1 of the DEIS/PA.

Floodplains: Floodplain data for the HGLA were obtained from the Federal Emergency Management Agency (FEMA) National Flood Insurance Program maps and is shown on Figure 3.6-2 of the DEIS/PA. Additional details regarding floodplains in the HGLA area are provided in Section 3.6.2.1 of the DEIS/PA.

Groundwater: The principal hydrostratigraphic units that comprise the Rose Valley aquifer consist of recent alluvial deposits as well as the Coso Lake Bed and Coso Sand Members of the Coso Formation. No information was identified regarding the water-yielding properties of older bedrock underlying Rose Valley.

Within Rose Valley, the groundwater table is typically first encountered during drilling within the upper portion of recent alluvial deposits. Figure 3.6-3 of the DEIS/PA shows the lateral extent of alluvial deposits. Depth to groundwater ranges from 140 to 240 feet below ground surface (bgs) in the north and central parts of Rose Valley. It raises to 40 feet bgs at the northern end of the Little Lake Ranch near the south end of the valley, and surfaces at the southern end of the Little Lake Ranch property. Additional information and updates on the baseline groundwater is provided below.

Depth to groundwater and groundwater elevation in wells located throughout Rose Valley are being monitored for the Hay Ranch groundwater diversion project (Inyo County Water Department 2017). The estimated average groundwater elevation levels in Rose Valley, based on data obtained from monitoring wells in March 2017 from the groundwater elevation hydrographs published at the Inyo County Water Department's Hay Ranch Monitoring data portal (Inyo County Water Department 2017), are tabulated in Table O-1, Appendix O. Figure 3.6-3 of the DEIS/PA shows a groundwater elevation contour map of Rose Valley developed from these data. The March 2017 groundwater elevation data indicated generally southeasterly groundwater flow along the axis of the northwest to southeast trending Rose Valley.

Long term groundwater level hydrographs posted at the Inyo County Water Department website (Inyo County Water Department 2017) indicate that groundwater levels have decreased over the last 10 years with the exception of the Los Angeles Department of Water and Power (LADWP) Well V816. Groundwater levels in the LADWP V816 well at the north end of Rose Valley vary up to five feet or more during the year. This area has lower transmissivity than the main part of Rose Valley (see discussion below), and is closer to the South Haiwee Reservoir; as a consequence, it may be influenced more by variable seepage losses from the reservoir. The average decrease in groundwater levels for the 21 wells measured in September 2017 was 5.2 feet. The long term trend for most of the wells was downward from 2009 through 2013 and has trended up for the last four years. Baseline groundwater elevations were set in January 2010 and March 2011 by the Inyo County Water Department for nine wells and all but one well (18-28 GTH) are below the established baseline for the September 2017 measurements (Inyo County Water Department 2017). Based on third quarter 2017 groundwater monitoring data and using the previously established maximum allowable pumping amounts and trigger levels, the water level at Little Lake Ranch North was measured in exceedance of its revised trigger level in August and September 2017. There were no other trigger levels exceeded in project wells during the third quarter and none of the maximum acceptable drawdown levels were exceeded, based on the trigger levels which were effective June 1, 2017 (Coso 2017).

Aquifer Properties: The baseline aquifer properties of the Rose Valley and north central Rose Valley/Hay Ranch Area is described in Section 3.6.2.1 of the DEIS/PA. Figure 3.6-3 of the DEIS/PA shows the groundwater elevation contours of the HGLA. This groundwater elevation contour map, developed for Rose Valley, reveals the presence of several areas of distinctly different groundwater gradient, potentially indicating variable recharge rates or transmissivity in different parts of Rose Valley. From the vicinity of the Cal Pumice well near the north end of Rose Valley to Little Lake at the south end of Rose Valley, a relatively low groundwater gradient of approximately 20 feet/mile was observed. At the north end of Rose Valley, between South Haiwee Reservoir and the LADWP V816 well, a higher gradient of approximately 135 feet per mile was observed. However, between the LADWP V816 and Cal Pumice wells, the groundwater elevation drops 120 feet in less than 0.2 mile, indicating a very high groundwater gradient.

There may be a higher groundwater gradient near and immediately south of the reservoir. The pumping test conducted by LADWP in Well V817 indicated that the transmissivity of the aquifer in this area is likely significantly lower than it is in the main part of the valley. The very high groundwater gradient between Well V816 and Cal Pumice well is likely indicative of a very low permeability zone. United States Geological Survey (2009) has concluded that a barrier to groundwater flow exists in this area. However, the consistent southerly groundwater gradient from the Enchanted Village well at the north end of the HGLA to LADWP's Well V816, Cal Pumice well, and remaining wells in southern Rose Valley indicates that continuity of groundwater flow exists.

Groundwater Quality: As described in the DEIS/PA, the chemistry of groundwater found in Rose Valley and the associated watershed varies widely. Recharge waters from drainage from the mountains surrounding Rose Valley have lower dissolved solids than the Rose Valley groundwater, which typically is higher in dissolved solids reflecting longer transit times and a greater degree of water-rock interaction. A more detailed discussion of the Rose Valley groundwater chemistry is presented in Appendix C. However, a geologic barrier appears to prevent migration of geothermal fluids from the Coso groundwater basin into the Rose Valley groundwater basin (Williams 2004).

Current Groundwater Use: Much of the Groundwater Use analysis for the HGLA can be found in the DEIS/PA (page 3-48). A total of approximately 5.42 billion gallons of groundwater (16,704 acre-feet) have been pumped from the Hay Ranch North and South production wells from December 25, 2009 through September 13, 2017.

Approximately 190 acre-feet of groundwater were pumped from the Hay Ranch wells from June 14, 2017 to September 13, 2017. The cumulative total of pumped groundwater from 2009 through 2017 complies with Inyo County Water Department's allotment for the Hay Ranch Conditional Use Permit (CUP) (Coso 2017).

The Hay Ranch Project CUP Hydrologic monitoring report for the third quarter 2017 reported that groundwater samples were collected from the Coso Junction Store #2 and Little Lake North wells and samples were analyzed for Total Dissolved Solids. None of the samples exceeded "Threshold Requiring Action" levels (Coso 2017).

At the north end of Rose Valley, as many as 74 domestic wells are believed to extract relatively small quantities of groundwater for domestic uses and small scale irrigation in the Dunmovin area. The Coso Ranch South well, southern Coso Junction Store well (Coso Junction #2), and the Caltrans well at Coso Junction are regularly used by area businesses. The Cal-Pumice mine reportedly takes five to 10 tanker trucks of water a day during the workweek from the Coso Ranch South well. The Coso Junction Store well supplies the general store and Coso Operating Company offices in Coso Junction. One of the wells near the north end of the Little Lake Ranch property reportedly provides water to a local cinder mine. The Siphon well on the Little Lake Ranch property extracts groundwater in a gravity-fed system and delivers it to a pond a short distance to the south; some portion of that water likely evaporates, but the majority is believed to infiltrate back into the aquifer.

Geothermal System and Surface Manifestations: Permeability, Heat Sources and Water Sources

The relationship between the HGLA and the Coso Hydrothermal System is described in Section 3.6.2.2 of the DEIS/PA. The HGLA lies north and west of the Coso Hydrothermal System which is currently supplying geothermal fluids for power generation (see Figure 3.6-4 of the DEIS/PA). Because no geothermal exploration results for this area appear to be readily available in the public domain, the relationship between the areas must be evaluated using comparison of the general geologic setting. Figures 3.6-1 and 3.6-4 of the DEIS/PA shows the physiographic features and heat source depths in the HGLA area. Section 3.6.2.2 of the DEIS/PA provides additional details on the geologic setting related to permeability, heat and fluid which has helped to produce the Coso geothermal system. These conditions have remained unchanged from the DEIS/PA. Refer to Section 3.6.2.2 of the DEIS/PA for more details.

3.7 BIOLOGICAL RESOURCES

3.7.1 Applicable Laws, Regulations, Plans, Policies/Management Goals

A number of federal laws and state regulations provide protection to specific animal and plant species and habitats. In addition, the CDCA Plan, as amended by the DRECP, and West Mojave (WEMO) Plans provide a number of policies and management goals for specific biological resources occurring in and around the HGLA.

At the federal level, the United States Fish and Wildlife Service (USFWS) administers the Endangered Species Act (ESA) (e.g., 16 United States Code [U.S.C.] § 1531 et seq.; 50 CFR Parts 17.11 and 17.12) which protects all federally listed species (threatened and endangered). The Migratory Bird Treaty Act (MBTA) (16 U.S.C. §§ 703-711; 50 CFR Part 10) also offers comprehensive protection for migratory bird species, and the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. §§ 668–668d, 54 Stat. 250, as amended) provides protections bald and golden eagles. The BLM also has specific management guidelines for raptors, including golden eagles, and affords protection to select species listed on BLM's "Sensitive Species" list as detailed in the DEIS/PA.

At the state level, the California Department of Fish and Wildlife[1] (CDFW) administers the California Endangered Species Act (14 California Code of Regulations 670.5), and additional protection is provided to species listed under CEQA (CEQA Guidelines Section 15380) and under California's Native Plant Protection Act (California Fish and Game Code 1900 et seq.).

[1] Note that references in this FEIS may refer to the "California Department of Fish and Game (CDFG)"; the agency's official name changed to California Department of Fish and Wildlife (CDFW) after the publication of the 2012 DEIS/PA.

The HGLA lies within the designated Mohave Ground Squirrel Conservation Area (MGSCA), as identified in the WEMO Plan. The BLM also identifies Desert Wildlife Management Areas (DWMAs) in the 1992 CDCA Memorandum of Understanding.

In 2016, the BLM published the DRECP LUPA to update all aspects of the CDCA Plan for management of renewable energy development. The DRECP identified the following land allocation areas that overlap the HGLA: DFA, Rose Springs ACEC, Mojave Ground Squirrel ACEC, Ayers Rock ACEC, Sierra Canyons ACEC, and East Sierra SRMA. The DFA, as identified by the DRECP, overlaps with portions of the MGSCA and amended those areas as open to renewable energy development.

3.7.1.1 CDCA Biological Resources Goals and Objectives

The federal and state authorities described above are reflected in the corresponding management goals of the CDCA Plan which identify specific objectives to protect Mojave Desert vegetation communities and wildlife species. The CDCA Plan goals and objectives detailed in Section 3.7.1 of the DEIS/PA that pertain to the biological resources of the HGLA, including Vegetation Management Goals and Wildlife Management Goals, remain applicable.

3.7.1.2 DRECP LUPA Biological Resources Goals and Objectives

The CDCA, as amended by the DRECP LUPA, identified four additional goals which pertain to biological resources of the HGLA. Similar to the CDCA goals described above, these goals and objectives from the DRECP LUPA identify specific objectives to protect Mojave Desert vegetation communities and wildlife species that might occur on the HGLA. These Goals and Objective can be found in Section II.4 of the DRECP LUPA.

3.7.2 Affected Environment and Existing Conditions

The HGLA is located on the eastern slope of the Sierra Nevada Mountains, in the Coso Range, and in the Rose Valley. It is generally within the western portion of the Mojave Desert area. The western Mojave Desert is generally flat and sparsely vegetated, with creosote bush and saltbush plant communities dominating the landscape. Within the HGLA elevations are between about 3,200 feet above mean sea level (amsl) in the Rose Valley to about 5,700 feet amsl in the Coso Range. Summer temperatures are often greater than 110^{o}F, and winter snow or frost can occur with temperatures below 32^{o}F. Annual precipitation is less than 7.0 inches (including snowfall) and can be variable from year to year.

3.7.2.1 Vegetation

As detailed in Section 3.7.2.1 of the DEIS/PA, the HGLA is located at the southwestern edge of the Great Basin Floristic Province and is adjacent to the California Floristic Province and the Desert Floristic Province. Common species include creosote bush (*Larrea tridentata*), white bur-sage (*Ambrosia dumosa*), winter fat (*Krascheninnikovia lanata*), hop-sage (*Grayia spinosa*), desert needlegrass (*Stipa speciosa*), sand rice grass (*Stipa hymenoides*) and Nevada blue grass (*Poa secunda*). Emergent Joshua trees (*Yucca brevifolia*) also occur in lower numbers within these alliances. This series occurs on alluvial fans, bajadas, and upland slopes having well-drained soils. The baseline vegetation conditions, including invasive and non-invasive species, have not changed between publication of the DEIS/PA to this document. Refer to Section 3.7.2.1 of the DEIS/PA.

3.7.2.2 Fish and Wildlife

Mammals, birds, reptiles, amphibians and fish species occurring in the HGLA have remained essentially unchanged from the time of the DEIS/PA and are summarized below.

Mammals: Common mammals known to occur in the HGLA include coyote (*Canis latrans*), black-tailed jackrabbit (*Lepus californicus*), kangaroo rat (*Dipodomys* sp.) and pocket mouse (*Chaetodipus* sp.). A number of mammals common to the area have adapted to the high diurnal temperatures by spending much of the day underground, or in aestivation (summer sleep). As a result, the HGLA supports a high proportion of burrowing rodents. Other mammals that may occur include bobcat (*Lynx rufus*), antelope ground squirrel (*Ammospermophilus* sp.) and deer mouse (*Peromyscus* sp.).

Birds: The generally sparsely vegetated habitats of the HGLA do not support a high diversity of birds. In the vicinity of the HGLA, the largest number of breeding bird species is expected to be found outside its boundaries near South Haiwee Reservoir and Little Lake (BLM 1980).

Many bird species in the greater Haiwee area are seasonal residents. The USFWS has outlined a plan to conserve and protect migratory birds in its Migratory Bird Strategic Plan 2004-2014. The strategy includes direct collaboration with the BLM in making land use and planning decisions within the Pacific Flyway.

The distribution of bird species inhabiting the HGLA depends on habitat type. Common passerine species expected throughout much of the HGLA include Bell's sparrow (*Artemisiospiza belli*), black-throated sparrow (*Amphispiza bilineata*), California horned lark (*Eremophila alpestris actia*), and verdin (*Auriparus flaviceps*). The number of raptor and owl species differs considerably by season. However, common raptor species in the HGLA include red-tailed hawk (*Buteo jamaicensis*), great-horned owl (*Bubo virginianus*), and American kestrel (*Falco sparverius*). The project area is also within the range of burrowing owl (*Athene cunicularia)* and golden eagle (*Aquila chrysaetos)*, both DRECP focal species.

Reptiles: Rocky outcrops, bajadas, washes, and gravel plains support a varied herpetofauna, with certain species occurring commonly across most habitats. The HGLA provides these habitats, and supports such species which generally prefer habitats which are warm and arid with sparse vegetation. Common reptiles expected to occur include side-blotched lizard (*Uta stansburiana*), western whiptail (*Aspidoscelis tigris*), gopher snake (*Pituophis catenifer catenifer*), red coachwhip (*Masticophis flagellum piceus*), long-nosed leopard lizard (*Gambelia wislizenii*), and zebra-tailed lizard (*Callisaurus draconoides*). Rattlesnakes such as the Panamint rattlesnake (*Crotalus stephensi*) and the Mojave Desert sidewinder (*Crotalus cerastes cerastes*) may also be present. Several of these species have been reported within the California Natural Diversity Database (CNDDB) at several sites near the HGLA, and may be common throughout the rest of the HGLA.

Amphibians and Fish: Most of the HGLA does not contain habitat that would support amphibian species except for a limited area on the northwest corner of the HGLA. Because permanent natural surface waters are absent, no fish species occur within the boundaries of the HGLA. Refer to Section 3.7.2.2 of the DEIS/PA for additional details.

3.7.2.3 Protected and Sensitive Species

Special Status – Plants: Because no field surveys were conducted for this FEIS, probability of occurrence for these species was based on potentially suitable habitat, and on existing records. Special-status plant species with the potential for occurrence within the HGLA and general habitat descriptions are provided in Table D-1, Appendix D in this FEIS. The HGLA is not in critical habitat of any federally listed species.

Each species was assigned a "probability to occur" status (e.g., present, high, moderate, and low) based on HGLA habitats and their known occurrences in the vicinity as defined and shown in Appendix D.

Special Status – Wildlife: The presence, or potential presence, of special-status species and sensitive biological resources was identified primarily through a literature review and agency contacts. Special status wildlife species with the potential to occur in the HGLA are described in Table D-2 of Appendix D in this FEIS. General habitat descriptions for these species are included in Appendix D. The HGLA is not in critical habitat of any federally listed species. Those species where the potential for occurrence is high or the species is confirmed present are described in additional detail below.

Golden Eagle – Golden eagle is protected under BGEPA. The species is also listed as a Bird of Conservation Concern by the USFWS, as a Species of Special Concern by the CDFW, and as a Fully Protected species by the CDFW. Golden eagles occupy open habitats where it can spot and attack prey from high above. Rocky mountainous and hilly terrain is favored by golden eagles. Nests typically occur on rocky cliffs, ledges, or in large trees located away from human disturbance.

Burrowing Owl – In California, the burrowing owl is listed as a Bird of Conservation Concern by the USFWS, as a Species of Special Concern by the CDFW, and as Sensitive by the BLM. It resides in dry, open habitats, including short grass prairies and open patches in annual grasslands, and on disturbed lands, golf courses, airports, and vacant lots. As noted in the DEIS/PA, the presence of mammal burrows is a necessary habitat component for burrowing owls, and burrowing owls are present on a portion of the HGLA.

Several burrowing owl occurrences have been documented in the southern portion of the HGLA as well as within and east of Rose Valley (California Department of Fish and Game [CDFG] 2009). There are at least 53 records of burrowing owls for the WEMO Planning Area, although they are apparently scarce from the eastern Mojave Desert through Inyo County (BLM 2005). The total breeding population in the WEMO Planning Area is estimated to be a few hundred pairs.

Desert Tortoise – Desert tortoise (*Gopherus agassizii*) is the only species listed under the ESA occurring within the HGLA and is listed as Threatened by the USFWS and CDFW. Its range includes Indian Wells Valley and Rose Valley (LaBerteaux 2009; BLM 2005). According to the USFWS, desert tortoises also occur in areas dominated by lava substrate (USFWS 2009a). Diet typically consists of herbs, grasses, cactus, and wildflowers, and foraging occurs mainly in the spring before aestivation in the summer. Desert tortoises emerge again in the fall with the cooler weather. Aestivation occurs again in the winter (Jennings 1997). The CNDDB records indicate the presence of desert tortoise within the HGLA (CDFG 2009) and suitable habitat is present in the northern portion (USFWS 2009).

The HGLA is near the northern extent of the range of the desert tortoise. Typical tortoise habitats include creosote, burrobush (*Ambrosia dumosa*), saltbush (*Atriplex* spp.) scrub, yuccas (*Yucca* spp.), alluvial fans, Joshua tree woodlands, barren washes, shrub-steppe, and black brush (*Coleogyne ramosissima*) and juniper (*Juniperus* spp.) woodland ecotones (Berry 2008; USFWS 2008). While it has been historically believed that optimal tortoise habitat occurred in an elevation range of approximately 300 to 900 meters, (1,000 to 3,000 feet) more recent studies and data have found that tortoises may be more abundant at higher elevations than lower elevations. Soils within the tortoise's habitat must be friable for easy burrowing, but still firm enough to prevent burrows from collapsing (USFWS 2008).

Northern Sagebrush Lizard – The northern sagebrush lizard (*Sceloporus graciosus graciosus*) is listed as a BLM Sensitive species and a Species of Special Concern by the CDFW. The species occurs in mountainous areas of the Great Basin, Sierra Nevada, and Cascade mountains. Isolated populations occur at Sutter Buttes in the Sacramento Valley, in the Coast Range, and in the desert mountains of Inyo County. Potential habitats include montane chaparral, hardwood and conifer forests, eastside pine and juniper, and Great Basin shrub habitats. As temperatures rise during the day, individuals escape extreme daytime temperatures by retreating to burrows. The northern sagebrush lizard forages and is most active during the morning and evening hours.

Pallid Bat, Townsend's Big-eared Bat, Silver-haired Bat, Western Red Bat – Four sensitive bat species have a high likelihood of occurrence in the HGLA. The pallid bat (*Antrozous pallidus*) and Townsend's big-eared bat (*Corynorhinus townsendii*) are each listed as BLM Sensitive, a Species of Special Concern by the CDFW, and High Priority species by the Western Bat Working Group. The silver-haired bat (*Lasionycteris noctivagans*) and the western red bat (*Lasiurus blossevillii*) are High Priority species by the Western Bat Working Group. The western red bat is also listed as a Species of Special Concern by the CDFW.

Pallid bat occupies a wide range of habitats including deserts, grasslands, shrublands, woodlands, and forests. They are most common in open, dry habitats with rocky outcrops for roosting. Townsend's big-eared bat also occupies a wide range of habitats but is most common in mesic areas and roosts in caves and abandoned mines.

Silver-haired bats occur in forested habitats and roost in trees. Western red bat occurs along habitat edges between conifer forests and open areas. Western red bats also roost in trees.

American Badger – The American badger (*Taxidea taxus*) is listed as a Species of Special Concern by the CDFW. The species is most abundant in drier, open sites in most shrub, forest, and herbaceous habitats. Friable soils for denning are also an important component of American badger habitat (Kays and Wilson 2002).

Mohave Ground Squirrel – The Mohave ground squirrel (*Xerospermophilus mohavensis*) is listed as Threatened by the CDFW (CDFG 2009). Its range extends from Lucerne Valley to the southeast, Olancha to the northwest, and the Avawatz Mountains to the northeast; known areas of occurrence are shown on Figure 3.7-1 of the DEIS/PA. It is a diurnal species restricted to the Mojave Desert that lives in open desert scrub, alkali scrub, and Joshua tree woodland, primarily feeding on leaves and seeds of forbs and shrubs. It prefers sandy to gravelly soils, avoiding rocky areas and creating burrows at the base of shrubs for cover and nesting. Mohave ground squirrels enter aestivation in July or August, and emerge from February to June (Bartholomew and Hudson 1960).

The northern part of the Mohave ground squirrel geographic range is in Inyo County, and in the vicinity of Olancha and Haiwee Reservoir. Most trapping records come from the Coso region on China Lake NAWS. Two Mohave ground squirrel populations have been monitored at two sites just east of the HGLA in the Coso Range, and research by P. Leitner documents the presence of the Mohave ground squirrel within the HGLA (Leitner and Leitner 1989, 1990; Leitner et al. 1997). In addition, the majority of the HGLA supports potentially suitable habitat. As such, Mohave ground squirrels are expected to occur on the HGLA.

3.8 CULTURAL RESOURCES

3.8.1 Applicable Regulations, Plans, Policies/Management Goals

The term “cultural resource” as is used herein is not defined in NEPA or any other federal law. However, as noted in Section 1.0, there are numerous laws, regulations and executive orders that deal with particular kinds of resources that are “cultural” in character that include the myriad social and cultural aspects of the human environment. The Cultural Resource Element of the CDCA Plan is provided in detail in Section 3.8.1 of the DEIS/PA. Therefore, within any NEPA analysis, the human environment must be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment (40 CFR Part 1508.14).

A cultural resource is an object or location of human activity, occupation, use that can be identified through field inventory, historical documentation, tribal traditions, or oral and written evidence. Cultural resources are prehistoric, historic, archaeological, or architectural sites, structures, buildings, objects, and districts, as well as locations of traditional cultural or religious importance to specific social and/or culture groups. Cultural resources include the entire spectrum of objects and places, from artifacts to cultural landscapes, without regard to eligibility for inclusion on the National Register of Historic Places (NRHP).

The Western Geothermal PEIS (BLM 2008a) provides for the imposition of NSO stipulations to protect historic properties or significant cultural values. The impositions of the NSO stipulations are considered a major constraint as they do not allow for surface development. These NSO stipulations would be applied to the standard lease form as condition of the lease. An NSO is appropriate when the standard terms and conditions, other less restrictive lease stipulations (see below), and BMPs for permit approval are determined to be insufficient to achieve the resource protection objectives. An NSO would be considered a reasonable and appropriate management measure to achieve avoidance within the boundary of properties designated or eligible for the NRHP, including National Landmarks and NRHP Districts and Sites, for additional lands outside the designated boundaries to the extent necessary to protect values where the setting and integrity is critical to their designation or eligibility, and for areas with important cultural and archaeological resources, such as traditional cultural properties and Native American sacred sites, as identified through consultation.

In addition, as stated in the Western Geothermal PEIS and BLM Instruction Memorandum No. 2005-003, the BLM requires the following stipulation to protect cultural resources be made part of any leasing decision:

This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, EO 13007, or other statutes and executive orders. The BLM will not approve any ground disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.

The BLM's foremost management goal for cultural resources is avoidance of adverse effects on historic properties where possible. The BLM may approve undertakings with conditions that avoid historic properties or may not authorize an activity likely to result in adverse effects to significant characteristics of historic properties that cannot be successfully avoided, minimized, or mitigated. Avoidance measures could include moving development elements away from specific resources or sensitive areas, encouraging development in areas disturbed by previous development, or restricting travel to existing roads.

Consistent with the 36 CFR Part 800 and as described in the Western Geothermal PEIS, discovery and potential treatment of historic properties will follow procedures established by the Advisory Council on Historic Preservation for compliance with Section 106 of the NHPA. Once the leasing undertaking for the HGLA is approved and development projects are proposed within the area(s) to be leased, the DRECP Programmatic Agreement will serve as the specific regulatory procedure wherein Section 106 of the NHPA will be fulfilled by BLM.

Because the HGLA FEIS/PA lays the groundwork wherein undertakings inside pending lease CACA- 043998, CACA-9044082 and CACA-043992 can be approved, a review of the DRECP herein is appropriate. In short, any proposed development within leases reviewed under this FEIS/PA require additional Section 106 review consistent with the DRECP PA. If avoidance of historic properties is not possible, the BLM will notify and invite the Advisory Council on Historic Preservation (ACHP), State Historic Preservation Office (SHPO), Indian tribes, and all other consulting parties into consultation to resolve the identified adverse effect, consistent with 36 CFR Part 800.6.

3.8.1.1 DRECP LUPA Cultural Resources Goals and Objectives

The CDCA, as amended by the DRECP LUPA, identified eight new goals and eight new objectives which pertain to cultural resources in and near the HGLA. These goals and objectives from the DRECP LUPA identify specific objectives to protect historic properties, tribal resources and landmarks that might be adversely affected. These Goals and Objectives can be found in Section II.4.1.3 of the DRECP LUPA.

The most relevant federal historic preservation law applicable to the HGLA is the NHPA. Section 106 of the NHPA and its implementing regulations (36 CFR Part 800) have procedures for considering the effects of proposed federal undertakings on historic properties. A historic property is a cultural resource that is listed on, or has been determined eligible for listing on, the NRHP. The regulations at 36 CFR Part 800 identify the process for defining the Area of Potential Effect (APE), identifying historic properties; assessing effects; measures for resolving adverse effects; and the process for consulting with the ACHP, SHPO, Indian tribes, other parties, and the public.

The BLM has found that the HGLA PA and the three pending leases will have no adverse effect to historic properties. The SHPO concurred with this finding on June 6, 2014. A portion of the HGLA is designated as a DFA under the DRECP LUPA. All future geothermal lease development proposals within the HGLA must follow the Section 106 review and compliance process identified in the DRECP Programmatic Agreement (BLM 2016a).

The following requirements found within the body of the DRECP Programmatic Agreement are pertinent to all future lease developments proposed within the HGLA:

> "I.A.1. The LUPA establishes a framework for permitting for all renewable energy project and transmission line [right-of-way] ROW applications and portions of any connected actions, for solar, wind, geothermal

> production, and transmission lines that also includes appurtenant facilities (renewable energy projects), on lands administered by the BLM. It also includes those connected actions that may extend onto other jurisdictions. This Agreement and the LUPA will inform the agency's consideration of future, site-specific, renewable energy project applications including the identification of DFAs and other lands administered by the BLM where renewable energy project development may occur, areas where renewable energy project development will not be permitted, and development of CMAs to establish basic avoidance, minimization, and mitigation requirements for renewable energy project development within the DRECP LUPA Area, to ensure the most responsible development of renewable energy on BLM-administered public lands…."
>
> "I.A.2. This Agreement establishes the process the BLM will follow to fulfill its responsibilities under Section 106 of the NHPA for site-specific, renewable energy project application decisions that are implemented in accordance with the decisions supported by the LUPA and BLM policy. This Agreement does not provide streamlining or fast-tracking of renewable energy project applications. Instead, provisions of this Agreement will be incorporated in the LUPA to ensure a consistent, predictable, and timely approach to take into account the effects of renewable energy project application decisions upon historic properties across the LUPA Area."
>
> "I.B.1 The BLM will execute [Memorandums of Agreement] MOAs pursuant to 36 C.F.R. § 800.6 (c), as opposed to PAs, to fulfill the intent of this Agreement for site-specific, renewable energy projects that result in adverse effects whenever possible. MOAs are usually based upon knowledge of specific resources; therefore, resolutions of adverse effects are more accurate. Where there is adequate information regarding the nature of historic properties within areas of potential effect (APEs), MOAs can specify avoidance, minimization, and/or mitigation measures more precisely."

Per the DRECP Programmatic Agreement (Section II), consultation with Programmatic Agreement stakeholders is key to fulfill the Section 106 mandate. If adverse effects are anticipated, BLM must consult with ACHP under certain circumstances including: (1) non- routine interstate and/or interagency projects or programs; (2) undertakings that adversely affect National Historic Landmarks (NHLs); (3) undertakings that the BLM determines to be highly controversial; (4) undertakings that will have an adverse effect and with respect to which disputes cannot be resolved through formal agreement between BLM-SHPO, such as a memorandum of understanding; and (5) development and approval of program alternatives, including project-specific Programmatic Agreements. Also, BLM shall consult with SHPO, other federal agencies, the Secretary of the Interior, and recognized tribes and tribal organizations if a project is anticipated to affect an NHL. Coordination with state and local agencies is outlined in the DRECP Programmatic Agreement. The DRECP Programmatic Agreement also includes the following requirements:

> "<u>II.F. Coordination with state and local process</u>: The BLM will endeavor to coordinate its responsibilities under NHPA and the Section 106 process with the state and local agency responsibilities under [CEQA] and other applicable authorities for all renewable energy project applications. The BLM will also endeavor to collaborate with state and local agencies on NRHP and California Register of Historical Resources (CRHR) eligibility determinations. To facilitate this coordination the BLM has consulted with the Consulting Parties, which includes state and local agencies with CEQA responsibilities, to develop this Programmatic Agreement. Participation by state and local agencies in the consultation for specific renewable energy project applications, and their desired level of participation, will be identified by the responsible agency on a project-by-project basis after receiving BLM's invitation to consult per Stipulation III (B) [of the Programmatic Agreement]"

3.8.2 Affected Environment and Existing Conditions

For this analysis, cultural resources as defined above and in Section 3.8.1 of the DEIS/PA have been divided into three major categories: archaeological sites, architectural resources (the historic built environment), and Traditional Cultural Properties (TCPs). Archaeological sites are locations where human activity has measurably altered the earth or left deposits of physical remains (e.g., stone tools, historic-era building foundations, bottles, cans). The architectural, or built environment, includes standing buildings (e.g., houses, outbuildings) or intact structures (e.g., dams, canals, bridges). Under BLM policy, TCPs are defined as geographic places prominent in a particular group's cultural practices, beliefs, or values, when those practices, beliefs or values are: 1) widely shared within the group; 2) have been passed down through the generations, and 3) have served a recognized role in maintaining the group's cultural identity for at least 50 years. The term "traditional cultural property" is a term introduced in a National Park Service guidance document, National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties (Parker and King 1990 [rev 1998]). The BLM's definition of a TCP and related policy is found in H-1780-1 (X-3 and X-4) Improving and Sustaining Tribal Relations and MS 8110 (.22 D) Identifying and Evaluating Cultural Resources. The NHPA and its implementing regulations at 36 CFR Part 800 also require Federal Agencies to consider effects to resources of cultural and religious significance to Indian tribes in its Section 106 review. These three categories of data are manifestations of human existence and can be expressed in the historical record of the HGLA. A short historical review of the HGLA region follows.

3.8.2.1 Prehistory and Historic Period

Section 3.8.2.1 and 3.8.2.2 of the DEIS/PA details prehistoric and historic periods of the HGLA.

3.8.2.2 Cultural Resources in the Vicinity of the HGLA

No field investigations were performed for this FEIS/PA, or the supporting Section 106 review. If future geothermal developments are proposed within the HGLA, the BLM will require the permit applicants to provide project-specific inventories for cultural resources written by BLM-qualified archaeologists in compliance with Section 106 of the NHPA consistent with the terms of the DRECP LUPA. As noted above, a proposed development located within the HGLA plus any connected portions of that proposed development that may extend outside the HGLA are considered connected actions under the NHPA and would be included in the overall APE for that undertaking. The APE for the undertaking is the area in which BLM will consider both direct and indirect effects to historic properties, consistent with the DRECP LUPA. The analysis of cultural resources in the HGLA was based on background information from the sources detailed in Section 3.8.3.1 of the DEIS/PA.

National Historic Landmarks: NHLs are nationally significant historic places designated by the Secretary of the Interior for their exceptional value or quality in illustrating or interpreting the heritage of the United States. There are no known NHLs inside the footprint of the HGLA.

NRHP-listed Historic Places: Background research shows that 27 historic properties have been either determined eligible, determined not eligible, or are unevaluated for listing in the NRHP in or near the HGLA. No exclusively historic-era resources are eligible or considered not eligible for listing.

Prehistoric Archaeological Sites and Archaeological Sites with Historic-era Components: There are 23 prehistoric archeological sites and four archaeological sites with historic-era components within the HGLA study area. These are listed in Appendix R of this FEIS/PA.

BLM Areas of Special Designation: In 1985, the BLM established the Rose Spring ACEC to protect significant prehistoric archaeological sites for scientific use and public interpretation. Portions of the Rose Spring ACEC lie within the northwest portion of the HGLA. Pictographs located in the Ayers' Rock ACEC lie along the eastern HGLA border and some may be found in the extreme eastern part of the HGLA. The Sierra Canyons ACEC is located in the extreme southwest corner of the HGLA. No historic properties are known for this area.

Sites of Religious or Cultural Significance to Indian Tribes: Information about sites that Indian tribes attach religious or cultural significance to is generally identified through existing ethnographic information and consultation with Indian tribal governments. No specific sites have been identified within the HGLA in the ethnographic literature or through consultation.

3.8.2.3 Recorded Cultural Resources within the HGLA: Previous Surveys and Known/Recorded Cultural Resources

A review of previous cultural resource surveys within the boundaries of the HGLA shows that 1,500 to 2,000 acres out of the total area of over 24,000 acres, or six to eight percent, have been systematically and intensively surveyed for cultural resources. Because of the small amount of intensive survey, most cultural resources in the HGLA are not expected to have been identified. It is not necessary to conduct additional surveys for cultural resources for the proposed action because this FEIS simply identifies areas that may be available for exploration and development of geothermal resources and does not result in any ground disturbance or impacts to cultural resources. If future geothermal developments are proposed within the HGLA, the BLM will require the lease applicants to provide project-specific inventories for cultural resources as well as site-specific NEPA review.

Maps at the BLM Ridgecrest Field Office and the Eastern Information Center in Riverside show at least 218 cultural resources within the boundaries of the HGLA, most of which are archaeological sites. Most of these cultural resources have not been evaluated for NRHP eligibility. Twenty cultural resources have been either recommended as eligible, or determined eligible, for listing in the NRHP. Recorded historic period resources are much less common in the HGLA than prehistoric archaeological resources. Judging from known and recorded historic period cultural resources in the HGLA, most unrecorded historic period resources are expected to be related to mining, the construction of the Los Angeles Aqueduct and the aqueduct itself, or construction or use of thoroughfares such as the Coso Junction Road and railroads. Based on the distribution of known cultural resources and the limited number of past surveys in the HGLA, it is anticipated that the portion of the leasing area most likely to contain significant cultural resources would include Rose Valley, especially near existing or former lakes.

3.9 PALEONTOLOGY

3.9.1 Applicable Regulations, Plans, Policies/Management Goals

Federal laws that protect paleontological resources have not changed since the publication of the 2012 DEIS/PA and can be located in Section 3.9.1 of the DEIS/PA.

The Cultural Resource Element of the CDCA Plan, as amended, and general goals for the management of Paleontological Resources previously discussed in Section 3.9.1 of the DEIS/PA remain applicable.

The DRECP amendment to the CDCA Plan does not amend existing paleontological goals and objectives, it adds to them. The CDCA Plan, as amended, adds the following goals and objectives:

3.9.1.1 Goals

- Ensure that paleontological resources are given full consideration in land use planning and in management decisions.
- Preserve and protect a representative sample of the full array of the paleontological resources in the DRECP.
- Protect and conserve significant paleontological resources as they are discovered on public lands.
- Manage paleontological resources in ways that prioritize research needs, facilitate educational and recreational needs, and protect important sites.
- Develop specific objectives and management actions for fossil localities, when paleontological resources are discovered in the Planning Area.

3.9.1.2 Objectives

- Identify sensitive paleontological localities to aid in the project review and design process.

- Develop interpretive materials to correspond with recreational uses to educate the public about protecting paleontological resources and avoiding disturbance of sensitive paleontological localities.

The DRECP LUPA calls for a process to be followed by BLM land managers in which specific development projects undergo analytical procedures defined by BLM Manual 8270-1. Each proposed development project inside the HGLA must be analyzed for potential effects using the BLM's Potential Fossil Yield Classification (PFYC) process, which was slightly updated via reissue of Instruction Memorandum (IM) 2016-124 in July 2016 (BLM 2016). The PFYC assigns sensitivity ratings to particular exposed rock or soil strata that have the potential to yield fossils as project-related ground disturbances takes place (ibid). The rating system is abundance-related and is not meant to be applied to specific paleontological localities or small areas within geologic units.

The BLM IM states that the PFYC system will be used to classify paleontological resource potential on public lands in order to assess possible impacts and mitigation needs for federal actions involving surface disturbance, land tenure adjustments, and land-use planning. The PFYC classification system for paleontological resources is intended to provide a uniform tool to assess potential occurrences of paleontological resources and evaluate possible impacts. It uses geologic units as base data.

3.9.2 Affected Environment and Existing Conditions

Section 3.9.2 of the DEIS/PA discusses the affected area of the HGLA relative to paleontological resources. Fossils are considered non-renewable resources because the organisms from which they derive no longer exist. No changes have occurred from the time of the DEIS/PA publication.

Fossil discoveries in the immediate vicinity of the HGLA are rare. Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability of finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Section of the DEIS/PA discusses the existing condition of the HGLA relative to paleontological resources. It is not necessary to conduct additional surveys for paleontological resources for the proposed action because this FEIS simply identifies areas that may be available for exploration and development of geothermal resources and does not result in any ground disturbance or impacts to paleontological resources. If future geothermal developments are proposed within the HGLA, the BLM will require the lease applicants to provide project-specific inventories for paleontological resources as well as site specific NEPA review. Additionally, a PFYC has been prepared for the CDCA and will be used to inform separate NEPA analysis when applications for development in specific locations are processed.

3.10 VISUAL RESOURCES

3.10.1 Applicable Regulations, Plans, Policies/Management Goals

The following federal, state, and local laws, ordinances, regulations and standards provide guidelines for the management of visual resources in the HGLA.

3.10.1.1 Federal - Bureau of Land Management Ridgecrest Field Office

California Desert Conservation Area Plan of 1980, as Amended: The Ridgecrest Field Office is part of the California Desert District, which is included in CDCA. The CDCA as amended by the DRECP LUPA makes land use allocation decisions within the CDCA both inside and outside of the DRECP LUPA Planning Area, including Visual Resource Management (VRM) Classes, land use allocations to replace multiple use classes, and National Landscape Conservation System (NLCS) designations. As previously stated in the DEIS/PA, the CDCA requires that "Proposed activities will be evaluated to determine the extent of change created in any given landscape and to specify appropriate design or mitigation measures using the Bureau's contrast rating process."

Since the publication of the DEIS/PA, VRM Classes were established in the DRECP LUPA. VRM Classes within the HGLA include Class II and Class III objectives. VRM Class II objectives are assigned in some portions of the ACECs. Class III objectives are assigned in the DFA and remaining portions of the ACECs. The DEIS/PA visual resource impact assessment complies with the CDCA Plan as amended by the DRECP by assessing the potential impacts of the proposed activities and facilities and evaluating consistency of the potential activities and facilities with the established VRM Classes.

West Mojave Plan (2006): The West Mojave Plan Record of Decision (BLM 2006) and the Final Environmental Impact Report and Statement for the West Mojave Plan (BLM 2005) do not include regulations or standards pertaining to visual resources.

3.10.1.2 Applicable State Regulations

Applicable state regulations, including those associated with CEQA and the California Scenic Highway Program, remain unchanged from the DEIS/PA as described in Section 3.10.1.2.

3.10.1.3 Applicable Local Regulations

Applicable local regulations relative to the Inyo County General Plan remain unchanged from the DEIS/PA as described in Section 3.10.1.3. It should, however, be noted that the proposed May 2013 Draft General Plan Update (Inyo County Planning Department 2013) strikes Policy SH-1.3 expanding scenic route designations and revised the Scenic Highway Implementation Measures.

3.10.2 Affected Environment and Existing Conditions

Prior to the publication of the DEIS/PA, interim VRM Classes were established within the HGLA after a visual resource inventory (VRI) was completed in 2009. During this inventory, inventory observation points were identified (including pertinent ones related to cultural resources identified in Section 3.9 of the DEIS/PA), and a scenic quality analysis was conducted. After the publication of the DEIS/PA, VRM Classes were established by the DRECP LUPA as depicted in Figure 11 of the DRECP LUPA Record of Decision (BLM 2016). VRM Classes within the HGLA are shown in Figure P-1, Appendix P. As shown in Table P-1 of Appendix P, ACECs established as part of the DRECP were included as areas of high visual sensitivity in this FEIS/PA. VRM Classes within the HGLA include VRM Class II and VRM Class III objectives. VRM Class II objectives are assigned in some portions of the ACECs. VRM Class III objectives are assigned in the DFA and remaining portions of the ACECs. Inventory methods, data sources, data categories, and overall existing conditions remain the same from the DEIS/PA, except as noted with the establishment of VRM Classes and ACECs under the DRECP LUPA.

3.11 LAND AND REALTY

3.11.1 Applicable Regulations, Plans, Policies/Management Goals

Section 3.11.1 of the DEIS/PA describes the applicable regulations, plans and policies for Lands and Realty. Applications for commercial geothermal energy facilities would be processed under 43 CFR Part 3200.

3.11.1.1 California Desert Conservation Area Plan of 1980, as amended

The CDCA was amended with the DRECP LUPA in September 2016. The DRECP LUPA amendment establishes a total of five land allocations:

- Development Focus Areas (DFAs). The areas within which solar, wind, and geothermal renewable energy development and associated activities are allowable uses and that have been determined to be of low or lower resource conflict. The intent is to incentivize and streamline such development in these areas.
- Variance Process Lands (VPLs). These lands are available for solar, wind, and geothermal renewable energy development. Renewable energy projects on VPLs have minimal streamlining, and must comply with a specific set of CMAs. Renewable energy applications in VPLs will follow the variance process described in the Western Solar Plan Record of Decision.

- General Public Lands ("Unallocated Lands"). BLM-administered lands that do not have a specific land allocation or designation. These areas are available to renewable energy applications, but are not subject to permit review streamlining or other incentives, and thus would be subject to site-specific plan amendment for such development. The Approved LUPA includes CMAs that apply to activities in General Public Lands.
- BLM Conservation Areas. ACECs and Wildlife Allocations conservation designations, as well as California Desert National Conservation Lands established under the Omnibus Act.
- Recreation Management Areas. Two types of recreation management areas have been established: SRMAs and Extensive Recreation Management Areas (ERMA). As noted above, ERMAs that do not have a conservation allocation overlay and are available for renewable energy development are subject to a site-specific plan amendment.

The HGLA is located within the land use allocation areas detailed in the DRECP LUPA, including areas designated as DFA, ACEC/National Conservation Lands (NCL), and SRMA. There are no VPLs, General Public Lands/Unallocated Lands, Wildlife Allocations, or ERMAs located within the HGLA. Within ACEC areas, ground disturbance caps and ground disturbance mitigation govern surface disturbing activities.

The CDCA Plan sets forth the following management goals for land tenure adjustments, but not for other elements of the lands and realty program:

- Fully implement the network of joint-use planning corridors to meet projected utility needs.
- Identify potential sites for geothermal development, wind energy parks, and geothermal plants. The DRECP LUPA was a comprehensive collaborative effort to facilitate renewable energy development in appropriate places in the desert while conserving these other resources and uses.

According to the CDCA Plan new gas, electric, and water transmission facilities as well as cables for interstate communication may be allowed only within appropriately designated corridors. Designated corridors within the HGLA include BLM Designated Utility Corridor A, a two-mile-wide corridor, and Section 368 Designated Energy Corridor 18-23, an approximately 1,050-foot-wide corridor. Both corridors run north-south across the western portion of the HGLA. A one-mile-wide, five-mile-long corridor connecting the Coso Known Geothermal Resource Area (KGRA) with Utility Corridor A is also located on the southern portion of the HGLA.

The Multiple Use Classes (MUCs) that used to determine land tenure in the CDCA Plan were replaced in the DRECP LUPA land allocation areas with associated CMAs. LUPA-wide and land allocation area specific relevant CMAs (LUPA-LANDS-8 through LUPA-LANDS-10) are provided in Section II.4.2.1.5 (BLM 2016).

Nearly the entire range of the Mohave ground squirrel, a state-listed threatened species, lies within the West Mojave planning area, and most of this land is public land managed by the BLM. A total of 1,726,712 acres is included within the MGSCA. Public lands within the MGSCA are designated as a BLM Wildlife Habitat Management Area in the CDCA Plan.

The CDCA, as amended by the DRECP LUPA, established the Mohave Ground Squirrel ACEC, the Sierra Canyons ACEC, and the Ayers Rock ACECs, in part, for the preservation of Mohave ground squirrel. The Rose Spring ACEC is also included in the DRECP LUPA, but was originally established under the CDCA in 1980. The Mojave Ground Squirrel ACEC includes portions of the MGSCA. Portions of the MGSCA within the HGLA have been designated as Development Focus Areas under the DRECP LUPA.

The CDCA Plan also includes a G-E-M resource element, which defines the following goals for G-E-M resources. Section 3.11.1 of the DEIS/PA details the goals and objectives of the G-E-M resource element.

The DRECP LUPA does not amend existing goals and objectives identified in the G-E-M element of the CDCA. However, in addition to those stated above, the DRECP LUPA includes the following goals and objectives:

- Support the national need for a reliable and sustainable domestic mineral and energy supply.
- Support responsible mining and energy development operations necessary for California's infrastructure, commerce and economic well-being.

Designated Utility Corridors: The CDCA Plan designated 16 major Energy Production and Utility Corridors, as well as DFAs for renewable energy development as detailed in the DRECP LUPA. These corridors and DFAs were established to consolidate compatible ROWs, avoid sensitive resources wherever possible, complete the delivery-systems network, site ongoing projects for which decisions have been made, and for ROW networks for power needs and alternative fuel resources. The CDCA Plan also allows for the designation of corridors that address the following types of utility facilities: new electrical transmission towers and cables of 161 kV or above; all pipelines with diameters greater than 12 inches and coaxial cables for interstate communications; and major aqueducts or canals for inter-basin transfers. The plan calls for these corridors to be designed to provide a two mile standard for separation of existing facilities, and to accommodate flexibility in the selection of alternative routes for ROW.

In 1984, the CDCA Plan was amended to establish a one-mile-wide, five-mile-long corridor to connect the Coso KGRA with the designated Utility Corridor A (CDCA Plan, Map 16)/Section 368 Utility Corridor, which runs north and south along existing power lines on the east side and adjacent to US 395. A 115 kV transmission line and a buried telephone cable line ROW (BLM California Serial Numbers CACA 13510 and CACA 18885) primarily follow the amended corridor. This ROW was previously authorized to the California Energy Company, and then subsequently assigned to Coso Power Developers, Coso Finance Partners, and Coso Energy Developers. The California Desert District Designated Utility Corridor overlaps with the DFA and Mojave Ground Squirrel ACEC.

3.11.1.2 Applicable State Regulations

Applicable state regulations, including those related to the California State Planning and Zoning Law and California State Lands Commission regulations detailing the establishment of "school land" has remained unchanged from the DEIS/PA as described in Section 3.11.1.

3.11.1.3 Applicable Local Regulations

Several amendments to the General Plan have occurred from the time of the publication of the DEIS/PA. These amendments include:

- Renewable (solar) Energy General Plan Amendment (approved March 24, 2015)
- Renewable (solar) Energy General Plan Amendment, Solar Energy Development Areas Diagrams (approved March 24, 2015)
- Update to the Housing Element of the General Plan (approved June 17, 2014)
- Update to the Conservation and Open Space Element with an Energy Efficiency Chapter (approved June 3, 2014)

Inyo County is currently working on a General Plan Update and revised Zoning Code (Inyo County Planning Department 2013). There are no proposed changes to the Government Element (Chapter 1) of the General Plan. The Conservation/Open Space Element (Chapter 6) of the General Plan addresses agricultural and noxious weeds. Environmental review for the proposed General Plan and zoning updates are currently underway.

Air Installation Compatible Use Zones: No changes have occurred with respect to Air Installation Compatible Use Zones from the time of the DEIS/PA publication. The HGLA does not fall into the China Lake NAWS' Accident Potential Zone, Air Installation Compatible Use Zone footprint, or Military Influence Area.

3.11.2 Affected Environment and Existing Conditions

The affected environment has remained unchanged as described in the DEIS/PA Section 3.11.2.

3.11.2.1 Land Status and Jurisdiction

Lands within the HGLA are composed of federal, state, and private lands as previously described in Section 3.11.2.1 of the DEIS/PA. No changes have occurred with regard to jurisdictional acreages or the pending lease applications CACA 43993, CACA 43998 and CACA 44082 occupying 4,460 acres. The BLM-managed lands considered for leasing are located in the Mount Diablo Meridian, and generally occupy all or portions of 37 sections as specified in Appendix I.

3.11.2.2 Land Use Authorizations

Land use authorizations include various authorizations and agreements to use BLM-administered land such as ROW grants, road use agreements, and associated temporary use permits are detailed in Section 3.11.2.2 of the DEIS/PA. No changes to baseline conditions have occurred with regards to land use authorizations from the DEIS/PA. Current land use authorizations within the HGLA are listed in Table Q-1 of Appendix Q.

3.12 PUBLIC HEALTH AND SAFETY

3.12.1 Applicable Regulations, Plans, Policies/Management Goals

The CDCA Plan does not set out specific goals for human health and safety, or management of hazardous materials. However, the BLM's stated policy is to reduce threats to public health, safety, and property, and public lands managed by BLM may not be used for hazardous or non-hazardous waste disposal.

3.12.2 Affected Environment and Existing Conditions

3.12.2.1 Public Health

The baseline conditions as described in Section 3.12.2.1 of the DEIS/PA regarding public health in the HGLA area have not significantly changed from the DEIS/PA.

3.12.2.2 Hazardous Materials

Hazardous materials within the HGLA, as described in Section 3.12.2.2 of the DEIS/PA, may consist of materials in informal dumping sites and mining-related hazardous materials. The location and conditions of existing hazardous materials and areas in the vicinity of HGLA remain the same.

3.13 ENERGY AND MINERAL RESOURCES

3.13.1 Applicable Regulations, Plans, Policies/Management Goals

Mineral resources on federal lands are governed by the General Mining Law of 1872, as amended, and as previously detailed in Section 3.13.1 of the DEIS/PA.

The DRECP amendment to the CDCA Plan does not amend existing goals and objectives, it adds to them. The CDCA Plan, as amended, adds the following goals and objectives:

- Support the national need for a reliable and sustainable domestic mineral and energy supply.
- Support responsible mining and energy development operations necessary for California's infrastructure, commerce and economic well-being.

The CMAs in this section apply to all ACECs within the DRECP. All DRECP-wide and Ecological and Cultural Conservation Area CMAs also apply to ACECs.

- **ACEC-MIN-1**: High Potential Mineral Areas - In California Desert NCLs and ACECs, determine if reasonable alternatives exist outside of the California Desert NCLs/ACEC areas prior to proposing mineral resource development within one of these areas.

The objective for locatable minerals, mineral materials, and non-energy leasables for the Ayers Rock, Mojave Ground Squirrel, and Sierra Canyons ACECs and East Sierra SRMA states: support the national need for reliable and sustainable domestic minerals while protecting the sensitive resources in the area.

At the county level, the Inyo County General Plan includes mineral and energy resource development goals, policies, and implementation measures. Chapter 8.4 of the Inyo County General Plan (Conservation/Open Space Element-Mineral and Energy Resources) includes a single goal. Goal MER-1 seeks to "…(p)rotect the current and future extraction of mineral resources that are important to the County's economy while minimizing impacts of this use on the public and the environment." Policies to achieve the goal related to geothermal energy development include:

- Policy MER-1.1: Resource Extraction and the Environment-Support the production of mineral resource where it would not significantly impact sensitive resources as defined by CEQA and this General Plan.
- Policy MER-1.4: Environmental Contamination- All mining operations will be required to take precautions to avoid contamination from wastes or incidents related to the storage and disposal of hazardous materials, or general operating activity at the site.
- Policy MER-1.5: Maintain Accessibility- Ensure that extractive resource areas are protected from incompatible development that could interfere with extractive operations, now or in the future.

Mineral and Energy Resources Implementation Measures detailed in Chapter 8.4 of the Inyo County Plan identifies implementation measures the County should take to implement the goals and policies of the General Plan. The implementation program lists each specific implementation measure, a reference to which General Plan policy it is implementing, who is responsible to implement the program, and the timeframe for implementation. Implementation Measures applicable to MER-1.1, MER-1.4, and MER-1.5 include:

1.0 – The County shall ensure compliance with the CEQA on all mining projects (on private and LADWP-owned lands in the unincorporated portions of the County), including the proposal of adequate and feasible mitigations to reduce on-site and off-site impacts to less than significant levels.

2.0 – The County shall not permit mining operations in areas containing existing sensitive receptors, such as residences, schools, hospitals, and similar uses, unless it can be demonstrated that impacts would be less than significant, and/or mitigation measures are incorporated into the project design to ensure that impacts would not occur.

3.0 – For mining operations that involve heavy truck traffic, the County shall ensure that mitigations are in place to reduce adverse impacts from dust, noise, and erosion, and to also ensure that operations contribute equitably for the maintenance of public roads.

5.0 – All mining operators will be required to submit operating plans that contain spill prevention control plans and other measures that identify structural and non-structural methods to reduce environmental impacts.

6.0 – The County shall review development proposals to ensure that they would not conflict with mineral resource extraction.

7.0 – Discourage incompatible development on lands identified as containing significant mineral resources. Support uses that will not preclude future mining activities.

3.13.2 Affected Environment and Existing Conditions

3.13.2.1 Renewable Energy Resources

With the exception of the following, the Affected Environment relative to renewable energy resources in the HGLA has remained unchanged since the publication of the DEIS/PA and can be found in Section 3.12.2.1 of the DEIS/PA.

There are no permanent wind energy facilities on BLM-administered lands within the HGLA. The BLM does not have any current applications for wind energy projects and there are no known wind energy projects on private land in the area. Future applications for testing and/or development would be processed in accordance with the policies and best management practices established by the *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM Administered Lands in the Western United States* (BLM 2005b). However, a majority of the HGLA was identified as an area of "High Likelihood of Unacceptable Risk to National Security" (see Appendix D of the DRECP) by the Department of Defense as part of an evaluation of renewable energy facility conflicts, so it is unlikely wind development would occur even within the established DFA.

3.13.2.2 Minerals

Oil, Gas, and Geothermal: As previously detailed in Section 3.13.2.2 the DEIS/PA, the BLM considers geothermal resources, oil and natural gas to be a fluid mineral resource. Therefore, while land closures or restrictions to fluid leasable minerals are primarily meant for oil and gas exploration and development, they apply to geothermal exploration and development as well.

Non-Energy Minerals: Mining activities in Inyo County continue to extract common minerals such as sand, gravel, clay, borates, pumice, and perlite. Public agencies, such as Caltrans and Inyo County, are the largest users of these minerals. The related employment contributes both to Inyo County's economy and to local infrastructure. Future mineral price fluctuations and international political events will likely continue to affect the extent of the mining industry in Inyo County.

Active mines in the area remaining in operation from the time of the DEIS/PA publication include the TXI Olancha Pumice Mine east of Haiwee Reservoir on private land, and LADWP quarry sites for stone immediately south of Haiwee Dam. A number of inactive and abandoned mineral mines are also scattered throughout the HGLA (including pumice and molybdenum) and the surrounding region.

As of December 2017, there are 23 active mining claims recorded with the BLM within the HGLA (see Table S-1, Appendix S). An authorized material site (CACA 41832) on BLM public land (Township 21 South, Range 37 East, Section 36, SW 1/4 of SW 1/4) is situated in the HGLA. The site's products serve for maintaining US 395 along Inyo County's front range near Coso Junction. The material site is owned and operated by the Caltrans.

3.14 WILD HORSES AND BURROS

3.14.1 Applicable Regulations, Plans, Policies/Management Goals

The DEIS/PA provides a detailed account of applicable Regulations, Plans, Policies and Management Goals in Section 3.14.1. In 1999, the CDCA Area Plan largely restated the 1980 goals but added the goal of removing all wild horses and burros from areas not designated for retention and removing excess wild horses and burros from designated retention areas (BLM 1999).

The DRECP LUPA does not amend existing goals and objectives in the pre-DRECP LUPA land use plans, it adds to them. The DRECP LUPA adds the following goals and objectives:

3.14.1.1 Goals

- Ensure that wild horse and burro resources are given full consideration in land use planning and in management decisions.

- Preserve and protect remaining Herd Management Areas (HMA) in the DRECP.
- Manage wild horse and burro populations in ways that ensure thriving natural ecological balance of the herds in their habitats.

3.14.1.2 Objectives

- Development cannot reduce or otherwise negatively impact burros' forage, water, shelter, space or impede their wild, free-roaming behavior in HMAs.
- Ensure renewable energy development projects have no negative impacts on BLM burros.

3.14.2 Affected Environment and Existing Conditions

The HGLA covers portions of the Centennial HMA. In 1980, the CDCA Plan set the Centennial HMA's wild horse and burro proposed population at 168 wild horses and 1,137 burros. As of 2012, the BLM estimated a population of 400 wild horses and 180 burros in the Centennial HMA (BLM 2016).

3.15 GRAZING

3.15.1 Applicable Regulations, Plans, Policies/Management Goals

From the time of the DEIS/PA, applicable regulations, plans, policies and management goals have not changed substantially. However, these were not explicitly detailed in the DEIS/PA and are provided in detail in this FEIS along with the current grazing allotments as discussed in Section 3.15.2 below.

The FLPMA and the Public Rangelands Improvement Act of 1978 recognize livestock grazing as a principal use of public lands for the production of food and fiber, and the BLM manages livestock grazing through grazing allotments that are leased to cattle and sheep interests.

The Taylor Grazing Act of 1934 (PL 73-482), the FLPMA of 1976, the Public Rangelands Improvement Act of 1978, and Rangeland Health Standards regulate and manage livestock grazing on public lands. The Taylor Grazing Act of 1934 organized grazing management on public lands due to overgrazing and conflicts among livestock operators. Initially, the law reserved 80 million acres for grazing. Today, the law sets no limit on the number of acres that can be reserved in grazing allotments and there are approximately 162 million acres in grazing allotments. Surrounding landowners may be granted the right of passage across grazing allotments. The Public Rangelands Improvement Act of 1978, in conjunction with the FLPMA of 1976, requires the Secretary of Agriculture and the Secretary of the Interior to inventory and improve rangeland conditions.

BLM's Public Land Grazing Administration regulations included in 43 CFR Part 4100 implement the provisions of the Taylor Grazing Act of 1934, the FLPMA of 1976, and the Public Rangelands Improvement Act of 1978. Per 43 CFR Part 4100, a two-year notification is required when public lands in a grazing allotment are proposed to be devoted to a public purpose that precludes livestock grazing (43 CFR Part 4110.4-2 (b)). Per these provisions, a permittee cannot lose any of their grazing preference for two years from the "date of notification" that lands in the allotment would be dedicated to other uses. The permittee may waive the two-year notification if they choose.

The specific goals of the Livestock Grazing Element of the CDCA Plan are:

- Continue the use of the California Desert for livestock production to continue to satisfying the need for food and fiber from public land.
- Use livestock grazing as a tool to change or improve vegetation for meeting livestock needs as well as other management objectives as set forth in the Plan.
- Maintain lands that are in good to excellent condition at these production levels. Those lands in poor to fair condition will be improved by the application of appropriate management prescriptions to regulate livestock grazing within the framework of multiple use and sustained yield.
- Improve vegetation use by improving distribution of livestock through the use of range improvements and

specific management prescriptions which will be fully developed and implemented with Allotment Management Plans.

- Conduct specific monitoring procedures of condition and trend to determine the necessary grazing adjustments to meet management goals.

The 1999 California Desert Conservation Area Plan notes the following goals for livestock grazing, per CDCA Plan Amendment No. 6 in 1985:

- Use range management to maintain or improve vegetation to meet livestock needs and to meet other management objectives set forth in the Plan.
- Continue the use of the California Desert for livestock production to contribute to satisfying the need for food and fiber from public land.
- Maintain good and excellent range condition and improve poor and fair range condition by one condition class, through development and implementation of feasible grazing systems or Allotment Management Plans. Adjust livestock use where monitoring data indicate changes are necessary to meet resource objectives (BLM 1999).

Additionally, the Consolidated Appropriations Act of 2012 (PL 112-74) provides for the Secretary of the Interior to accept donations of valid existing public land grazing permits or leases in the California Desert Conservation Area. The donation allows the Secretary of the Interior to terminate the permit or lease, ensure a permanent end to grazing on the subject land, and make the land available for mitigation in allocating the forage to wildlife use consistent with any applicable Habitat Conservation Plan, Section 10(a)(1)(B) permit, or Section 7 consultation per the Endangered Species Act of 1973. If the land that the permit or lease covers also includes another valid permit or lease that is not being donated, the Secretary of the Interior shall reduce the authorized grazing level on the land covered by the permit or lease to reflect the land donated. The Secretary shall not allow grazing use on the non-donated land to exceed its authorized level.

3.15.2 Affected Environment and Existing Conditions

Two livestock grazing allotments exist in the HGLA: the Tunawee Allotment covering approximately 56,000 acres and most of the HGLA and the Lacey-Cactus-McCloud Allotment covering approximately 148,000 acres and a relatively small portion of the HGLA's northeast side. The DRECP proposed LUPA notes that cattle and sheep graze the Tunawee Allotment and that cattle graze the Lacey-Cactus-McCloud Allotment. According to mapping data that Public Employees for Environmental Responsibility compiled, the Tunawee Allotment meets applicable land health standards for grazing. Public Employees for Environmental Responsibility's mapping data for the Lacey-Cactus-McCloud Allotment did not provide information for land health standards (Public Employees for Environmental Responsibility 2012).

3.16 RECREATION

3.16.1 Applicable Regulations, Plans, Policies/Management Goals

Management goals detailed in the CDCA's Recreational Element remain as previously described in Section 3.16.1 of the DEIS/PA. The DRECP LUPA, however, added goals, CMAs, and established a SRMA related to recreational resources as described below and in Section 3.17 of this DEIS/PA.

Additionally, to meet the specific needs and changing demands of recreation visitors and changes in BLM recreation management, a BLM California-specific Recreation and Visitor Services Strategy was completed in 2008. The three primary goals of the document are to:

- Set a framework for achieving sustainable experiences and quality of life outcomes for individuals, communities, and the environment.
- Sustain diversity, distinctive character, and capacity of BLM recreation settings.

- Increase the economic stability and sustainability of the BLM California recreation program.

The seven main objectives for BLM recreation management in California are to:

- Manage for recreation experiences and quality of life.
- Encourage sustainable travel/tourism collaborations.
- Ensure fair value and return through fees and commercial services.
- Establish a comprehensive approach to travel management.
- Ensure public health and safety and improve accessibility.
- Enhance and expand visitor services.
- Encourage and sustain collaborative partnerships.

The DRECP LUPA does not amend existing goals and objectives in the pre-DRECP LUPA land use plans, it adds to them. The DRECP lists the following specific goals and objectives (summarized):

- **Special Recreation Management Areas (SRMA).** Protect SRMAs for their unique/special recreation values. Manage SRMAs for their targeted recreation activities, experiences and benefits. Maintain (and where possible enhance) the recreation setting characteristics.
- **Extensive Recreation Management Area (ERMA).** Support and sustain the principal recreation activities and associated qualities and conditions of the ERMA. Manage ERMAs to address the recreation use, demand, or recreation and visitor services program investments. Manage lands not designated as SRMAs or ERMAs to meet recreation and visitor services and resource stewardship needs as identified in field office RMPs.
- **Designated OHV Open Areas.** Protect vehicle access and OHV opportunities as specified in Recreation Area Management Plans and Travel and Transportation Management Plans.
- **Developed Recreation Facilities (BLM FAMS data)**. Protect and manage developed recreation facilities within the Planning Area.
    - Level 1 = high value: campgrounds, Long-Term Visitor Areas, Visitor Contact Facilities, Day Use areas, Watchable Wildlife areas, OHV Open Areas, etc. DRECP BLM Land Use Plan Amendment.
    - Level 2 = moderate value: recreational trailheads for motorized/non-motorized activities, parking staging areas.
    - Level 3 = lower value: Individual developments—kiosks, etc.
- Manage the remainder of the non-SRMA resource area within the Planning Area to provide for a variety of dispersed recreation opportunities. Emphasize primitive, semi primitive motorized, semi primitive non-motorized and roaded natural experiences.
- Enhance recreation experiences provided to the public through a well-managed Special Recreation Permit program.

CMAs NLCS-REC-1 as described in Section II.4.2.4.7 (BLM 2016) only applies to the California Desert National Conservation Lands identified through the DRECP LUPA, and do not amend existing management for other components of NLCS, such as Wilderness Areas.

CMAs SRMA-REC-1 through SRMA-REC-3 as described in Section II.4.2.7.3 (BLM 2016) apply to all SRMAs within the LUPA. All LUPA-wide CMAs also apply to SRMAs.

CMAs ERMA-LUPA-1 and ERMA-LUPA-2 as described in Section II.4.2.8 (BLM 2016) apply to all ERMAs within the LUPA. All LUPA-wide also apply to ERMAs.

CMAs GPL-REC-1 through GPL-REC-3 as described in Section II.4.2.10.5 (BLM 2016) will be implemented in the DFAs and Variance Process Lands, in addition to the LUPA wide CMAs (LUPA).

CMAs DFA-REC-1 through DFA-REC-4 as detailed in Section II.4.2.9.2 of the DRECP LUPA will be implemented in the DFAs, in addition to the LUPA-wide and DFA and Variance Process Lands CMAs.

3.7.1 Affected Environment and Existing Conditions

The recreational resource affected environment in and around the HGLA has remained essentially the same from the time of the DEIS/PA; however, the establishment of Special Management Areas has changed as previously noted (see Section 3.17). The Rose Valley and Owens Valley provides numerous recreational opportunities. Most of the land is owned and administered by the United States Forest Service, the BLM, and the City of Los Angeles. Although much of the Owens Valley floor is comprised of LADWP land, some LADWP-owned land in Inyo is also open to the public for daytime recreational uses.

The recreational resource baseline conditions in and around the HGLA have largely remained essentially the same from the time of the DEIS/PA. The HGLA and immediate surrounding area support most of the above-listed recreational activities. However, Multiple Use Classes that address travel routes and overall access within the HGLA have been eliminated, and land use allocations established in the DRECP LUPA direct potential recreational use as described below.

Currently, the BLM limits OHV use in the HGLA to designated routes of travel. Such routes are identified as “open” through the BLM planning process. Closed routes are signed on the ground, and off-road travel is prohibited unless prior approval has been granted by an authorized officer. According to the current West Mojave Route Designation Program, the following existing BLM routes within the HGLA are designated as “open”: SC1043O, SC10431, SC10434, SE1085, SE1189, SE1191, SE1192, SEO771, SEO866, SEO869, SEO870, SEO980, SEO984, SEO979, SEO986, SEO987, and SEO988 (Figure T-1, Appendix T). These routes currently provide for motorized-vehicle access for recreation activities (including OHV use) and other uses such as utility corridors, livestock operations, active mineral extraction/exploration sites, and private lands. An amended transportation and travel plan is being proposed for the West Mojave Planning Area and a DSEIS for the West Mojave Route Network Project is complete, but a FEIS/PA and final approvals are pending.

A portion of the HGLA lies within the Rose Spring, Mohave Ground Squirrel, Ayers Rock, and Sierra Canyons ACECs. The objective for trails and travel management within these Rose Spring and Ayers Rock ACECs are to protect resource values while providing recreational access. The objective for the Sierra Canyons ACEC is to limit OHV use to designated routes as per the local Travel Management plan and prevent user-created routes from developing and the objective for the Mohave Ground Squirrel ACEC is to provide for the use of the designated travel system to provide access to the public lands while protecting the significant values of the area. A small portion of the HGLA lies within the Eastern Sierra SRMA, which is described below.

In terms of recreation use, public lands are allocated as SRMAs or as ERMAs. A SRMA is a unit where specific recreation/tourism interests have expressed a desire for certain kind of activities, experiences, and other benefits. As such, these units are managed intensively for recreation, and the setting character in these units is a high priority. Areas with a SRMA allocation typically see investments in recreation facilities and visitor services. An ERMA is a unit with no identifiable market demand for structured recreation opportunities. Rather, an ERMA emphasizes the traditional dispersed recreation use of public lands. ERMAs are managed custodially; resources committed are generally limited and include provisions for visitor health and safety, and those aimed at reducing damage and mitigating user conflict. Visitors who want to avoid areas of intensive recreation activities generally prefer ERMAs. By default, anything not allocated as a SRMA becomes part of an ERMA.

A small portion of the HGLA lies within the Eastern Sierra SRMA. The Eastern Sierra SRMA stretches north, west of and parallel to Highways 14 and 395, encompassing the foothills of the Eastern Sierras from Highway 178 north to Olancha, for a total of 46 miles. This SRMA provides a recreational environment that focuses on low impact recreation and emphasizes on experiencing the splendor of the Eastern Sierras. The goal is to offer recreational opportunities that maintain the natural character of the landscape and protect sensitive resources, while encouraging a variety of outdoor activities that provide pleasure to the user. Vehicle use is limited to designated routes only. This SRMA overlaps with the Sierra Canyon ACEC. A total of 734.1 acres of the Eastern Sierra SRMA are located within the HGLA.

The BLM does not have visitation statistics specific to the HGLA; however, the recreational uses and visitation rates to the Ridgecrest SRMA between October 1, 2016 and September 30, 2017 are available, and are summarized in Table T-1, Appendix T. Total estimated visitation (participants and visitor days) for October 1, 2016 and September 30, 2017, for the Ridgecrest SRMA was 139,011 and 35,846, respectively. The most common activities within the Ridgecrest SRMA included driving for pleasure, OHV trail riding, hiking/walking/running, motorcycle riding, horseback riding, and mountain bicycling.

BLM also permits competitive recreational events, recreation-related commercial enterprises, and other organized events through the use of Special Recreation Permits. Special Recreation Permits are authorizations which allow specified recreational uses of the public lands and related waters. They are issued as a means to manage visitor use, protect natural and cultural resources, and provide a mechanism to accommodate commercial recreational uses. Special Recreation Permits within the HGLA includes permits issued for equestrian endurance rides and dual sport motorcycle tours.

3.17 SPECIAL DESIGNATIONS

3.17.1 Applicable Regulations, Plans, Policies/Management Goals

Special area designations on public lands can be established by Congress, Presidential Proclamation, or under BLM administrative procedures. The BLM then has the authority to adopt special management designations through RMP amendments or revisions. Wilderness Areas are designated through Congress and BLM manages wilderness areas under the provisions of the Wilderness Act of 1964, the specific designating legislation for each wilderness area, and BLM Manual 6340.

At its discretion, the BLM may also apply administrative designations in areas requiring special management. Administrative designations are not legislative. Special areas that are designated administratively by the BLM include ACECs, Research Natural Areas, National Natural Landmarks, Backcountry Byways, and Watchable Wildlife Areas. Uses are permitted in the administratively designated areas to the extent that the uses are in harmony with the purpose for which the area was designated. With the approval of the DRECP LUPA modifying the underlying administratively designated areas within the HGLA, this resource has substantially changed from the time of the DEIS/PA.

The ACEC designation is an administrative designation unique to the BLM. The BLM uses the ACEC designation to highlight public land areas where special management attention is necessary to protect and prevent irreparable damage to important historical, cultural, and scenic values; fish or wildlife resources; or other natural systems or processes. The ACEC designation may also be used to protect human life and safety from natural hazards. BLM Manual 1613 - Areas of Critical Environmental Concern provides the policy and procedural guidance on the identification, evaluation, and designation of ACECs in the development, revision, and amendment of RMPs. It also clarifies the relationship of ACECs to other designations and provides procedural guidance on the monitoring and management of ACECs.

The goals of the ACEC Program are to:

- Identify and protect the significant natural and cultural resources requiring special management attention found on the BLM-administered lands in the CDCA.
- Provide for other uses in the designated areas, compatible with the protection and enhancement of the significant natural and cultural resources.
- Systematically monitor the preservation of the significant natural and cultural resources on BLM-administered lands, and the compatibility of other allowed uses with these resources.

ACECs within the HGLA were previously established (Rose Spring ACEC) or were designated as part of the DRECP LUPA. Special Unit Management Plans for the HGLA ACECs were developed for ACECs in the DRECP LUPA, and detail Nationally Significant Values, Overarching Goals, Desired Future Conditions (Objectives), Allowable Uses, and Management Actions.

The FLPMA states that the BLM will give priority to the designation and protection of ACECs in the development and revision of land use plans. The ACEC designation indicates to the public that the BLM recognizes that an area meets relevance and importance criteria and has established special management measures to protect those values. In addition, an ACEC designation also serves as a reminder that significant value(s) or resource(s) exist that must be accommodated when future management actions and land use proposals are considered within an ACEC or its vicinity.

These ACECs differ from other special management designations in that designation by itself does not automatically prohibit or restrict other uses in the area. The one exception is that a mining plan of operation is required for any proposed mining activity within a designated ACEC.

The DRECP identified CDNCLs, in accordance with the Omnibus Public Land Management Act of 2009 (Omnibus Act), which are nationally significant landscapes within the CDCA with outstanding cultural, ecological, and scientific values. The DRECP also established CMAs to conserve, protect, and restore these landscapes. The CDNCLs are a permanent addition to the National Landscape Conservation System, as per the direction to BLM in the Omnibus Act.

Although PL 111-11 provides for lands within the CDCA, as amended, to become components of the National Conservation Lands, it does not include or define a process for developing specific management direction to conserve, protect, and restore resource values on the identified conservation lands. In addition to the identification of National Conservation Lands, the DRECP provides management direction to meet the objectives of PL 111-11. This management direction has been developed at two levels – planning area-wide and site or zone specific. The CMAs apply to all National Conservation Lands identified under PL 111-11 in the CDCA. Site-specific management is outlined in the Special Unit Management Plans in Appendix L of the DRECP.

The CDCA Plan as amended by the DRECP LUPA provides specific management goals or guidelines addressing Special Designation Areas. The ACECs within the HGLA are managed using CMAs and a one percent or 0.1 percent disturbance cap. The CDNCLs within the HGLA are managed using the CMAs and a one percent disturbance cap, or to the level allowed by a collocated ACEC, whichever is more restrictive. The CMAs identify a specific set of avoidance, minimization, and compensation measures, and allowable and non-allowable actions for siting, design, pre-construction, construction, maintenance, implementation, operation, and decommissioning activities on BLM-managed lands. DRECP LUPA-wide CMAs are considered to be "umbrella actions" or standard practices for ensuring appropriate biological conservation and management through implementation of avoidance and minimization for activities. These DRECP LUPA CMAs are required for all activities, as specified in individual CMAs, throughout the entire DRECP LUPA Decision Area. DRECP LUPA-wide CMAs are detailed in Section II.3.4.2.1 of the DRECP Final EIS. In addition to the DRECP LUPA-wide CMAs, ecological and cultural conservation CMAs apply within all ACECs/CDNCLs within the HGLA. Ecological and cultural CMAs are detailed in Section II.3.4.2.2 of the DRECP Final EIS. The CMAs detailed in Section II.3.4.2.4 of the DRECP Final EIS also apply to all ACECs within the HGLA. The CMAs detailed in Section II.3.4.2.3 of the DRECP Final EIS apply to all NCLs within the HGLA. Other CMAs are applicable within SRMAs and DFAs located within the HGLA are detailed in Sections II.3.4.2.7 and II.3.4.2.8 of the DRECP Final EIS.

3.17.2 Affected Environment and Existing Conditions

A number of special areas within and near the HGLA have been designated under the above guidelines to protect unique characteristics and contain resources that have been identified as scientifically, educationally, or recreationally important. Such areas include two wilderness areas and four ACECs; the wilderness areas are located outside of the HGLA. Special management is administered to these areas with the intent to improve the manageability of the areas, allowing the BLM to preserve, protect, and evaluate these significant components of national heritage.

No designated wilderness areas are situated within the HGLA. However, the Coso Range Wilderness Area, administered by the BLM, is located approximately one mile northeast of the HGLA, and comprises 49,294 acres of land designated for camping, hiking, backpacking, and horseback riding. The Coso Range Wilderness encompasses the northern section of the Coso Mountain Range, an area of extensive erosion revealing volcanic displays and numerous valleys and washes. Vermillion Canyon, located in the western side of the wilderness, and Joshua Flat are two especially important areas within this wilderness. The Sacatar Trails Wilderness is also in the vicinity of the HGLA, beginning about a mile to the southwest. It contains about 51,900 acres and spans elevations from about 3,500-8,800 feet amsl. This wilderness is part of the southern Sierra Nevada Mountains and is on the eastern slope.

Four designated ACECs are located within the HGLA. A summary description, a description of relevance and importance criteria s for each designated ACEC, nationally significant values, size, disturbance caps, and allowable uses are summarized below:

> <u>Ayer’s Rock ACEC</u>: Ayer’s Rock is one of a few known pictograph sites in the Ridgecrest Field Office. The ACEC covers 1,564 acres in an area. This ACEC is also within the MGSCA and is excellent habitat for this BLM special status species. The ACEC is currently readily accessible by open travel routes and is a popular destination for recreationists and rock art enthusiasts. The site Listed on the National Register of Historic Places in March of 2003. This area also includes Mohave ground squirrel core habitat within the MGSCA. Appropriate multiple uses will be allowed, consistent with this Special Unit Management Plan and the CMAs as detailed in the DRECP LUPA and Final EIS. If an activity is not specifically covered by the CMAs, it will be allowed if it is consistent with Relevant and Important Values, but prohibited if the uses conflict with those values. A total of 136.7 acres of this ACEC are located within the HGLA.

> <u>Rose Springs ACEC</u>: This 800-acre ACEC, originally established under the CDCA, was designated for significant prehistoric cultural resource values associated with the Rose Spring Archaeological site complex. The area is located at the north end of Rose Valley, which is overlapped by the traditional homelands of the Shoshone and Paiute peoples, as recorded by Steward. The site is eligible for listing on the National Register of Historic Places. Sites associated with the main Rose Spring are also eligible, and may contain human burials. This area also includes Mohave ground squirrel core habitat within the MGSCA. Other important values include desert tortoise habitat and features that have been identified as important climate refugia. Where the CMAs in this Special Management Plan conflict from the CMAs included in Volume II of the DRECP LUPA and Final EIS, the more restrictive CMA would be applied. The disturbance cap has been established at 1.0 percent. A total of 452.5 acres of this ACEC are located within the HGLA.

> <u>Mohave Ground Squirrel ACEC</u>: This 198,552-acre ACEC contains habitat for the state threatened Mohave ground squirrel, and was established to protect the long-term survival of this species. This area provides

greater connectivity between the large, mostly undeveloped and protected Mohave ground squirrel habitat found within the three Military Ranges to the north, east (China Lake NAWS) and south (Edwards). The ultimate goal of wildlife connectivity is to allow for unimpeded movement of wildlife. The habitat contains a diversity of desert shrubs that is home to many sensitive species such Nelson's bighorn sheep (*Ovis canadensis nelsoni*), bat species, and resident and migrating birds. Many BLM special status plant species potentially occur here such as the Mojave tarplant (*Deinandra mohavensis*). Some areas within the ACEC provide a combination of meteorological, geological, hydrological, and topographical features that have been identified as important climate refugia for wildlife species. The ACEC also contains 308 acres of lands that are managed to protect wilderness character. The CMAs for lands to protect wilderness character apply to these areas. Where the CMAs in this Special Management Plan conflict from the CMAs included in Volume II of the DRECP LUPA and Final EIS, the more restrictive CMA would be applied. The disturbance cap has been established at 1.0 percent. A total of 12,939.5 acres of this ACEC are located within the HGLA.

Sierra Canyons ACEC: This 26,405-acre ACEC was established to protect ecological and cultural resources. The area contains a flyway that provides outstanding habitat for golden eagles and other raptors, with nearby cliffs for nesting and the valley floor for foraging. This area is a part of the Pacific Migratory Bird Flyway with riparian stop-over habitats. Songbirds pass through the valley on their way to breeding grounds. Shore birds migrate to Owens Lake and Mono Lake. The flyway has stop-over riparian/wetland habitat in the Sierra Nevada canyons, Little Lake, Haiwee Reservoir, Owens Lake and Mono Lake and provides a path from Mexico to Canada for certain species. A total of 747.5 acres of this ACEC are located within the HGLA.

The area also provides habitat for numerous special status plant species, desert tortoise habitat, and the largest winter range for mule deer (*Odocoileus hemionus*) in the region. The North and South Units of the Sierra Canyons ACEC contain many large, prehistoric NRHP eligible properties in relatively undisturbed contexts, and also contains NRHP eligible and listed sections of the Los Angeles Aqueduct. The prehistoric sites have high densities of obsidian and other types of lithic material unparalleled in the Ridgecrest Field Office. Appropriate multiple uses will be allowed, consistent with this Special Unit Management Plan and the CMAs as detailed in the DRECP LUPA. If an activity is not specifically covered by the CMAs, it will be allowed if it is consistent with the Relevant and Important Values, but prohibited if the uses conflict with those values. The disturbance cap has been established at 1.0 percent.

3.18 TRAFFIC / TRANSPORTATION

3.18.1 Applicable Regulations, Plans, Policies/Management Goals

Federal, state, and local government-managed roads provide access in and around the HGLA. Each level of government establishes requirements and enforces regulations for the safe and efficient use of their roadway facilities.

Federal Government: The U.S. Department of Transportation's Federal Highway Administration oversees the nation's Federal Aid Highway System to help state and local governments design, construct, and maintain the nation's highway system. The Federal Highway Administration's Federal Lands Highway program oversees transportation on federal- and tribal-owned lands.

The CDCA Plan's Motorized Vehicle Access Element seeks to manage motorized vehicle access on public lands, and designate areas for appropriate vehicle access. To these ends, the CDCA Plan seeks to constrain access to balance public and private needs, to avoid adverse impacts to desert resources, and to use maps, signs, and published information to alert users to motorized vehicle access situations (BLM 1980).

Per Executive Order 11644 "Use of Off-Road Vehicles on the Public Lands" and Executive Order 11989 "Off-Road Vehicles on Public Lands", the BLM designates OHV travel routes as open, closed, or limited. An open area is where all types of vehicle use are permitted at all times. A closed area is where OHV use is prohibited. The closed designation applies to all Congressional-designated wilderness, unless exempted; land in ACECs provided for in the ACEC's management plan; certain sand dunes and dry lakes; and other public lands, regardless of location, that are closed to protect sensitive resources or for public safety. A limited area is where access is restricted at certain times, in certain locations, or to certain vehicle use. The limited designation applies to all lands that are not in open or closed areas.

The CDCA Plan's Motorized Vehicle Access Element seeks to manage motorized vehicle access on public lands, and designate areas for appropriate vehicle access, and these remain unchanged from the DEIS/PA. The DRECP LUPA eliminated the Multiple Use Classes that controlled motorized vehicle access and replaced them with land use allocation restrictions as previously discussed.

The BLM defines the following kinds of transportation facilities:

- Roads: facilities that accommodate low-clearance vehicles that have four or more wheels and are maintained for regular and continuous use. Roads can include those used for ROW access.
- Primitive roads: facilities that accommodate four-wheel drive or high-clearance vehicles. Primitive roads do not meet BLM road design standards.
- Trails: facilities that accommodate human-powered, stock, or OHV means of transportation. In general, trails are not managed for four-wheel drive or high-clearance vehicle use.

The BLM categorizes roads, primitive roads, and trails as Tier 1, Tier 2, and Tier 3 facilities as follows:

- Tier 1 includes roads and primitive roads with high values for commercial, recreational, casual uses, and/or to provide access to other recreational activities.
- Tier 2 includes roads and primitive roads with high values for recreation and other motorized access.
- Tier 3 includes primitive roads and trails with high value for motorized and non-motorized recreational pursuits. Tier 3 facilities include spur routes.

In the BLM California Desert District's Ridgecrest Field Office territory that includes the HGLA, vehicle use is limited to designated roads and trails (BLM 2016). All ACECs designated in the DRECP LUPA recognize motorized access as an allowable use with specific management actions identified within each ACEC (see Appendix B, BLM 2016).

DRECP LUPA-wide CMAs (LUPA-CTTM-1 through LUPA-CTTM-7) as detailed in Section II.4.2.1.3 of the DRECP LUPA (BLM 2016) are applicable for trails and travel management within the HGLA.

State Government: The California Department of Transportation (Caltrans) enforces the California Vehicle Code, which establishes requirements for licensing, and for transporting oversize, overweight, and hazardous materials shipments on state-owned roads (California Legislative Information 2017).

Local Government: The Inyo County Public Works Department uses Caltrans' Standard Specifications to ensure that county roads comply with the state's roadway design, engineering, construction, and maintenance standards. The Inyo County Public Works Department also provides leadership for the Inyo County Local Transportation Commission, which is the state-mandated Regional Transportation Planning Agency for Inyo County. The Inyo County Local Transportation Commission oversees transportation planning for Inyo County and prepares an Overall Work Program and Regional Transportation Plan to identify roadway projects for programming and funding. Per the *Inyo County 2015 Regional Transportation Plan*, and relevant to the purpose of this FEIS/PA, the county establishes the following policies and objectives for its transportation system:

- Policy 1.1.1: Give the greatest priority to maintaining, rehabilitating, and reconstructing roads relative to other roadway transportation projects.
- Objective 2.1: Maintain or improve existing level of service (LOS[2]) on roadways in the county.
- Objective 3.1: Widen US 395 to four lanes. By 2020, provide a four-lane facility for US 395 in Inyo County.
- Policy 3.1.1: Improve US 395 in sections and widen US 395 as funding allows (Inyo County 2015).

Inyo County continues to work with Caltrans regarding the Olancha-Cartago Four-Lane Project along US 395 (Inyo County Local Transportation Commission 2017). Between milepost 29.2, just south of Olancha and milepost41.8, just north of Cartago, the Olancha-Cartago Four-Lane Project would convert approximately 12 miles of the existing US 395 highway from a two-lane conventional highway to a four-lane divided expressway or a combination of four-lane conventional highway and divided expressway (Caltrans 2017). Caltrans plans to widen US 395 in this section to improve the current LOS D traffic conditions to LOS A and reduce the number of vehicle collisions. LOS D is a zone that approaches unstable flow, with tolerable operating speeds, although driving speed can be considerably affected by changes in operating conditions.

3.18.2 Affected Environment and Existing Conditions

This section describes the existing transportation network and traffic conditions in Inyo County in and around the HGLA. Inyo County, the second-largest county in California in land area at approximately 10,181 square miles, lies in the eastern part of the state. Public agencies own 98 percent of the land in the county. The City of Bishop is the only incorporated city in the county. Given the rural nature of the communities, low development densities, and limited options for using alternate modes of travel, transportation in Inyo County is primarily by automobile. No passenger or freight rail service currently exists in the county, and air travel is limited.

Inyo County's road network includes more than 3,500 miles of streets, roads, and highways (Inyo County 2015). The system is built around a framework of federal and state highways, including US 395, US 6, State Route (SR) 127, SR 136, SR 168, SR 178, SR 190, and county roads.

3.18.2.1 Existing Access

Existing access remains essentially unchanged from the DEIS/PA, with US 395 being the primary north-south highway that traverses Inyo County and the HGLA's western half, SR 190 is the highway closest to the HGLA, merging with US 395 in Olancha, approximately 11 miles north of the HGLA. US 395 is a four-lane, divided highway that crosses HGLA on its western side. US 395 is designated as a High Priority Interregional Highway in Caltrans' Interregional Transportation Strategic Plan. This highway is also part of the national Surface Transportation Assistance Act network, which sets specific requirements for truck length, including the length of the semitrailer, and the length from the kingpin to rear axle. SR 127 is part of the Terminal Access Surface Transportation Assistance Act network. All other state highways in Inyo County are designated as California Legal or California Legal Advisory routes. Surface Transportation Assistance Act-sized trucks are not allowed on these highways (Inyo County 2015). Figure 3.18-1 in the DEIS/PA shows the road network in the vicinity of HGLA.

3.18.2.2 Existing Traffic Volumes

Along US 395, traffic associated with recreational activities and goods movement account for 60 percent and 20 percent of this highway's traffic volume, respectively. Improving economic conditions will likely increase recreational traffic along this highway as people travel to and from nearby national and state parks (Caltrans 2015). Table U-1 in Appendix U presents 2016 traffic volumes at the US 395-SR 190 East junction near the HGLA (6,700

[2] Roadway operations are measured in terms of LOS, which is a qualitative measure describing operational conditions in a traffic stream based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. LOS is defined for each type of facility that has analysis procedures available in the Highway Capacity Manual 2000. Letters designate each LOS from A to F, with LOS A representing the best operating conditions and LOS F representing the worst.

annual average daily traffic). For comparison, Table U-2 in Appendix U presents historic annual average daily traffic volumes at the US 395-SR 190 East junction near the HGLA (5,300 to 5900 annual average daily traffic from 2007 to 2015).

No comparable annual average daily traffic volumes or peak-hour flow rates are available for Coso-Gill Station Road or Sykes Road.

3.19 SOCIOECONOMICS

3.19.1 Applicable Regulations, Plans, Policies/Management Goals

Few management goals for social or economic conditions or environmental justice in existing land use plans cover the HGLA. The CDCA Plan currently has no applicable management goals for social or economic conditions, or environmental justice issues.

In February 1994, EO 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" required all federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations, including tribal populations, in the United States (Federal Register 1994). In 1997, in response to this EO, the White House CEQ established the following principles:

- Consider the composition of the affected area to determine whether low-income, minority or tribal populations are present and whether there may be disproportionately high and adverse human health or environmental effects on these populations.
- Consider relevant public health and industry data concerning the potential for multiple exposures or cumulative exposure to human health or environmental hazards.

Inyo County's Economic Development Element in the Inyo County General Plan (Inyo County Planning Department 2001) addresses primarily tourism and redevelopment, and goals related policy relevant to the HGLA remains unchanged from the DEIS/PA.

3.19.2 Affected Environment and Existing Conditions

The affected environment that includes the Socioeconomic Study Area (SSA) as depicted in Figure 3.19-1 of the DEIS/PA remain unchanged. Most of the anticipated economic and social effects associated with the exploration and development of the HGLA would occur in an area within approximately 60 miles to the north and south, that is, within a one-hour commute to or from the HGLA. Some economic, housing, income, population projections, and census data has been updated from the DEIS/PA, are summarized in this section, and provided in detail in Appendix E.

3.19.2.1 Regional Setting

The regional setting remains unchanged from the DEIS/PA, with the City of Bishop lying north of the 60-minute SSA and being the only incorporated city in the county. The Inyo County unincorporated communities of Independence and Lone Pine are within the region, but outside of the Census Block Groups associated with the HGLA. The United States Census Bureau (USCB) designates Independence and Lone Pine each as a Census-Designated Place (CDP), which recognizes a place's concentrated population. CDPs do not have established governments. California City is the only other city in the SSA. A "planned" community, California City is the third-largest incorporated city in California in terms of land area. The HGLA SSA is isolated from major economic hubs such as Bakersfield, an approximate two-hour drive west of the SSA, and Los Angeles and Las Vegas, both of which are an approximate four-hour drive west and east from the SSA, respectively.

3.19.2.2 Population

Population numbers have been revised for this FEIS/PA as shown in Appendix E, and have not significantly changed from those provided in the DEIS/PA. The HGLA SSA remains sparsely populated with the incorporated cities of

Ridgecrest and California City and a few small, unincorporated communities. Table E-4 in Appendix E displays historical population trend data for the counties in the HGLA SSA.

To provide an approximate population estimate for the HGLA SSA, zip code data from the Census 2010 were used. Although not precisely the same as the exact area within a 60-minute SSA, the area represented by the summed zip codes comes reasonably close to it. Aggregating the appropriate zip codes, the 2010 population of the HGLA SSA is estimated at 64,400 individuals. These estimates are shown in Table E-5 in Appendix E. These data also include population density estimates. The zip code area in which the HGLA is located (Olancha) had a low population density of 1.1 persons per square mile. This density contrasts with an average of 12.5 persons per square mile in the total zip code area. The communities of Ridgecrest, California City, Trona, and Lone Pine were the only zip code areas with other low-density urban type densities. Lone Pine is the only one of those located in Inyo County.

Population Projections: Inyo County, Kern County, and San Bernardino County are expected to increase their populations by approximately two percent, 45 percent, and 33 percent, respectively, by 2050. Table E-6 in Appendix E presents these counties' population projections from 2020 through 2050. California's population is expected to increase by approximately 21 percent during this time period.

Published population projections specific to the HGLA SSA do not exist. But it is assumed that little growth would occur in the southern Inyo County portion of the SSA, perhaps at the projected county-wide rate of two percent; however, until an economic recovery takes hold in the county, this assumed rate may be high. The Greater Antelope Valley Economic Alliance (2009) has published some projections for some of the subareas and zip codes in the Kern County portion of the SSA. These projections can serve as proxies for the entire area. These projections, shown in Table E-7 in Appendix E, call for only 0.2 percent average annual growth rates through the year 2030. In sum, the population projection for the HGLA SSA through the year 2030 would be for very limited growth, amounting to perhaps only a few thousand more than its estimated 2010 population of about 65,000 persons.

3.19.2.3 Social Environment

The characteristics of the social environment in the HGLA SSA were identified using secondary source data, and remain essentially unchanged as described in Section 3.19.3.2 of the DEIS/PA.

3.19.2.4 Demographics

The specifics of the region's demography and economy are presented in the following sections. These demographic and economic data offer a basis from which to assess the potential socioeconomic effects to the HGLA in Chapter 4. Refer to Table E-1, Appendix E for racial composition percentages for communities in the HGLA SSA.

3.19.2.5 Housing

This section examines housing supplies and occupancy in the SSA, focusing on the area within a 60-minute drive of the HGLA and as described in Section 3.19.3.4 of the DEIS/PA.

Rental and Ownership Housing: The USCB provides 2012-2016 data for rental and ownership housing in and around the HGLA SSA, including Inyo, Kern, and San Bernardino counties and the communities listed in Appendix E, Table E-2.

Hotels and Other Transient Housing: Hotels and transient housing remains essentially unchanged as described in Section 3.19.3.4 of the DEIS/PA, with southern Inyo County having limited hotel, motel, and RV capacity and Ridgecrest having the bulk of the available hotel and motel rooms. Lone Pine has around 300 rooms in approximately 10 hotels and motels, and the two motels in Olancha have a total of 20 rooms as previously described. Two RV and mobile home parks are in the vicinity of the HGLA containing 140 RV spaces combined.

3.19.2.6 Economic Conditions

Kern and San Bernardino counties are geographically large, with the HGLA SSA's 60-minute area encompassing only very small portions of their territory. As employment and income time-series data are tabulated primarily at the much broader county level, these county-wide data may not be applicable to the smaller SSA. However, the

HGLA SSA does incorporate a significant portion of Inyo County and, as a result, county-wide data for Inyo County may be somewhat more indicative of conditions in the HGLA SSA. This section presents the available employment and income data describing past and current economic conditions in the three counties, with application to the smaller SSA conditions where appropriate.

Employment and Income: From 2012 to 2016, the percentages of the population age 16 or older who were employed in the civilian labor force varied from zero percent in Johannesburg and Trona to 55.4 percent in Inyo County, which featured the greatest percentage of employed laborers relative to Kern and San Bernardino counties. Those employed in the military accounted for 2.2 percent of Ridgecrest's labor force, which featured the greatest percentage of military employees relative to military employment in Inyo, Kern, and San Bernardino counties and the communities of Independence, Lone Pine, California City, Johannesburg, Mojave, Randsburg, and Trona. The USCB did not provide employment data for Red Mountain.

According to economic characteristics compiled for the USCB's 2012-2016 American Community Survey, individuals employed in the educational services and health care and social assistance industry accounted for the largest single percentage of employees in Inyo, Kern, and San Bernardino counties with 21.7 percent, 19.6 percent, and 22.3 percent of employees, respectively. Individuals employed in Inyo County's arts and entertainment industry, Kern County's agricultural industry, and San Bernardino County's retail trade industry accounted for the second-largest percentage of employees (USCB 2012-2016).

Educational services, arts and entertainment, public administration account for the largest percentages of workers in the communities mentioned above. This is particularly apparent in Randsburg, where 68.2 percent of its employees work in public administration and 31.8 percent of its employees work in the arts and entertainment industry. Of those cities having workforces, unemployment is greatest in California City at 17.9 percent and least in Ridgecrest at 5.3 percent, Inyo County's December 2017 unemployment rate was 3.8 percent (California Employment Development Department 2018). Statewide, California's unemployment rate totals 4.3 percent, matching the nation's 4.3 percent rate.

Median household incomes and per capita incomes for the three counties and associated communities in the HGLA SSA, as well as the state of California are provided in Appendix E, Table E-3. Across these geographies, median household incomes vary by approximately 127 percent and per capita incomes vary by approximately 168 percent.

3.19.2.7 Environmental Justice

Environmental justice concerns minority populations and low-income populations. Minority populations are considered to be those who do not identify themselves as white only and account for more than 50 percent of a given geography's population. Low-income populations are those individuals and families for which annual incomes are not greater than the poverty level that the federal government establishes. The poverty level is the point at which an individual's or family's annual cash income is insufficient to provide food and other needs. Three census tracts cover the majority of the HGLA SSA: Census Tract 8 in Inyo County and census tracts 52.01 and 52.03 in Kern County. In these census tracts, no minority populations exist as defined above. Low-income populations account for 15.3 percent of residents in Census Tract 8, 12.4 percent of residents in Census Tract 52.01, and 23.1 percent of residents in Census Tract 52.03, which lies farther south of Census Tract 52.01 (USCB 2012-2016).

3.20 LANDS WITH WILDERNESS CHARACTERISTICS

3.20.1 Applicable Regulations, Plans, Policies/Management Goals

BLM Manual 6320 provides policy and guidance for considering lands with wilderness characteristics in the land use planning process. Managing wilderness resources is part of BLM's multiple-use mission. Lands identified for protection of their wilderness characteristics in a land use plan are not managed as part of the National Wilderness Preservation System, the NLCS, or recommended as Wilderness Study Areas or for wilderness designation, but the BLM uses the land use planning process to determine how to manage lands with wilderness characteristics, as part of BLM's multiple-use mandate. When such lands are present, BLM examines options for managing these lands and determine the most appropriate land use allocations. The BLM completed a wilderness characteristics inventory for those lands within the DRECP LUPA. The analysis regarding lands with wilderness characteristics contained in this FEIS was not provided in the DEIS/PA.

BLM has a responsibility under Sections 201 and 202 of FLPMA to maintain updated inventories for lands with wilderness characteristics (LWC) and to consider protection of and impacts to this resource in our project and RMP level planning (Per IM No. 2011-154). BLM must analyze the effects of (1) plan alternatives on LWCs, and (2) management of LWCs on other resources and resource uses.

This can result in several outcomes, including: emphasizing other multiple uses as a priority over protecting wilderness characteristics; emphasizing other multiple uses while applying management restrictions (conditions of use, mitigation measures, reclamation standards) to reduce impacts to wilderness characteristics; and emphasizing protection of wilderness characteristics as a priority over other multiple uses.

Section 201 requires BLM to maintain on a continuing basis an inventory of all public lands and their resources and other values. This inventory requirement includes maintaining information regarding wilderness characteristics. Section 201 also provides that the preparation and maintenance of this inventory shall not, in itself, change or prevent change of management or use of the lands. Inventories should follow guidance developed in Attachment 1 of IM No. 2011-154.

Section 202 of FLPMA requires BLM to rely on resource inventories in the development and revision of land use plans, including inventory information regarding the wilderness characteristics. BLM will continue to consider the wilderness characteristics on public lands as part of its multiple-use mandate in developing and revising land use plans and making subsequent project level decisions. BLM Manual 6320 provides instructions on how to consider LWCs in the BLM land use planning process.

In some circumstances, consideration of management alternatives for lands with wilderness characteristics may be outside the scope of a particular planning process (as dictated by the statement of purpose and need for the planning effort). For example, a targeted amendment to address a specific project or proposal may not in all circumstances require consideration of an alternative that would protect wilderness characteristics. In these situations, the NEPA document associated with the plan amendment must still analyze effects of the alternatives on lands with wilderness characteristics.

The DRECP LUPA has a single goal for wilderness characteristics, which is to “ensure that adequate consideration and protection is given to lands with wilderness characteristics outside of designated Wilderness and Wilderness Study Areas and that these areas are managed to protect wilderness characteristics where appropriate in concert with other multiple-use and sustained-yield objectives.”

Wilderness inventories were completed in July 2010 and in March 2012 in preparation for the HGLA DEIS/PA. These inventories covered Wilderness Inventory Unit (WIU) #CDCA 133 (Lava Domes) and WIU #CDCA 131 (Coso) in the proposed HGLA.

Extensive geothermal development would be incompatible with protecting and preserving lands with wilderness characteristics. If extensive geothermal reserves are located within any part of the HGLA identified as having wilderness character, these lands should be withdrawn from WIU # CDCA 131-1. However, at this time it is not known whether these lands contain any geothermal resources, or if they do, whether these resources are of sufficient quantity or sufficient quality to be exploited profitably. The BLM would apply BMPs (conditions of use, mitigation measures, and reclamation standards) to prevent unnecessary degradation to lands identified as having wilderness characteristics, until the existence and nature of the geothermal resource is confirmed and understood.
BMPs and stringent reclamation requirements would be implemented, particularly with respect to initial exploration. Exploration may not find geothermal reserves and may not lead to development. BLM would not want to allow actions that would diminish wilderness characteristics unnecessarily.

3.20.2 Affected Environment and Existing Conditions

Approximately 7,000 acres of LWCs exist within the HGLA. These acres exclude two short roads to pumice mines (SE430 and SE431), as well as the mines themselves. They include three vehicle routes that do not qualify as wilderness inventory roads. Two routes (SE986 and 985) extend less than a mile each into the LWC. The third route, SE756, runs the length of the LWC, but does not qualify as a wilderness inventory road for most of its length. It constitutes one mile of primitive jeep trail within the HGLA. In total, the three routes account for a total of 3.75 miles of vehicle route within the LWC-eligible portion of the HGLA. None of these vehicle routes affect the integrity of the LWC within the HGLA. They are too small in number, too far apart, and too short in length to isolate contiguous parts of the LWC.

An area must be at least 5,000 acres or more to meet minimum wilderness size requirements. Any change in the number, extent, location, or permanence of vehicle routes, corridors, and other developments could isolate and disqualify parts of the LWC from wilderness consideration (see previous discussion of impact levels).

Natural Condition - Three primitive vehicle routes totaling 3.75 miles in length are located within the part of the HGLA identified as having wilderness characteristics. Otherwise, there are no manmade developments, no developed ROWs, no pipelines, no transmission lines, no active mines, and no large man-made disturbances. The imprint of man's work is substantially unnoticeable. The area remains natural, because it is undeveloped. It is affected primarily by the forces of nature. It is an area where earth and its community of life are untrammeled by man. In these respects, the area stands in contrast to the more heavily developed lands within the HGLA to the west, where man and his works already dominate much of the landscape.

The BLM's original 1979 wilderness inventory found that approximately 26,486 acres located in the Coso Mountains and Joshua Flat met wilderness criteria. However, the numerous mines and associated roads and trails in the remainder of the area, specifically in Cactus Flat, McCloud Flat, and in the adjacent mountains to the west, were found to have substantially noticeable imprints of man. As a result, these areas were determined not to have wilderness character. They were subsequently dropped from wilderness consideration.

In 1994, the California Desert Protection Act designated 49,296 acres of wilderness within the original WIU #CDCA 131. The new Coso Range Wilderness encompassed all of the 26,486 acres previously determined to have wilderness character and an additional 22,810 acres more.

The remaining areas of the original WIUs currently under consideration are west and south of the Coso Range Wilderness. An updated inventory was conducted in July 2010 in response to interim BLM guidance that was evolving and not formalized at that time. This inventory found none of these remaining areas to have wilderness characteristics. The inventory relied heavily on the 1979 findings and decisions and was not field checked. Subsequent to this inventory, formal inventory requirements were adopted by the BLM and are contained in BLM IM-2011-154/Manuals 6310 and 6320.

In March 2012, a new inventory was completed with extensive field checks. It resulted in the following findings:

1. WIU #CDCA 133 (Lava Domes) does not qualify as an LWC due to insufficient size. This unit is bounded and isolated on all sides by wilderness inventory roads: Gill Station Road, SE435, SE432, and SE433. The unit's small size (2,560 acres) does not meet BLM's size requirements for lands with wilderness characteristics.
2. WIU #CDCA 131 (Coso) contains areas that qualify as LWCs and areas that do not qualify. The unit was subsequently broken up into 3 subunits and evaluated as shown in Table V-1, Appendix V.

Approximately 7,000 acres or 32.8 percent of WIU #CDCA 131-1 falls within the proposed Haiwee Geothermal Leasing Area. This represents about 32 percent of the proposed leasing area as a whole.

The 2012 inventory found 4,481 acres identified as WIU #CDCA 131-3 did not qualify as an LWC due to insufficient size.

The 2012 inventory found another 2,560 acres identified as WIU #CDCA 131-2 that met the size requirement but did not meet other requirements. WIU # CDCA 131-2 encompasses the part of Cactus Flat east of SE756 that was left out of wilderness. It meets the size requirement because it is immediately contiguous to wilderness. However, it does not meet requirements for naturalness, solitude, or opportunity for primitive and unconfined recreation.

The 2012 inventory found 21,322.5 acres identified as WIU #CDCA 131-1 to have lands with wilderness characteristics (LWC). WIU #CDCA 131-1 is located north of Gill Station Road, south and west of the Coso Range Wilderness and the China Lake Naval Air Weapons Station, east of Haiwee Reservoir, and east of any developed and/or heavily disturbed private or public lands west of US 395. The unit encompasses most of the rugged mountains between US 395 and the Coso Range Wilderness, all of McCloud Flat, and part of the remaining area of Cactus Flat west of SE756. Approximately 7,000 acres or 32.8 percent of WIU #CDCA 131-1 falls within the proposed Haiwee Geothermal Leasing Area. This represents about 32 percent of the proposed leasing area as a whole. BLM WIUs within the DRECP LUPA Decision Area are depicted on Figure III.14-5 for the DRECP LUPA Final EIS (BLM 2016). A small portion of WIU #CDCA 131-1 is located within the DFA allocation land area located within the HGLA.

WIU #CDCA 131-1 meets the criteria for size: contiguous, suitable land of 5,000 acres or more. The soils here are soft and highly erodible. Vehicle routes frequently wash out, fall into disuse, and rehab on their own. Currently 12 open designated vehicle routes extend into WIU #CDCA 131-1. These routes total approximately 23 linear miles. Only a portion of one of these routes qualifies as a wilderness inventory road: the northern end of SE756 where it crosses Cactus Flat. The other routes do not qualify as roads because they are not constructed and/or regularly maintained and/or are not in frequent use. All 12 of the inventoried vehicle routes could be removed from the WIU without significantly reducing the area’s size or diminishing its integrity.

Only three routes are located within the 7,000-acre portion of WIU #CDCA 131-1 that overlaps the HGLA. These routes are unmaintained, user-created jeep trails, totaling less than 3.75 miles in length. The southern, unimproved end of SE756 supports an estimated 500 vehicles per year, but is not a constructed road and has not been maintained. The remaining two unconstructed and unmaintained routes, SE985 and SE986 support very little traffic (estimated at less than 20 vehicles per year).

The area is important biologically, and contains significant cultural resources Refer to Sections 3.7 and 3.8 for discussions of these resources in the area. For additional information on WIU #CDCA 131-1, see the DRECP LUPA (BLM 2016).

Chapter 4 Environmental Consequences

4.1 INTRODUCTION AND OVERVIEW

This chapter analyzes the direct, indirect, cumulative and residual impacts that could occur, or that are reasonably foreseeable, as a result of implementing each of the action alternatives described in Chapter 2 of this FEIS/PA, based on the RFD Scenario described in Appendix B. Residual impacts are those impacts that would remain after mitigation measures have been applied. The overall impact analyses criteria, methodology, assumptions on data availability, chapter format and terminology for each of the resources is identical to those detailed in Section 4.1 of the 2012 DEIS/PA. Impact methodology and criteria for each of the resource sections are detailed in the DEIS/PA and are not repeated in this FEIS/PA, except as noted.

For most of the following identified resources, it will not be necessary to conduct additional surveys or inventory for the proposed action because this FEIS simply identifies areas that may be available for exploration and development of geothermal resources and does not result in any ground disturbance or impacts to those resources. If future geothermal developments are proposed within the HGLA, the BLM will require the lease applicants to provide project-specific inventories for specific resources as well as conduct site specific NEPA review and analysis.

The analyses of impacts from the No Action Alternative have already been described in the CDCA plan, as amended, for most of the resources in this FEIS. Under this alternative, the CDCA plan, as amended, would not be amended to make the HGLA available for geothermal leasing and exploration, and the pending non-competitive leases would neither be denied nor authorized. Any future lease applications would be processed under the current land use plan guidance and evaluated under separate NEPA documentation. Reference to DRECP Volume IV – Environmental Consequences/Effects Analysis will be made for each resource under Alterative D.

As stated in Chapter 1 of this FEIS, the HGLA is located within the DFA, ACEC/CDNCL and SRMA land use allocation. Within ACEC/CDNCL areas, ground disturbance caps and ground disturbance mitigation govern surface disturbing activities.

Under the CDCA, as amended, all land within the HGLA is managed using CMAs. CMAs identify a specific set of avoidance, minimization, and compensation measures, and allowable and non-allowable actions for siting, design, pre-construction, construction, maintenance, implementation, operation, and decommissioning activities on BLM-managed lands. DRECP LUPA-wide CMAs are considered to be “umbrella actions” or standard practices for ensuring appropriate biological conservation and management through implementation of avoidance and minimization for activities. These DRECP LUPA CMAs are required for all activities, as specified in individual CMAs, throughout the entire DRECP LUPA Decision Area. The ACECs within the HGLA are managed using CMAs and a one percent disturbance cap. In addition to the DRECP LUPA-wide CMAs, ecological and cultural conservation CMAs apply within all ACECs and CDNCLs within the HGLA. Other CMAs are applicable within SRMAs and DFAs. The impact assessment considers the use of CMAs applicable to associated land allocation.

Mitigation measures designed to reduce or avoid impacts are identified in Appendix A of this document as BMPs; they will be applied by the Authorized Officer to the action alternatives, as appropriate. With any proposed project requiring additional authorization, site- and project-specific mitigation measures and stipulations may become part of that approval. Such measures are often based on the conditions at a specific location and on the characteristics of a specific proposed project. Therefore, additional mitigation measures and stipulations may be developed and applied as needed. In addition to the BMPs identified in Appendix A, applicable CMAs would be applied to protect resource values, and are identified and applied throughout the DRECP LUPA area or are specific to land use allocation (DFA, ACEC/CDNCL, SRMA).

4.2 AIR QUALITY

4.2.1 General Impacts

General impacts related to visible plumes and emissions remain unchanged from the DEIS/PA and can be located in Section 4.2.2.1 of the DEIS/PA. The pollutants are generally associated with geothermal plants are identical to those described in the DEIS/PA, including: Hydrogen Sulfide (H_2S), Oxides of Nitrogen (NOx), SO_2, PM_{10} and $PM_{2.5}$,, Carbon Dioxide (CO_2), Methane, Mercury, Volatile Organic Compounds (VOCs), (other) Reactive Organic Gases (ROG), Ammonia, and Arsenic.

Geothermal plants typically emit in a regional emissions budget only trace amounts of NOx, almost no SO_2, and small amounts of CO_2. The primary pollutant that a minority of geothermal plants must abate is H_2S, which is naturally present in many volcanic geothermal reservoirs. With the use of advanced abatement equipment, however, emissions of H_2S are regularly maintained below applicable California standards. Fossil fuel combustion only occurs as a result of the production of electricity at geothermal facilities during emergency generator use.

Detailed discussion of direct and indirect impacts to air quality is located in Section 4.2.2 of the DEIS/PA. Appendix F of this FEIS/PA also provides details on the emission assumptions and calculations.

Greenhouse Gas Emissions: According to the CEC (CEC 2016), CO_2 accounts for 82 percent of statewide GHG emissions, with methane accounting for about nine percent. Other pollutants account for the remaining percentage of GHG emissions in California. The transportation sector is the single largest source of California's GHG emissions, accounting for 37.3 percent of emissions statewide. In 2014, California produced 441.54 million metric tons of total carbon dioxide-equivalent (CO_2e) emissions (not including energy imports).

Table 4.2-6 of the DEIS/PA summarizes the estimated emissions of GHGs. The corresponding emission calculations are provided in Appendix F of this FEIS/PA.

4.2.2 Impacts By Alternative

Alternative A (Preferred Alternative) - The foreseeable and potential air quality impacts associated with Alternative A are discussed in Section 4.2.2.2 of the DEIS/PA and above. Any future geothermal development project would be required to undergo permitting by the GBUAPCD, and to comply with all conditions of the air permit issued under that permitting process. Under the DRECP LUPA, areas will be managed to protect their air quality and visibility in accordance with Class II objectives of Part C of the Clean Air Act amendments, unless designated another class by the state of California as a result of recommendations developed by any regional air quality management plan. In addition, leases issued under Alternative A would be subject to other applicable laws, regulations, formal orders, terms and conditions, and CMA requirements. In the event that future site-specific permitting studies would identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

The total annual emissions that are expected to result from construction activities within each phase of the realization of the RFD scenario are estimated as follows: Annual PM_{10} emissions are estimated to increase by 0.61 ton during exploration activities, by 2.56 tons per year during well field development activities, and by 1.22 tons per year during geothermal plant construction. Emissions associated with well testing could be controlled through injection of hydrogen peroxide or other fluids to control emissions of H_2S and other non-condensable gases from the wells.

Vehicle emissions from employee and delivery vehicles, as well as emissions from the cooling towers, would be the primary sources of pollutants during geothermal plant operation. The cooling towers are the primary source of gas emissions when using wet cooling towers during normal operations. However, wet cooling towers are an unlikely option given the limitation to use of groundwater to compensate for evaporative losses in wet cooling towers. Moreover, as discussed above, technology exists to control emissions of non-combustible gases, off-gassing releases from the condensate, and particulate matter (PM_{10} and $PM_{2.5}$) from cooling tower drift.

Since projected annual emissions of PM_{10} under the realization of the Haiwee RFD scenario would not exceed the 100 tons per year *de minimis* threshold, either for construction or for operations, the development and operation of the two geothermal plants would also be exempt from the General Conformity Rule and would not require a conformity review. Finally, the anticipated level of GHG emissions would not result in a significant impact on global climate, and the Haiwee geothermal leasing program would therefore not conflict with the provisions of AB 32.

Alternative B - Alternative B would result in air quality impacts similar as those described for Alternative A, but potentially less due to NSO in sensitive areas. The land available for surface development would be restricted to the DFA. NSO could result in less PM_{10} emissions due to reduced surface disturbance from construction and operation activities.

Alternative C - Geothermal development within ACECs/CDNCLs and SRMAs would not be an allowable use therefore, surface disturbance in those areas would not be allowed. This is no different than designating those areas as NSO. As a result, the foreseeable and potential air quality impacts associated with Alternative C would be generally similar to those for Alternative B.

Alternative D – Air Quality impacts associated with the No Action Alternative are discussed in the DRECP under Chapter IV.2 Air Quality.

4.3 NOISE

4.3.1 General Impacts

Given the location of existing, potentially sensitive noise receptors, construction noise from geothermal exploration and development activities, would not be expected to expose potentially noise-sensitive land uses to continuous noise sources louder than the existing sources such as off-highway vehicles. Noise would be generated by construction and well-drilling equipment during exploration and development and, at a lower level, during the subsequent operation of geothermal facilities. The principal noise sources during construction would be construction equipment and vehicles that would access the geothermal well and geothermal plant sites. Additional detail on general noise impacts generated from plant and well construction activities and plant operations are detailed in Section 4.3.2.1 of the DEIS/PA.

4.3.2 Impacts By Alternative

Alternative A (Preferred Alternative) - The foreseeable and potential noise impacts associated with Alternative A are discussed in Section 4.3.1 above and in Section 4.3.3 of the DEIS/PA. Alternative A would result in some temporary and permanent increases in ambient noise levels in the HGLA. The degree of impact would vary with the location of potentially sensitive noise receptors relative to the locations of exploration and operation activities. The locations of potentially sensitive noise receptors, and the corresponding degree of impact, would be identified as part of future site-specific permitting studies. For noise-sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific mitigation measures. Noise levels would also have to comply with the applicable noise limits issued by Inyo County. Noise impacts from construction would be relatively short-term. Noise impacts from operations would be considered long-term and increase noise levels in the immediate area of the plants, but it would not produce significant increases in noise levels to receptors located more than 0.5 mile from the geothermal generating facilities. However, any future geothermal development project would be required to comply with Inyo County's noise ordinance, to the extent consistent with federal law. In addition to meeting County maximum allowable noise thresholds, leases issued under Alternative A would be subject to other applicable laws, regulations, formal orders, the terms and conditions of BLM's standard lease form and CMA requirements. In the event that future site-specific permitting studies would identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

Alternative B - Alternative B would result in noise impacts similar to Alternative A as geothermal development occurs within the HGLA. Additionally, surface development would be restricted to the DFA, limiting the potential source location of noise. The NSO stipulation for specific areas of Alternative B will not change the application of the RFD to the HGLA, only the location as previously stated. Therefore, the foreseeable and potential noise impacts associated with Alternative B would be generally similar as those for Alternative A. Any future geothermal development project would still be required to comply with the Inyo County noise ordinance, and leases issued under Alternative B would be subject to existing laws, regulations, formal orders, terms and conditions, and CMA requirements.

Alternative C - The foreseeable and potential noise impacts associated with Alternative C would be similar to those for Alternatives A and B, but would only occur within the DFA. Leases issued under Alternative C would be subject to applicable stipulations, BMPs, and mitigation measures as well as to existing laws, regulations, formal orders, terms and conditions, and CMA requirements.

Alternative D - Noise impacts associated with the No Action Alternative are discussed in the DRECP under Chapter IV.21, Noise and Vibration.

4.4 TOPOGRAPHY, GEOLOGY AND SEISMICITY

4.4.1 General Impacts

As described in Section 4.4.2.1 of the DEIS/PA, some seismic or volcanic activity in the HGLA could occur naturally or resulting from changes in subsurface pressures from the extraction and injection of geothermal fluids. However, design of geothermal resource production and injection would minimize changes in reservoir pressure. Geothermally induced micro seismicity is not of sufficient magnitude to rupture the ground, and geothermal induced volcanism is not known. Small local venting of hydrothermal fluids related to extreme shallow pressure drawdowns is not likely to occur in the HGLA because the resource is very deep and geothermal developments would be designed to minimize reservoir pressure changes.

The BLM has developed draft evaluation guidance available for use to determine seismic risk related to geothermal development. This risk assessment would be used to determine the potential for induced seismicity of a proposed project, and would reduce the potential for impacts caused as a result of induced events.

The HGLA is currently largely undeveloped economically and has a small human population. The minor, transient nature of the micro seismic events typically related to geothermal activity, relative to the large seismic events which naturally occur in this area, suggest that damage would most likely fall in the nuisance category.

Extensive seismic networks are present to monitor earthquakes in the region operated by the Southern and Northern California Earthquake Centers and a micro-earthquake network within the Coso geothermal field.

4.4.2 Impacts By Alternative

Development of HGLA's geothermal resources under Alternatives A, B, and C would result in the clearing and grading of an estimated 404 acres for well sites, well fields, and the geothermal generating facilities and associated infrastructure. Utilization of the HGLA geothermal resource could result in some level in local micro seismicity, but the frequency, magnitude, and duration and magnitude of such events cannot be predicted. As with most geothermal developments in deep fractured reservoirs for which injection is part of reservoir management, induced micro seismicity is a possibility. However, given the risk assessment conducted by the BLM, the small nature of the seismic events, the sparse population in the vicinity and, the high level of natural seismicity, it is not likely to be significant. Extensive seismic monitoring would allow for potential induced seismicity to be monitored for each development.

Development of HGLA's geothermal resources under each Alternative would be conducted consistent with all applicable laws, regulations, formal orders, the terms and conditions of BLM's standard lease form and CMA requirements. In the event that future site-specific permitting studies would identify sensitive resources that warrant additional protection or preservation, the BLM would also stipulate appropriate, project-specific onsite mitigation measures.

The NSO stipulation for sensitive areas of Alternative B will not change the application of the RFD to the HGLA other than the locations where development occurs.

Impacts to Geology associated with Alternative D are analyzed in the DRECP under Chapter IV.4 Geology and Soils.

4.5 SOILS

4.5.1 General Impacts

The anticipated impacts to soil resources from geothermal exploration and development include physical disturbance (e.g., movement or removal), compaction, changes to erosion patterns, and changes to the largely undisturbed conditions within the initial direct RFD impact areas covering an estimated 404 acres of the 24,574-acre HGLA. Following post-construction reclamation, the soils in 276 acres of land will remain altered or removed. General impacts on soils are related to the clearing of exploration and construction areas and access roads, drilling of wells, and the movement of vehicles and construction equipment with the realization of the RFD as described in Section 4.5.2.1 of the DEIS/PA remain unchanged. Environmentally sensitive siting of future RFD facilities, should they be realized, and application of the appropriate BMPs and mitigation measures, are expected to reduce impacts to soils to less than significant levels, resulting in only minor and local, if any, soil loss from the HGLA.

4.5.2 Impacts By Alternative

The foreseeable and potential impacts to HGLA soils associated with Alternatives A, B, and C are similar to those discussed in above and detailed in Section 4.5.2.1 of the DEIS/PA. Approval of a site-specific GDP, POO, or POD would be required before ground-disturbing activities could occur. The degree of impacts to soils will vary with the soil characteristics of future development sites, but consistently includes temporary soil alterations to 404 acres of the HGLA, and long-term disturbance to 276 acres. However, adherence to state and county soil erosion and sediment control measures and construction storm water management regulations would minimize or eliminate other impacts such as erosion and compaction outside construction areas. In addition, leases issued under Alternative A would be subject to other applicable laws, regulations, formal orders, terms and conditions, and CMA requirements. In the event that future site-specific permitting studies would identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures. Impacts to Soils associated with Alternative D are analyzed in the DRECP under Chapter IV.4 Geology and Soils.

4.6 WATER RESOURCES

The RFD scenario for the HGLA anticipates that Dual-flash technology will likely be used (rather than binary) since the nearby Coso geothermal plants use this plant design, and the resource parameters for the HGLA could be similar in terms of temperature and flow. These resource assumptions, however, do not preclude a binary process from being the technology of choice. A binary process might be preferable if a resource was identified that had more moderate temperatures than those currently found in production wells at Coso, or based upon the source and type of surface water or groundwater supplies that may be available for plant operations. The level of surface disturbance is roughly equivalent in acreage for both dual-flash and binary technologies, as are the volumes of freshwater consumption for well drilling, construction and light industrial use. The principal difference between them is that the operation of binary systems consume relatively less groundwater than dual-flash systems, but flash systems, while consuming little freshwater for plant operations, do consume and eventually may degrade the geothermal reservoir. Other types of geothermal systems are not expected to be identified in this location, and thus were not analyzed.

4.6.1 General Impacts

<u>Water Utilization and Consumption by Plant Design</u>

<u>Geothermal Plant Design and Operation--Flash</u>

Where the geothermal resource temperatures are high enough for the geothermal fluid to “flash” or transition to steam on contact with ambient atmospheric conditions when produced at the surface (generally above 350 degrees

Fahrenheit), dry steam or dual flash power plants can produce energy by utilizing this fluid directly to turn a turbine. (See PEIS for Geothermal Leasing in the Western United States (2008) at pp. 4-4-41- 4-46).

Surface Water Impacts --Flash Plants

No significant surface water or freshwater supplies are consumed to operate or cool a flash plant beyond the drilling and plant construction stages. This may appear to be an option in the southern portion of the area HGLA, where freshwater supplies are limited. However, under current technologies and industry practices, flash plants must use evaporative or "wet cooling" to condense the spent geothermal fluid before it can be reinjected back into the reservoir, and evaporation rates can approach 90% of the fluid produced in hotter seasons. Over many years, this practice can result in impacts to the geothermal resource reservoir.

Groundwater Impacts --Flash Plants

Fluid produced from geothermal reservoirs usually occurs much deeper than freshwater aquifers, and while "geofluid" does function as a type of groundwater, it is not in demand for other purposes due to its high temperature and mineral content. In water-cooled plants, fluid not lost to evaporation is injected back into the reservoir to maintain reservoir pressures. It is only after decades of continuous operation that a geothermal reservoir may suffer drawdown to the point where the function of the geothermal system becomes degraded and power production at a flash plant may decline with reservoir pressures. In such circumstances, operators at dual-flash plants like Coso and the Geysers have contracted to supplement their available geofluid supply by injecting freshwater from surface aquifers or other groundwater sources to recharge the geothermal reservoir. While this secondary demand may impact surface water sources directly, there is also the potential for large scale geofluid recharge projects to impact shallow aquifers and the subsurface sources of recharge for the existing surface water bodies. The source for this water is currently unknown because each project developer would need to obtain water through legal sources. The BLM will prohibit or restrict by stipulation any groundwater extraction in the HGLA for consumptive use. In the case of the Geysers geothermal area, a mutually beneficial solution was reached where treated wastewater (undesirable for domestic or irrigation uses) is now used as the source of water necessary to recharge the geothermal reservoir.

New methods of dry or air cooling for flash plants is at the research and development stage. Therefore, it would be speculative to presume that flash plants would either draw down shallow freshwater aquifers that overlie the geothermal reservoir need to recharge the reservoir with supplemental freshwater supplies and thereby strain the recharge capacity of those aquifers or the surface water bodies.

<u>Geothermal Plant Design and Operation—Binary</u>

Groundwater Impacts—Binary Plants with wet cooling

In contrast to dry flash and dual-flash plants, binary geothermal plant designs utilize the heat in geothermal resource fluid indirectly, in a closed-loop system whereby the geofluid is never exposed to the atmosphere. Therefore, impacts to the resource reservoir are negligible. To the extent that geofluid can be considered a type of groundwater for these purposes, the fluid is diverted and utilized, but it is not consumed. It should be noted that under both California law and the federal definition, no "water allocation" is involved in utilizing (or consuming) geothermal resource fluid, because both regulatory schemes classify geothermal resource as being mineral in character, and not a groundwater resource subject to water allocation permitting.

A working fluid with a lower boiling point is used to turn the turbine in a binary plant. Therefore, all of the produced geofluid is reinjected back into the reservoir, so drawdown and degradation of the geothermal reservoir is not an issue, and new demands for freshwater supplies at the 30-year mark would not be a concern. (See PEIS for Geothermal Leasing in the Western United States (2008) at pp. 4-4-41- 4-46).

Surface Water Impacts—Binary Plant with wet cooling

While a binary plant design is better suited for geothermal resources in a lower temperature range, (225-350 degrees Fahrenheit) the produced geofluid must similarly be cooled prior to reinjection, and therefore another water source (i.e., freshwater supplies such as surface water or shallow aquifers) will be needed if evaporative cooling methods are used. The source for this water is currently unknown because each project developer would need to obtain water through legal sources. The BLM has decided to prohibit or restrict by stipulation any groundwater extraction in the

HGLA for consumptive use. The table below (Shevenell, 2011) offers an indication of the volume of water (or geofluid, for the flash plants listed) consumed and the proportion lost in plant operations, largely from evaporative "wet" cooling.

Fluid Loss (usage) in California Binary and Flash Geothermal Power Plants

	MW	% Loss	Acre-feet/year
Binary Powerplant			
Casa Diablo	40	4%	623
East Mesa	49.5	4%	2,518
Heber	92	6%	2,556
Multi-stage Flash			
Coso	273[3]	48%	13,540
Salton Sea	340	18%	10,807

Binary Plant with Dry Cooling or Air Cooling: Negligible Impacts to Surface or Groundwater Supplies
The binary plant examples above that use evaporative "wet" cooling methods were typical of plants in arid climates with high summer temperatures in 2010. In the HGLA, dry "air" cooling was not considered economic, since plant efficiency and production levels suffer significantly if dry cooling is used in hot seasons, when the differential between air temperature vs. condensed and injected resource temperatures declines. For this reason, the RFD assumes that air-cooled binary plants are unlikely in the HGLA. However, air-cooled geothermal power plants typically require no supplemental water for cooling purposes, and have the added benefit of avoiding impacts to the geothermal resource reservoir. With recent drought concerns and dwindling surface- and groundwater supplies, nearly all new binary plants constructed in the past five to seven years have been designed for air cooling full time, or at least seasonally (known as hybrid dry cooling) in the most arid climates. It is speculative whether consideration of these factors would lead potential lessees in the HGLA to decide that full time air cooling or binary plant designs might be economically feasible. Decisions may be influenced by water allocation permitting. Withdrawals would be denied under the groundwater protection stipulation developed for the HGLA if they would exceed the natural recharge levels in the aquifer that feeds Little Lake.

Availability of Data and Analysis Challenges

DOE's *Report to Congress on the Interdependency of Energy and Water*[4] uses data from two Northern California Power Agency plants as representative; however, the report fails to differentiate between geothermal fluid and freshwater usage. In addition, figures for "water use" versus consumption of either source are often misleading, because they often do not differentiate between utilization and consumption. As described above, binary plants consume virtually no geothermal "groundwater" or fluid, but may consume freshwater for cooling usage; whereas the reverse is true with flash plants. Modern advanced-cooling technologies may combine aspects of both water- and air-cooling to improve performance in geothermal operations, or may utilize a second source of renewable energy such as solar power to offset seasonal inefficiencies in air cooling. Such hybrid systems reduce water-cooling requirements while maintaining (or improving) plant efficiency.

To better understand potential impacts of geothermal development in the HGLA, Argonne National Laboratory (ANL) evaluated and estimated both annual fresh water and geofluid consumption for prospective geothermal power

[3] The volumes of acre-feet consumed in evaporative cooling in these flash plant examples appears more drastic due to the larger plant sizes (e.g., 273 MW for Coso vs. 40 MW for Casa Diablo). While it is an oversimplification to correct for the MW difference alone (as temperature and pressure differences also affect volume), such a calculation would show that 40 of Coso's MW might consume 1,983 acre-feet of geofluid annually, as compared to the 623 acre-feet of freshwater consumed to produce 40 MW at the wet-cooled binary Casa Diablo plant.
[4] Report to Congress on the Interdependency of Energy and Water; Department of Energy, 2006.

plant operational use in the HGLA for this DSEIS (see Argonne, 2016). Four geothermal power plant scenarios were modeled using the United States Department of Energy's Geothermal Electricity Technology Evaluation Model. Parameters for the power plant scenarios were developed according to characteristics of the HGLA as described in the DEIS. In addition to the 30-MW wet-cooled dual-flash power plant described in the DEIS (RFD scenario: HF-1), the BLM asked Argonne to evaluate three 49-MW power plants: a wet-cooled dual-flash (HF-2), a wet-cooled binary (HF-1), and an air-cooled binary (HB-2).

The results from the ANL model runs are as follows:

"*For the hydrothermal flash scenarios, there appears to be slight water efficiency gains for a 49-MW power plant over a 30-MW power plant with a normalized average annual geofluid water consumption of 59 acre-feet per year per MW versus 60 acre-feet per year per MW. . . .Plotting these consumption values versus temperature shows a strong trend of decreasing water consumption at higher temperatures*" per megawatt. However, "*for those temperatures where both hydrothermal binary and hydrothermal flash can operate, water consumption for the binary power plant is less than the flash power plant. The* [Flash plant] *relies on water from the geothermal reservoir for cooling, while the [wet-cooled binary plant] requires another water source for cooling needs. Modeling for this analysis considered a power plant lifetime of 30 years; however, long*[er]*-term reliance on water* [geofluid] *from the geothermal reservoir to support a flash plant is likely to require supplemental injection from another source, as has occurred at Coso (BLM 2009; LADWP 2009). The scenario with the least water consumption is* [the air-cooled binary plant] *due to the use of air-cooling. While the most water efficient scenario is* [air-cooled binary], *binary systems may not be practical for all conditions evaluated*" (Argonne 2016).

While this conclusion is correctly stated, it is not reflected in the model or the data. The ANL model itself suffered from limited data and similarly failed to differentiate between these types and sources of fluid consumption. The ANL modeling effort supports the water use assumptions in the groundwater flow model (Appendix G) developed for the RFD scenario as described in the DEIS and DSEIS. Only a binary plant would require a water allocation permit or a source of surface water for normal operations, because geofluid is a mineral resource under the GSA and CA definitions.

Summary of Impacts to Surface Water Supplies

The Haiwee RFD scenario will require surface water for well drilling, dust control and construction, but consumption volumes from these stages are of limited duration and are not likely to have a significant impact on freshwater supplies. General surface water impacts from the Haiwee RFD scenario could include impacts to wetlands, groundwater recharge areas, surface waters like Little Lake, and floodplains as described in Section 4.6.2.1 of the DEIS/PA, in the event that wet-cooled binary plant designs are chosen. Impacts to surface waters from the operation of flash plans are not expected to occur during at least the first 20 years of normal flash plant operations. These impacts are applicable to the Alternatives described in this FEIS/PA, as well.

Summary of Impacts to Groundwater Supplies

The Haiwee RFD scenario will require surface water for well drilling, dust control and during construction. In addition, although flash plants do not require or consume surface water during normal operations, there may be a need for the injection of makeup water from surface sources to compensate for evaporative losses of geofluid during plant operations that may eventually degrade the geothermal groundwater reservoir. The potential for such a significant drawdown of the brine groundwater source would only take place over a very long term (after approximately 30-plus years of operations), but if reservoir pressures do decline, an outside source of water might be needed to maintain plant operation if the flash plant designs include conventional (wet) cooling towers. The source for this water is currently unknown because each project developer would need to obtain water rights. However, based on the limited availability of groundwater underneath the HGLA, the BLM will prohibit or restrict by stipulation any groundwater extraction in the HGLA for consumptive use. General groundwater impacts from the Haiwee RFD scenario could include impacts to groundwater and are described in Section 4.6.2.1 of the DEIS. These impacts are applicable to the Alternatives described in this FEIS, as well.

Potential for Long-Term Impacts to Water Supplies

A numerical groundwater flow model was used to evaluate potential impacts of prolonged groundwater extraction with the realization of the Haiwee RFD scenario (Appendix G). Simulations were conducted to evaluate the impacts to local groundwater resources from pumping the required makeup water quantities by water-cooled plants. This modelling remains valid for the alternatives considered in this FEIS, as well.

Analysis presented in Appendix G indicate that if long-term groundwater extraction from the local, near surface groundwater aquifer, were to be sought in the later years of plant operations to augment geothermal reservoir fluid levels, continuous efforts to recharge the geothermal resource reservoir would likely have significant long-term impacts on groundwater resources in Rose Valley. In particular, surface water features such as Little Lake at the south end of Rose Valley may be impacted over the life of a plant, in the absence of the groundwater stipulation SA-HGLA-10. In addition, this analysis indicated that groundwater resource impacts from multiple groundwater development projects in the area are likely to be additive. Groundwater extraction rates to offset the projected evaporative loss and loss via other processes were estimated at up to 2,340 ac-ft/yr for a typical 30 MW geothermal flash plant, or 4,680 ac-ft/yr for the two geothermal flash plants projected under the Haiwee RFD scenario. For a typical 30-year geothermal project life, the potential for makeup water extraction, if needed to extend the productive life of a flash plant, would represent a significant use of local groundwater. Analysis presented in the Hay Ranch Groundwater Extraction Project Draft EIR (MHA 2008), indicated that groundwater extraction for that project could have significant adverse effects on existing groundwater uses in Rose Valley, including a lowering of the local groundwater elevation and the potential for a reduction of groundwater flow towards Little Lake.

Protective Stipulation to Ensure Sustainable Groundwater Supplies in the HGLA

The BLM has established stipulations in this FEIS to ensure protection of these groundwater supplies that will be part of the terms of individual leases in the HGLA. These stipulations include the ability to deny development permits or to issue non-compliance notifications, if necessary, should groundwater extraction exceed the safe yield as defined by SA-HGLA-10. Administrative Stipulation SA-HGLA-10 (see Chapter 2, Section 2.6) will be attached to any geothermal leases issued within the HGLA with items SA-HGLA-10a, SA-HGLA-10b, and SA-HGLA-10c lined out, removed, and not in effect. Groundwater extraction for consumptive use may have other requirements or restrictions to be determined on a project- or activity-specific basis.

4.6.2 Impacts By Alternative

Alternative A (Preferred Alternative) - Groundwater extraction for consumptive use during exploration, development and plant operations may be allowed for some leases. Such use, when combined with all other uses that have been approved within the Rose Valley, may not exceed the safe yield or recharge rate to the Rose Valley Aquifer and may not cause a decline of 10 percent or more to the average annual flow of water flowing into the surface features at Little Lake. Special Administrative Stipulation SA-HGLA-10 (see Chapter 2, Section 2.6) will be attached to any geothermal leases issued within the HGLA. Groundwater extraction for consumptive use may have other requirements or restrictions to be determined on a project- or activity-specific basis.

The foreseeable and potential impacts to the water resources of the HGLA and surrounding areas that could be associated with Alternative A are discussed above in Section 4.6.2.1 and in Section 4.6.2.1 of the DEIS/PA. Assuming that consumptive groundwater use does not occur during exploration and development, the foreseeable and potential impacts of Alternative A to the water resources of the HGLA and surrounding areas are expected to be minor, and largely limited to local changes in groundwater recharge or runoff patterns. Alternatively, should consumptive water use occur under specified stipulations during geothermal exploration, development, and operations, impacts would be moderate. Any effects to the Coso Hot Springs from Alternative A (or under any of the alternatives) are unlikely due to the distance between the Coso Hot Springs and the HGLA, the likely discontinuity between geothermal resources between the two areas, and the observed isotopic differences in the waters. Moreover, surface manifestations in such hot springs reflect natural seasonal (and sometimes diurnal) variations (Geologica 2007).

With regard to surface water impacts, and until a proposed site-specific development is available for the BLM to analyze under a separate NEPA document, the specific locations of ground disturbing activities are not known at this time. Soil erosion and runoff from disturbed areas could potentially cause increased sedimentation and decrease in water quality in wetlands. However, due to infrequent precipitation in the area, absence of onsite or adjacent surface waters, and implementation of BMPs required under the NPDES General Permit and the Inyo County SWPPP, impacts to water quality are anticipated to be low and not expected to be in violation of water quality standards or impairment of beneficial uses of wetlands. The potential for direct impacts to the floodplain would be low since geothermal development would be sited to avoid flood prone areas. The increase in impervious surface area would be minimal overall and the potential for impacts to hydrology would be low. In the event that future site-specific permitting studies would identify additional sensitive water resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

Alternative B - The foreseeable and potential water resource impacts associated with Alternative B would be generally similar to those for Alternative A, but the location of surface geothermal development would be restricted to the DFA, so the overall impacts would be lower. Alternative B provides additional protection of specific hydrological features such as playas, wetlands, and floodplains, for example, via issuance of controlled surface use, or NSO restrictions, thereby giving a higher level of protection to such sensitive areas. The majority of known wetlands and ephemeral streams are located within the sensitive areas being protected under the NSO rule in Alternative B (e.g., within ACECs/CDNCLs). Similarly, the potential for direct impacts to floodplain areas would be low since sensitive resource areas include critical groundwater recharge areas that would be closed to surface disturbance.

The acreage of disturbance might be concentrated in a smaller area than under Alternative A, thus having a greater potential to impact erosion, sedimentation, and recharge, but such areas could be protected by design restrictions. The increase in impervious surface area would be minimal overall and the potential for impacts to hydrology would be low. In the event that future site-specific permitting studies would identify additional sensitive water resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures within DFAs land allocation areas.

As under Alternative A, any future geothermal development project under Alternative B would be required to comply with the corresponding surface and groundwater permit programs by Inyo County and the state. In addition, leases issued under Alternative B would be subject to other applicable existing laws, regulations, formal orders, and terms and conditions, and CMA requirements.

Alternative C - The foreseeable and potential impacts to HGLA are generally similar to those of Alternative B, providing additional protection to important areas of the watershed. Any future geothermal development project would be required to comply with the corresponding surface and groundwater permit programs by Inyo County and the state. In addition, leases issued under Alternative C would be subject to other applicable existing laws, regulations, formal orders, terms and conditions, and CMA requirements.

Alternative D – Impacts to Water Resources from the No Action Alternative are described in the DRECP under Chapter IV.6 Groundwater, Water Supply and Water Quality.

4.7 BIOLOGICAL RESOURCES

4.7.1 General Impacts

The general impacts of the realized RFD scenario on vegetation, wildlife, special status species and important habitats and communities are discussed in detail in Section 4.7.2.1 of the DEIS/PA and summarized in Table D-4, Appendix D, and Table 4.6-1 in the DEIS/PA. It should be noted that, prior to the onset of any disturbance, mitigation measures, BMPs and construction and operation procedures and policies would be established to avoid and minimize the potential impacts. CMAs identified in the CDCA Plan as amended by the DRECP LUPA would be applied to protect sensitive resources, as appropriate. A full list and definition of potentially applicable CMAs is available in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA.

Many impacts can be reduced or avoided when resources are considered during the siting and design phase, and BMPs identified in Appendix A and CMAs as identified in the DRECP LUPA are applied. Site-specific measures would be developed as part of future site-specific analysis and permitting conditions at the time of subsequent proposed exploration, development or utilization activities. Ground disturbance activities associated with geothermal development may impact biological resources in areas identified for protection under conservation allocations (e.g., ACECs/CDNCLs), but may also occur in allocations identified as suitable for geothermal development under the DRECP LUPA (e.g., DFAs). Potential impacts are dependent on the location of geothermal development under each Alternative.

4.7.2 Impacts By Alternative

Alternative A (Preferred Alternative) - Under Alternative A, the management designations identified in the CDCA Plan, as amended by the DRECP, would remain in place. Management designations within the HGLA include Ayers Rock ACEC, Sierra Canyons ACEC, Rose Spring ACEC, Mohave Ground Squirrel ACEC, East Sierra SRMA, and lands identified as CDNCLs and DFAs. Goals and Objectives for these sensitive areas would be amended under Alternative A, as required, to allow geothermal leasing and development. This development may occur in areas where conflicts could occur. CMAs identified in the CDCA Plan as amended by the DRECP LUPA would be applied to protect sensitive resources in all land allocation areas.

The location of disturbance under Alternative A would not be restricted because of a change in allowable use within the HGLA, and disturbances may occur anywhere within the footprint, including all ACECs/CDNCLs, SRMA, and DFAs. However, the three currently proposed leases which would be authorized under Alternative A generally occur in the flatter portions of the HGLA. Because the location of disturbance would not be restricted, habitat fragmentation may increase under Alternative A. Potential disturbance locations would not be restricted to those areas of the HGLA that have been previously disturbed and may be distributed to previously undisturbed areas.

Impacts to vegetation include very slow recovery of plant cover, loss or change in native species populations, and reduced species diversity; increased risk of invasive species; increased risk of topsoil erosion and seed bank depletion; increased risk of fire; and alteration of water availability and seed dispersal. Appendix B details the acreage potentially impacted by geothermal leasing under the RFD. Impacts to these vegetation communities are potentially adverse. Impacts to ruderal and disturbed vegetation and developed land are considered to be minimal and do not require mitigation.

Introduction of non-native plant species would occur primarily during construction and could continue to occur during the operation and maintenance phase of realized RFD actions. Vehicles moved from other areas supporting non-native or invasive species could introduce non-native or invasive plants by transporting seeds that may be clinging to vehicle structures or that have been incorporated into soil adhering to the vehicle. In addition, the potential for establishment of invasive plants could be increased when construction vehicles alter the structure of existing soils through compaction or excavation, which alters the ability of native plants to compete with introduced plant species. The introduction or spread of non-native plant species would result in adverse impacts without mitigation.

The introduction of noxious weeds can have direct or indirect long-term effects on wildlife and wildlife habitat, and special-status plants and animals in more mesic environments, including stream channels, burned areas, and eroded slopes. Noxious plant species are largely confined to road edges, newly graded areas, and other areas where existing vegetation is crushed, and soils are impacted. Potential impacts associated with noxious weed introduction and spread would be minimized through the implementation of mitigation measures.

Protected and Special Status Species: Potential impacts to Special Status Species are described in detail in Section 4.7.2.2 of the DEIS/PA and would be similar to those described under General Impacts. The implementation of BMPs presented in Appendix A would reduce potential impacts to all sensitive species under Alternative A. Specific CMAs designed to protect various species were included in the DRECP. Additionally, general CMAs included in Section II.4.2 – *Conservation and Management Actions* of the DRECP would likely provide protection measures for all sensitive species.

Special Status Plants: Of 34 special status plant species determined to have a potential to occur in the vicinity of the HGLA, three special-status plant species have a high potential to occur, Darwin Mesa milkvetch (*Astragalus atratus* var. *mensanus*), Charlotte's phacelia (*Phacelia nashiana*), and white pygmy poppy (*Canbya candida*), 13 species have a moderate potential to occur, and the remaining species have a low potential to occur within the HGLA. Refer to Appendix D for information on the special-status plant species with a potential to occur.

Desert Tortoise: Previously recorded instances of desert tortoise and their known habitat indicate the species is most likely to occur in the northwestern portion of the HGLA. Potential impacts to desert tortoise from development of the RFD may include the permanent loss of up to 276 acres and the temporary disturbance of up to 128 acres of desert tortoise habitat, depending on the location of development within the HGLA. Development of the RFD under Alternative A could increase potential fragmentation of desert tortoise habitat by allowing development throughout the HGLA which may not all be suitable for the species.

Desert tortoise may experience direct impacts in the form of disturbance if individuals occur in areas developed under the RFD. Injury or mortality caused by crushing from heavy equipment or maintenance vehicles may occur under Alternative A. Ravens using transmission lines developed as part of the RFD as hunting perches may prey on desert tortoise in the HGLA, if transmission lines are located in desert tortoise habitat.

Potential impacts to desert tortoise would be avoided and minimized by the inclusion of BMPs described in Appendix A. The CDCA, as amended by the DRECP, also includes numerous CMAs which would reduce potential impacts to desert tortoise. CMAs contained in the DRECP LUPA are a mix of general applications and those specific to ACECs/CDNCLs, SRMAs, and DFAs and would be applicable under Alternative A depending on the location of geothermal development. CMAs to protect desert tortoise include, but are not limited to, preconstruction clearance surveys, use of exclusion fencing, use of biological monitors, and enforcement of project-wide speed limits. CMAs for the protection of desert tortoise specifically identified in ACECs/CDNCLs that would be open for geothermal development under Alternative A include prohibition of development where desert tortoise densities exceed five per square mile or 35 total individuals. A full list and definition of potentially applicable CMAs is available in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA.

Mohave Ground Squirrel: Analysis of Mohave ground squirrel habitat was included in the DRECP when DFAs, SRMAs, and ACECs/CDNCLs were designated. The CDNCL, Rose Hill, Ayers Rock, Sierra Canyons, and Mohave Ground Squirrel ACECs, were all identified as providing valuable habitat to the Mohave ground squirrel. The Mohave Ground Squirrel ACEC was identified to provide valuable habitat connectivity for Mohave ground squirrel between various existing ACECs/CDNCLs, BLM Wilderness areas, and NLCS designations which all collectively protect the species. Additional connectivity is provided between the military ranges to the north, east (China Lake NAWS) and south (Edward Air Force Base). All four ACECs would be open for geothermal development under Alternative A and may result in the permanent loss of 276 acres and temporary disturbance of 128 acres of Mohave ground squirrel habitat, depending on the location of development under the RFD. Development of the RFD under

Alternative A could increase potential fragmentation of Mohave ground squirrel habitat by allowing development throughout the HGLA, including ACECs/CDNCLs specifically identified for Mohave ground squirrel protection.

Direct mortality or injury can occur if undetected active burrows are crushed by heavy equipment, displacement due to construction noise or vibrations, decreased food availability, and increased predation risk due to loss of vegetation cover. To reduce these potential impacts to this species a lease applicant will conduct protocol level surveys for Mohave ground squirrel occupancy. The surveys shall follow protocol acceptable to the CDFG and BLM and shall include suitable habitat within the lands that would be open for geothermal development under Alternative A.

Controlled Surface Use Stipulation CSU-HGLA-1 may be implemented to minimize project impacts to the Mohave ground squirrel. CMAs designed to protect Mohave ground squirrel include, but are not limited to, the completion of preconstruction surveys, assessment of long-term population function, siting activities in pre-disturbed habitat or low habitat quality to the maximum extent practicable, restriction of activities during the Mohave ground squirrel dormant season (August 1 through February 28), and the establishment of a 50-foot avoidance buffer around Mohave ground squirrel occurrences. Most ACEC/CDNCL specific CMAs would be applicable within the ACECs/CDNCLs, and include the prohibition of long-term vegetation removal unless compatible with Mohave ground squirrel conservation and management, and establishment of exclusion fencing to reduce livestock grazing in areas managed and protected for Mohave ground squirrel. Additional CMAs specific to the protection of Mohave ground squirrel are included in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA. If Mohave ground squirrels are detected, the lease Applicant shall consult with BLM and CDFW to establish additional on-site measures to protect the areas occupied by the Mohave ground squirrel.

Burrowing Owl: Potential habitat and known occurrences have been documented for burrowing owl on flatter areas in the southern HGLA that would be open for geothermal development under Alternative A. Direct impacts to this species would be similar to those described under General Impacts above and could include the removal of active burrows and direct mortality of owls during Program activities. Development of the RFD under Alternative A could increase potential fragmentation of burrowing owl habitat by allowing development throughout the HGLA, including the flatter areas where the species has been previously documented. Indirect impacts could occur from increased noise, lighting, and dust during construction. Although this species is not currently listed by federal agencies, it is a state species of special concern and the CDFW (AB 3180) requires mitigation measures for this species according to currently accepted protocols. As outlined in Appendix A, preconstruction surveys shall be performed in accordance with the accepted CDFW Burrowing Owl Guidelines. CMAs designed to protect burrowing owl include, but are not limited to, biological monitoring, avoidance of occupied burrows by 200 meters, and passive burrow exclusion if burrows cannot be avoided. Additional CMAs specific to the protection of burrowing owl are included in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA.

Golden Eagle: Golden eagles are very sensitive to human activity, especially in the vicinity of nesting area(s), and even distant human activity could cause abandonment and failure of a nest. Alternative A would open the entire HGLA to potential geothermal development, including mountainous and rocky terrain in the eastern portion that could provide suitable nesting substrate for golden eagles. However, given the golden eagle’s ability to cover vast areas and forage over multiple habitat types, the entire HGLA could provide suitable foraging habitat. The three leases which would be approved under Alternative A are generally located on the flatter portions of the western half of the HGLA. While the flatter areas may not provide suitable nesting substrate for golden eagles, individual eagles are likely to forage throughout all lands that would be open for geothermal development under Alternative A. Development of the RFD under Alternative A could increase potential fragmentation of golden eagle foraging and nesting habitat by allowing development throughout the HGLA in potential nesting areas.

The implementation of BMPs presented in Appendix A would reduce potential impacts to golden eagles under Alternative A. CMAs designed to protect golden eagles include, but are not limited to, a one mile avoidance buffer around active golden eagle nests, no more than a 20 percent cumulative loss of foraging habitat within a one to four mile radius around nests, and the potential for further golden eagle impacts analysis under the USFWS Eagle

Conservation Plan Guidance. CMAs designed to protect golden eagles on ACECs/CDNCLs which would be open for development under Alternative A include no more than a 10 percent cumulative loss of foraging habitat within a four mile radius around active or alternative nests. A full description of CMAs specific to the protection of the golden eagle are included in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA.

Pallid Bat, Townsend's Big-eared Bat, Silver-haired Bat, Western Red Bat: Pallid bat, Townsend's big-eared bat, silver-haired bat, and western red bat all have the potential to occur in suitable habitat throughout lands that would be open for geothermal development under Alternative A. Alternative A would open the entire HGLA to geothermal development, including mountainous terrain in the eastern half. Such habitat may support cliffs, rock crevices, and forested habitat that provide potential roosts for sensitive bat species. Construction activities may have an impact on sensitive bat species if well pads and geothermal plants are located near roosts or known foraging locations. Potential impacts would be similar to those described under General Impacts and may include loss of foraging habitat, disturbance of roosts, and disturbance of foraging activities. The implementation of BMPs presented in Appendix A would reduce potential impacts to sensitive bat species under Alternative A. CMAs designed to protect sensitive bat species include, but are not limited to, avoidance of occupied maternity roosts by 500 feet, and assume all mines are occupied roosts unless appropriate surveys have been conducted in all seasons. Additional CMAs specific to the protection of sensitive bat species are included in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA. Geothermal leases are subject to standard stipulations and lease terms, and include surveys for special-status mammal species, including sensitive bat species.

American Badger: American badger is a habitat generalist which requires dry friable soils for denning. As such, the majority of the HGLA provides suitable habitat for American badger and the species may occur throughout the area. It is possible that the RFD may have short-term indirect effects on American badger during construction activities similar to those described under General Impacts above. Indirect impacts could also occur from clearing and grading for geothermal plants, well pads and pipelines. The permanent removal of 276 acres and temporary disturbance of 128 acres could result in the loss of forage and cover for these species. Development of the RFD under Alternative A could increase potential fragmentation of American badger habitat by allowing development throughout the HGLA. The implementation of BMPs presented in Appendix A would reduce potential impacts to American badger under Alternative A. There are no CMAs specific to the American badger included in the DRECP; however, general CMAs included in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA would likely provide protection measures for the species.

Northern Sagebrush Lizard: Optimal habitat for the northern sagebrush lizard occurs in the mountainous areas in the western portion of the HGLA. Under Alternative A those areas would be open for geothermal development. Potential impacts to northern sagebrush lizard would be similar to those described under General Impacts and include habitat loss leading to a potential reduction in local species range or dispersal to adjacent, less-suitable habits; disturbance of general foraging or breeding behavior; and mortality during construction through crushing, grading, or burying that may be required for tower site preparation or construction. Individuals may be disturbed by construction activity, noise, and/or vibrations and vacate the area, forcing them to temporarily move to areas which they may be unfamiliar with or which may be unsuitable habitat. This may also lead to increased competition or predation from wildlife in adjacent habitats. However, this is a short-term impact, as it is expected that individuals would begin moving back to their native habitat shortly after construction leaves the area or after the area has become at least partially restored through revegetation. Development of the RFD under Alternative A could increase potential fragmentation of northern sagebrush lizard habitat by allowing development throughout the HGLA. The implementation of BMPs presented in Appendix A would reduce potential impacts to northern sagebrush lizard under Alternative A. There are no CMAs specific to the northern sagebrush lizard included in the DRECP; however, general CMAs included in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA would likely provide protection measures for the species.

Alternative B - Potential impacts to plant and wildlife species under Alternative B would be similar to those described under General Impacts and Alternative A. The major distinction is that surface disturbance and habitat removal would only be permitted in non-sensitive areas. Non-sensitive areas include those designated as DFAs in the CDCA Plan, as amended by the DRECP. No surface occupancy would be allowed in sensitive areas identified in the CDCA Plan, as amended by the DRECP, which includes ACECs/CDNCLs and SRMAs. Therefore the potential for impacts to wildlife species and habitat under Alternative B would be reduced by approximately 13,534 acres (ACEC, CDNCL, and SRMA).

Implementation of Alternative B would approve the three current lease applications with the NSO stipulation in place for ACECs/CDNCLs and SRMAs within the HGLA. The RFD scenario would be achieved; however, all disturbances would be limited to non-sensitive areas within the DFAs in the western and southern portion of the HGLA. All 276 acres of permanent disturbance and all 128 acres of temporary disturbance would occur in those portions of the DFAs and would not occur in ACECs, CDNCLs, or SRMAs. Alternative B would reduce impacts to habitat fragmentation by limiting ground disturbing activities to DFAs.

Protected and Special Status Species: Potential impacts to Special Status Species would be similar to those described under General Impacts.

Special Status Plants: Potential impacts to special status plants under Alternative B would be similar to those under the General Impacts and Alternative A described above. Alternative B may concentrate disturbance under the RFD. Habitat fragmentation of special status plant habitat may still occur under Alternative B but would be lower than Alternative A, because surface disturbance would be restricted to DFAs. DFAs present suitable habitat for several special status plant species.

CMAs to protect special status plants include, but are not limited to, timed surveys, avoidance setbacks, and native habitat avoidance. A full description of CMAs specific to the protection of special status plants are included in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA.

Desert Tortoise: BLM has determined that the effect to desert tortoise under the Preferred Alternative is the same as the No Action Alternative, which has been analyzed in the DRECP Biological Opinion. However, subsequent consultation would be required for any ground disturbing activities that may be proposed in the future.

Potential impacts to desert tortoise under Alternative B would be similar to those under the General Impacts and Alternative A described above. Alternative B may concentrate disturbance under the RFD by only allowing construction activities on the lower, flatter areas which provide better desert tortoise habitat. Desert tortoise occurrences noted in the CNDDB occur in the northwestern portion of the HGLA which would be open to development under Alternative B. Habitat fragmentation of desert tortoise habitat may be higher under Alternative B than Alternative A because all surface disturbance would be restricted to DFAs, which also present suitable habitat for desert tortoise.

CMAs to protect desert tortoise include, but are not limited to, preconstruction clearance surveys, use of exclusion fencing, use of biological monitors, and enforcement of project-wide speed limits. CMAs for the protection of desert tortoise specifically identified in ACECs/CDNCLs would not be applicable under Alternative B because no surface occupancy would be allowed in these areas.

Mohave Ground Squirrel: Potential impacts to Mohave ground squirrel under Alternative B would be similar to those under the General Impacts and Alternative A described above. Alternative B may concentrate disturbance under the RFD scenario by only allowing construction activities on the lower, flatter areas which provide suitable Mohave ground squirrel habitat. Mohave ground squirrel occurrences noted in the CNDDB occur throughout the HGLA, including DFAs which would be open for development under Alternative B and ACECs/CDNCLs which would be closed to surface occupancy. Alternative B would reduce potential habitat fragmentation for Mohave ground squirrel by restricting surface occupancy in ACECs/CDNCLs which were designated in part to protect habitat for the species.

All four ACECs and the CDNCL which overlap the HGLA were done so with a direction to provide additional protection to Mohave ground squirrel habitat. The DRECP considered and modeled potential Mohave ground squirrel habitat during its development. The DFA was designed to concentrate potential disturbance while preserving vast areas of Mohave ground squirrel habitat. Alternative B would reflect this purpose by eliminating any surface disturbance on the ACECs/CDNCLs within the HGLA, and would reduce potential impacts to Mohave ground squirrel.

Controlled Surface Use Stipulation CSU-HGLA-1 may be implemented to minimize project impacts to the Mohave ground squirrel. CMAs designed to protect Mohave ground squirrel include, but are not limited to, the completion of preconstruction surveys, assessment of long-term population function, siting activities in pre-disturbed habitat or low habitat quality to the maximum extent practicable, restriction of activities during the Mohave ground squirrel dormant season (August 1 through February 28), and a 50-foot avoidance buffer around Mohave ground squirrel occurrences. CMAs for the protection of Mohave ground squirrel specifically identified in ACECs/CDNCLs would not be applicable under Alternative B because no surface occupancy would be allowed in those areas. If Mohave ground squirrels are detected, the lease Applicant shall consult with BLM and CDFW to establish additional on-site measures to protect the areas occupied by the Mohave ground squirrel.

Burrowing Owl: Potential impacts to burrowing owl under Alternative B would be similar to those under the General Impacts and Alternative A described above. Alternative B may concentrate potential impacts to burrowing owl under the RFD scenario by only allowing construction activities on the lower, flatter areas which provide better burrowing owl habitat. Burrowing owl occurrences noted in the CNDDB occur on the flatter habitat in the southern portion of the HGLA which would be open to development under Alternative B. Alternative B may increase potential habitat fragmentation for burrowing owl by concentrating disturbance in DFAs which present suitable burrowing owl habitat; although DFAs may also have pre-existing disturbances.

As outlined in Appendix A, preconstruction surveys shall be performed in accordance with the accepted CDFW Burrowing Owl Guidelines. CMAs designed to protect burrowing owl include, but are not limited to, biological monitoring, avoidance of occupied burrows by 200 meters, and passive burrow exclusion if burrows cannot be avoided.

Golden Eagle: Potential impacts to golden eagle under Alternative B would be similar to those under the General Impacts and Alternative A described above. Disturbance from construction activities would likely be further removed from potential golden eagle nesting habitat located on the mountainous and rocky terrain of the ACECs/CDNCLs and SRMAs. However, foraging golden eagles may still be disturbed by construction activities if individuals occur in DFAs during development. Alternative B would reduce potential habitat fragmentation for golden eagle foraging habitat by prohibiting surface occupancy in ACECs/CDNCLs and only allowing disturbance in DFAs which may have pre-existing disturbances.

The implementation of BMPs presented in Appendix A would reduce potential impacts to golden eagles under Alternative B. CMAs designed to protect golden eagle include, but are not limited to, a one mile avoidance buffer around active golden eagle nests, no more than a 20 percent cumulative loss of foraging habitat within a one to four mile radius around nests, and the potential for further golden eagle impacts analysis under the USFWS Eagle Conservation Plan Guidance. CMAs specifically designed to protect golden eagles on ACECs/CDNCLs and SRMAs would not be applicable under Alternative B because no surface occupancy would be allowed in those areas.

Pallid Bat, Townsend's Big-eared Bat, Silver-haired Bat, and Western Red Bat: Potential impacts to the special status bat species under Alternative B would be similar to those under the General Impacts and Alternative A described above. Potential disturbance to roosting bat species would likely be reduced under Alternative B because no surface occupancy would be allowed in ACECs/CDNCLs and SRMAs which typically provide roosting habitat. Foraging bats may still be disturbed by construction activities if individuals occur over construction activities in DFAs.

CMAs designed to protect sensitive bat species include, but are not limited to, avoidance of occupied maternity roosts by 500 feet, and assume all mines are occupied roosts unless appropriate surveys have been conducted in all seasons. No CMAs specifically designed to protect special status bats in ACEC/CDNCLs or SRMAs were identified.

American Badger: Potential impacts to the American badger under Alternative B would be similar to those under the General Impacts and Alternative A described above; however, potential habitat disturbance would be eliminated in mountainous ACEC/CDNCLs and concentrated in the DFAs on the flatter portions of the HGLA. Because the species is a habitat generalist, the American badger may occur in areas open for geothermal development under Alternative B. The implementation of BMPs presented in Appendix A would reduce potential impacts to American badger under Alternative B. There are no CMAs specific to the American badger included in the DRECP; however, general CMAs would likely provide protection measures for the species.

Northern Sagebrush Lizard: Potential impacts to the northern sagebrush lizard under Alternative B would be similar to those under the General Impacts. Because Alternative B would restrict development in ACEC/CDNCLs which provide suitable mountainous habitat for the northern sagebrush lizard, potential impacts would be reduced under Alternative B when compared to Alternative A. The implementation of BMPs presented in Appendix A would reduce potential impacts to northern sagebrush lizard under Alternative B. There are no CMAs specific to the northern sagebrush lizard included in the DRECP; however, general CMAs would likely provide protection measures for the species.

Alternative C - Potential impacts to plant and wildlife species under Alternative C would be similar to those described under General Impacts and Alternative B. From the perspective of biological resources, Alternative B and Alternative C are essentially the same. Alternative C would restrict geothermal development to DFAs, while Alternative B would allow geothermal development throughout the HGLA but would restrict all surface disturbances to DFAs. In simple terms, surface disturbance which may impact biological resources would only occur on DFAs under both Alternative B and Alternative C, making potential impacts essentially the same.

Alternative D – Impacts to plant and wildlife species under the No Action Alternative are described in the DRECP under Chapter IV.7 Biological Resources.

4.8 CULTURAL RESOURCES

4.8.1 General Direct

Section 106 of the NHPA requires BLM to take into account the effects of the proposed federal action on historic properties. To be determined eligible for listing on the NRHP and subsequently deemed a historic property, the resource must be demonstrated to possess one or more of the four criteria established by the Secretary of the Interior in 36 CFR Part 60.4 and defined in the BLM Handbook (MS-8110, rev. 12/03/04) defines these criteria as follows as noted in the DEIS/PA, and also possess integrity in terms of location, design, setting, materials, workmanship, feeling, and association.

Because of limited survey in the HGLA, it is assumed that there remain many resources, primarily archaeological sites, which remain to be identified and recorded within any one project APE. Of the 218 known and recorded cultural resources in the HGLA, most have never been subject to NRHP evaluation.

The impact levels for the cultural resource impact assessment are defined on the basis of potential activities in a project APE. Short-term activities include exploration drilling, seismic testing, and construction. Long-term activities include construction of geothermal wells, geothermal power plants, operations and maintenance, and the construction of new or modifications of existing transmission lines authorized by leasing decisions in this plan and would remain for the life of the Project. Direct and Indirect impacts as well as impact levels and are described in detail in Section 4.8.2.1 of the DEIS/PA.

4.8.2 Impacts By Alternative

Alternative A (Preferred Alternative) - Under Alternative A, impacts to cultural resources would be avoided or minimized by implementing the stipulations and best management practices described in Appendix A and current BLM cultural resource policy and guidance procedures. As a specific project in a lease area is considered by BLM, analysis and consultation procedures mandated by the DRECP LUPA would ensure that BLM can comply with implementing regulations associated with Section 106 of the NHPA. To meet each of these regulatory needs, planning and compliance-related cultural resource surveys of project areas that shall be directly impacted by construction will be required. Indirect impact areas may also require some level of survey and analysis. Such surveys will identify resource locations and their significance. By stipulating appropriate, project-specific avoidance and minimization measures, adverse effects to historic properties under Alternative A can be avoided.

Avoidance is a key aspect of ensuring that adverse impacts can be resolved. Because the RFD scenario does not specify any development, and because the ability to re-design or modify projects to avoid adverse effects to historic properties within the planning area is possible, impacts under Alternative A would be considered negligible once specific project proposals clearly demonstrate full avoidance of all sensitive archaeological and historical resources.

Alternative B - The analysis of Alternative B is nearly identical to Alternative A above with the difference that only subsurface geothermal development (NSO) may be allowable in culturally sensitive areas and ACEC/CDNCLs. Because the likely locations of historic properties are located within ACEC/CDNCLs, lower impacts than Alternative A are expected. All historic properties in culturally sensitive areas can be avoided, and temporary or permanent adverse effects would not occur.

Alternative C - With regards to cultural resource impacts, Alternative C is nearly identical to Alternative B because no surface development would occur in potentially sensitive cultural resource areas (e.g., ACEC/CDNCLs). Leases issued under Alternative C would be subject to applicable stipulations, BMPs, and mitigation measures as well as to existing laws, regulations, formal orders, terms and conditions, and CMA requirements.

Alternative D – Impacts to Cultural Resources from the No Action Alternative are described in the DRECP under Chapter IV.8 Cultural Resources.

4.9 PALEONTOLOGY

4.9.1 General Impacts

As previously described in Section 4.9.2.1 of the DEIS/PA, geothermal exploration and drilling, construction of geothermal plants and wells, and construction of roads and transmission lines will have the potential to impact paleontological resources if they are present in the HGLA. In general, for project areas that are underlain by paleontological sensitive geologic units, the greater the amount of ground disturbance, the higher the potential for impacts to paleontological resources. In some situations, the BLM may determine, based on local geological conditions, that proposed geothermal exploration or construction activities in a specific location warrants further analysis for paleontological resources or monitoring.

4.9.2 Impacts By Alternative

Alternative A (Preferred Alternative) - Surface disturbing activities could potentially occur in any area of the HGLA under this alternative. However, no adverse impacts are anticipated under Alternative A based on the low probability of occurrence of paleontological resources in the HGLA. In the event that future site-specific permitting studies identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures. As a result, impacts under Alternative A, if any, are considered low.

Alternative B - As with Alternative A, no adverse impacts are anticipated under Alternative B based on the low probability of occurrence of paleontological resources in the HGLA. In the event that future site-specific permitting studies identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures. As a result, impacts under Alternative B, if any, are considered low.

Alternative C - No adverse impacts to paleontological resources are expected under Alternative C based on the low probability of occurrence of paleontological resources in the HGLA. In the event that future site-specific permitting studies identify sensitive resources that warrant protection or preservation, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

Alternative D – Impacts to Paleontological Resources from the No Action Alternative are described in the DRECP under Chapter IV.10 Paleontological Resources.

4.10 VISUAL RESOURCES

4.10.1 General Impacts

The Visual Resources section in the DEIS/PA (Section 4.10) describes in detail the impacts to visual resources for the HGLA.

VRM Classes were established in the DRECP LUPA. It is assumed that geothermal leasing would generally be compatible with VRM Class III areas. However, further analysis would be required under site specific development proposals. The objective of VRM Class III is to partially retain the existing character of the landscape. The level of change to the characteristic landscape is expected to be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

To meet the VRM Class III objective, facilities and disturbance should be located where they will not be a dominant element in the landscape from sensitive viewpoints. Locations immediately adjacent to sensitive viewpoints, or on steep slopes and ridges where geothermal activities would be an obvious and potentially dominant element of the landscape, would generally not meet this objective.

The objective of VRM Class II is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. Due to the steep, variable terrain of the Class II areas, cut and fill for wellpads, geothermal plants, and access for these areas would likely be substantial. Pending lease area CACA 43998 (Maxx) is located entirely within and area designated VRM Class II, and would be seen within the middleground distance zone from US 395. A majority of pending lease area CACA 43993 (Metcalf) and CACA 44082 (Maxx) are designated as VRM Class III, but have small contiguous areas of VRM Class II designation that would be seen within the middleground distance zone from US 395.

4.10.2 Impacts by Alternative

Alternative A (Preferred Alternative) - The foreseeable and potential visual impacts associated with Alternative A are described above. Impacts would vary with the specific location of future realized RFD facilities relative to sensitive receptors. Development could potentially occur in any area of the HGLA. Landform contrast levels could generally be strong to moderate due to steep topography in the northeast portion of the HGLA, and generally weak in the remainder of the HGLA due to relatively flat to rolling terrain. Open pit mining sites could also influence landform contrast, resulting in weak landform contrast levels in specific locations where existing disturbance from mining activities occurs.

As seen from the nearest sensitive viewpoint (US 395), visual contrast would be visible in the foreground in VRM Class III areas, and would be visible in the middleground in Class II areas. With the strongest contrast occurring in the eastern and northern portions of the HGLA in areas designated as VRM Class II and visible in the middleground, an RFD project could potentially be inconsistent with the VRM Class II objective. Weaker contrast would be expected in those areas that are designated as VRM Class III because these areas are typically in locations that would require less grading, and vegetation consists of Desert Scrub. An RFD project would likely be consistent with Class III depending on the configuration and proximity to existing high voltage transmission lines, aqueducts, and existing buildings in Coso Junction and Dunmovin. VRM Class III lands are also located in the eastern portion of the HGLA within the CDNCL, Mohave Ground Squirrel ACEC, and Ayers Rock ACEC located in the background view of sensitive viewpoints, so the RFD would likely be consistent with the VRM Class III Objective should the CDCA be amended to allow geothermal development in these areas. Large geothermal plants within the foreground view of US 395 would likely be compatible with the VRM Class III objective with the implementation of BMPs described in

Appendix A.

The CDCA, as amended by the DRECP LUPA, also includes numerous CMAs which would reduce potential impacts to visual resources. CMAs contained in the DRECP LUPA are a mix of general applications (LUPA-VRM-*) and those specific to ACECs (ACEC-VRM-*) and DFAs (DFA-VRM-* or DFA-VPL-VRM-*) and would be applicable under Alternative A depending on the location of geothermal development. The CMAs to protect visual resources include, but are not limited to siting associated transmission lines to ensure consistency with VRM Classes, use of alternative transmission line structures and non-specular conductors, using approved colors from the BLM Standard Environmental Color Chart for facilities, incorporation of the most current visual design standards and BMPs, use of BMPs to minimize impacts to night skies, and mitigation based on underlying visual values. A full list and definition of potentially applicable CMAs is available in Section II.4.2 – *Conservation and Management Actions* of the DRECP LUPA.

Alternative B - Potential impacts to visual resources under Alternative B would be similar to those described under Alternative A. However, geothermal development would only be permitted in DFAs. No surface occupancy (NSO) stipulations would be applied in sensitive areas identified in the CDCA Plan, as amended by the DRECP, which includes ACEC/CDNCLs and SRMAs; subsurface development would not affect the visual values of the sensitive areas. These areas are located closer to sensitive viewpoints, but development of the RFD would occur in locations that would require less grading, vegetation consisting of Desert Scrub, and existing features such as the transmission lines, distribution and telephone lines, Haiwee Substation, and other development could reduce perceived contrasts depending on the location of the facilities relative to US 395. An RFD project would likely be consistent with the Class III Objective as seen in the middleground and could be consistent with the Class III Objective as seen in the foreground with the implementation of CMAs and BMPs as described for Alternative A visual impacts.

Implementation of Alternative B would approve the three current lease applications with the NSO stipulation in place for ACEC/CDNCLs and SRMAs within the HGLA. However, all disturbances would be limited to the DFAs in the western and southern portion of the HGLA, which would not allow surface occupancy within one entire pending lease area (CACA 43998 Maxx) and small percentages of the other pending lease areas. Subsurface development could occur in sensitive and Class II VRM areas without affect to visual resources. All 276 acres of permanent disturbance and all 128 acres of temporary disturbance would occur in DFAs and would not occur in ACEC/CDNCLs or SRMAs. Alternative B would reduce potential impacts resulting from vegetation, landform and structure contrasts by limiting ground disturbing activities to DFAs. The DFA located in the HGLA is designated as VRM Class III Objective.

The CDCA, as amended by the DRECP LUPA, also includes numerous CMAs which would reduce potential impacts to visual resources associated with ROW land authorizations and/or geothermal development. CMAs contained in the CDCA, as amended by the DRECP LUPA, are a mix of general applications (LUPA-VRM-*) and those specific to ACECs (ACEC-VRM-*) and DFAs (DFA-VRM-* or DFA-VPL-VRM-*), and would be applicable under Alternative B depending on the location of geothermal development and associated ROWs.

Alternative C - Potential impacts to visual resources under Alternative C would be similar to those described under Alternative B. Because ACEC/CDNCLs and SRMAs are closed to geothermal leasing under current management under the CDCA as amended by the DRECP LUPA, NSO or subsurface development of geothermal in sensitive areas (ACEC/CDNCLs and SRMAs) would be allowed, pending leases in sensitive areas would be denied, and surface development would occur only in the DFAs.

Transmission line development associated with geothermal development, however, is a management action under the CDCA, as amended by the DRECP LUPA, that could be developed within ACEC/CDNCLs and the East Sierra SRMA located within the HGLA in appropriately designated corridors. As part of the RFD, it is possible that a geothermal plant could be located in the DFA, but required interconnection routes to existing transmission lines could cross an ACEC/CDNCL or SRMA in designated corridors. Impacts resulting from transmission line interconnection within an ACEC/CDNCL or the SRMA would be limited because of apparent contrasts would be weak due to distance from identified sensitive viewpoints unless they are located in the Rose Spring ACEC or East

Sierra SRMA. Stronger contrasts may be visible if the transmission line crosses steep terrain or is located in an area of high visibility with no existing infrastructure located within the viewshed. These areas are mostly designated as VRM Class III except for the southwestern-most portion of the HGLA within a portion of the East Sierra SRMA outside of designated utility corridors, so transmission lines crossing these areas would likely be consistent with the VRM Class designations.

According to the CDCA Plan, new gas, electric, and water transmission facilities as well as cables for interstate communication may be allowed only within appropriately designated corridors. Designated corridors within the HGLA include BLM Designated Utility Corridor A, a two mile wide corridor, and Section 368 Designated Energy Corridor 18-23, an approximately 1,050 foot wide corridor. Both corridors run north-south across the western portion of the HGLA. A one mile wide, five mile long corridor connecting the Coso KGRA with Utility Corridor A is also located on the southern portion of the HGLA.

CMAs and BMPs identified in the DRECP LUPA and Appendix A of this EIS would reduce potential impacts to visual resources in DFAs. ACEC and SRMA specific CMAs would not be applicable because no geothermal development would be allowed in these areas.

Alternative D – Impacts to Visual Resources from the No Action Alternative are described in the DRECP under Chapter IV.20 Visual Resources.

4.11 LANDS AND REALTY

4.11.1 General Direct

Leasing creates a right, which could conflict with other existing or future land use authorizations. The FLPMA requires that prior existing rights must be recognized, so geothermal development would be designed to avoid or minimize impacts to existing authorized land uses or facilities. Through appropriate coordination with authorized land use holders, physical disturbances or temporary disruptions in use may be acceptable.

Areas of geothermal development and infrastructure such as at the Coso geothermal fields or Hay Ranch Water Extraction and Delivery Project create prior existing rights for the lessees and may affect the direction or placement of future ROWs unrelated to any geothermal project. Along the same lines, mission operations at the U.S. Department of Defense's China Lake NAWS will be taken into consideration. Based on their locations, overhead high voltage transmission lines could potentially have impacts on flight lines and training operations at the China Lake NAWS. As such, coordination between the BLM and Department of Defense would be conducted prior to the approval of any future geothermal energy development to determine project compatibility with current and future military missions, and consistency with the Joint Service Restricted R-2508 Complex.

The potential impacts from management of lands and realty actions are assumed to be low since standard lease stipulations specify that all leasing activities are subject to these existing rights, and conformance with CMAs would be required.

4.11.2 Impacts By Alternative

Alternative A (Preferred Alternative) - As previously described, the HGLA is designated into three allocations: DFAs, BLM Conservation Lands (i.e., ACEC, CDNCL), and Recreation Management Areas (e.g., SRMA). Transmission development and operation will occur in previously designated corridors and other identified areas, both inside and outside the DFAs.

Development within the ACEC/CDNCLs and SRMAs within the HGLA is not an allowed use; transmission line authorizations would be analyzed on a case-by-case basis to determine compatibility with the allocation area and management goals.

Geothermal electrical generation facilities may be allowed pursuant to licenses issued under 43 CFR Part 3250, et seq. if all applicable NEPA requirements are met. Also, a plan amendment changing allowable uses within sensitive areas would not affect the underlying land uses within the allocation areas, and would still require the implementation of CMAs to protect resources. As a result, this alternative would not conflict with BLM's multiple-use management objectives.

Leasing of the subsurface geothermal resources would not affect existing authorizations. However, development of new facilities, including ROWs, would require new authorizations. Establishment of utility ROWs would require a plan amendment to the CDCA if they are located outside of existing utility corridors in any allocation area other than a DFA. Utility corridors proposed in DFA would not require a plan amendment.

According to the Land Use Element of the Inyo County General Plan, the HGLA and surrounding region falls within the State and Federal Lands Designation. This designation is characterized by absence of privately-owned lands and applied to those state- and federally-owned parks, forests, recreation, and/or management areas that have adopted management plans (Inyo County Planning Department 2001). BLM's Alternative A would be consistent with the Inyo County General Plan and with the Inyo County Zoning Ordinance. The impacts from implementing the Haiwee RFD on the existing land uses of the HGLA would be low.

Alternative B - Alternative B impacts would be similar to Alternative A because geothermal electrical generation facilities may be allowed pursuant to licenses issued under 43 CFR Part 3250, et seq. if all applicable NEPA requirements are met. Also, there would be no change in allowable uses within sensitive areas. As a result, this alternative would not conflict with BLM's multiple-use management objectives. New ROW grants may be required; no surface occupancy in sensitive land allocation areas would likely restrict new transmission corridors to the DFA allocation areas. A NSO requirement could result in less overlapping resource use in certain areas of sensitive land allocations.

Alternative C: Alternative C would not result in any impacts to lands and realty issues because geothermal development would occur within the HGLA in accordance with the present CDCA Plan, as amended by the DRECP LUPA. No CDCA Plan amendment would occur, and all phases of geothermal exploration, development, and operation under Alternative C for pending lease applications in DFAs and future geothermal development would also comply with all applicable laws, regulations, formal orders, the terms and conditions of BLM's standard lease form and CMA requirements.

Geothermal electrical generation facilities may be allowed in the DFA pursuant to licenses issued under 43 CFR Part 3250, et seq. if all applicable NEPA requirements are met. Also, there would be no change in allowable uses within land allocations identified in the DRECP LUPA. As a result, this alternative would not conflict with BLM's multiple-use management objectives.

Alternative D – Impacts to Lands and Realty from the No Action Alternative are described in the DRECP under Chapter IV.13 BLM Land and Realty.

4.12 PUBLIC HEALTH AND SAFETY

4.12.1 General Direct

The potential hazardous and solid waste issues typically associated with geothermal exploration and development are described in detail in Section 4.12.2.1 of the DEIS/PA. In addition to those identified in the DEIS/PA, the potential for toxic gas release is discussed below.

Potential Toxic Gas Release and Emergency Response - When a site-specific project proposal has been submitted to the BLM in a Plan of Operations, the project proponent must demonstrate how the project will be comply with federal and state regulations detailed in the Emergency Planning and Community Right-to-Know Act (EPCRA), Section 112 (r) of the CAA Amendments of 1990 (42 U.S.C. §7401 et. Seq.), and California Accidental Release Prevention Program.

Implementation of EPCRA has been delegated to the state of California. EPCRA establishes requirements for federal, state, and local governments, Indian tribes, and industry regarding emergency planning and "Community

Right-to-Know" reporting on hazardous and toxic chemicals. The project proponent must show that they have procedures in place to implement Emergency Release Notification reporting, Hazardous Chemical Storage reporting, and Toxic Chemical Release Inventory tracking as applicable and required by EPCRA.

Requirements pertaining to the prevention of accidental releases are detailed in Section 112 (r) of the CAA Amendments of 1990 (42 U.S.C. § 7401 et. Seq.). The objective of these requirements is to prevent the accidental release and to minimize the consequences of any such release of a hazardous substance. Under these amendments, facilities that produce, process, handle or store hazardous substance must: 1) identify hazards which may result from releases using hazard assessment techniques; 2) design and maintain a safe facility and take steps necessary to prevent releases; and 3) minimize the consequence of accidental releases that occur.

The purpose of the California Accidental Release Prevention program is to prevent accidental releases of substances that can cause serious harm to the public and the environment, to minimize the damage if releases do occur, and to satisfy community right-to-know laws. This is accomplished by requiring businesses that handle more than a threshold quantity of a regulated substance listed in the regulations to develop an RMP. An RMP is a detailed engineering analysis of the potential accident factors present at a business and the mitigation measures that can be implemented to reduce this accident potential. The California Accidental Release Prevention program is implemented at the local level by Inyo County. The contents, level of detail in the RMP, and inspection protocols, and public access to most of the information is provided by Inyo County, who must be consulted with. Additionally, Inyo County's Local Emergency Planning Committee may require a facility to produce an emergency response plan.

4.12.2 Impacts By Alternative

Alternative A (Preferred Alternative) - The foreseeable and potential impacts associated with Alternative A are discussed in detail in Section 4.12.2.1 of the DEIS/PA, and above. The impacts to public health and safety are expected to be low based on the terms and conditions of BLM's lease, and adherence to applicable construction storm water pollution prevention and subsequent NPDES permit requirements. All hazardous materials as well as hazardous and solid wastes will be handled, stored, and disposed of consistent with applicable safety guidelines and regulatory requirements, and in compliance with the BLM guidelines. In the event that future site-specific permitting studies identify sensitive resources that warrant additional protection, the BLM would stipulate appropriate, project-specific mitigation measures.

Alternative B - The foreseeable and potential impacts associated with Alternative B are similar to those discussed for Alternative A, but surface disturbance would only occur within the DFA, and this is where the potential for hazardous and solid waste release could occur. In addition to complying with existing laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form, Alternative B contains NSO requirements that may protect potentially sensitive resources or receptors. As such, the impacts to public health and safety under Alternative B are expected to be low.

Alternative C - The foreseeable and potential impacts to public health and safety under Alternative C would be generally similar as those for Alternatives B. As such, the impacts to public health and safety under Alternative C are expected to be low.

Alternative D – Impacts to Public Health and Safety from the No Action Alternative are describe in the DRECP under Chapter IV.22 Public Services and Safety.

4.13 ENERGY AND MINERAL RESOURCES

4.13.1 General Impacts

Mining, mineral material sites, unpatented mining claims, and abandoned mines exist in portions of some of the lease areas, and geothermal leases would be subject to valid existing rights. Both geothermal development and mining could be conducted in the same general area. The extent of their compatibility would depend on the nature of the mining operation and of the geothermal development. Geothermal leases must coexist, as feasible, with the location of and production of minerals from mining claims; mining claim uses must not unreasonably interfere with or endanger geothermal operations; and geothermal operations must not unreasonably interfere with or endanger mining claim operations.

Although the HGLA contains mineral resources, construction and operation of geothermal production plants is not expected to significantly affect access to or future development of these minerals or mineral production. Geothermal exploration, including drilling deep wells, may have the beneficial impact of identifying additional, previously unrecognized, mineral deposits. There is a low potential risk for impacts on mineral resources.

4.13.2 Impacts By Alternative

Alternative A (Preferred Alternative) - The foreseeable and potential impacts to mining operations in the HGLA under Alternative A are discussed above and considered low. Future geothermal leases would be subject to existing rights, are not necessarily incompatible with mining, and would be subject to all applicable laws, regulations, formal orders, and the terms and conditions of BLM's standard lease form and CMA requirements.

Alternative B - The foreseeable and potential impacts to mining operations in the HGLA under Alternative B are similar to those discussed under Alternative A, and considered low. Under Alternative B NSO requirements for part of the HGLA could further eliminate potential conflicts between mining operations and geothermal leasing.

Alternative C - The foreseeable and potential impacts to mining operations in the HGLA under Alternative C are similar to those discussed for Alternative B. Under Alternative C portions of the HGLA would be closed which could further eliminate potential conflicts between mining operations and geothermal leasing.

Alternative D – Impacts to Energy and Mineral Resources from the No Action Alternative are described in the DRECP under Chapter IV.15 Mineral Resources.

4.14 WILD HORSES AND BURROS

4.14.1 General Impacts

The noise and human presence connected with geothermal exploration, development, and utilization can influence herd distribution and movements within the Centennial HMA. Impacts as discussed in Section 4.14.2.1 of the DEIS/PA remain applicable to the FEIS Alternatives. Based on their general absence or, at best, seasonal use of a portion of the HGLA, the impacts from the realized Haiwee RFD scenario on wild horses and burros is expected to be low. The potential for indirect impacts to the wild horse and burro population would be minimized through compliance with State and federal regulations, adherence to lease stipulations, implementation of appropriate BMPs (Appendix A), and CMAs described in the DRECP. Observations of potential problems regarding wild horses or burros, including animal mortality, must be immediately reported to the appropriate agencies.

4.14.2 Impacts By Alternative

Alternative A (Preferred Alternative) - Under Alternative A, the management designations identified in the CDCA Plan, as amended by the DRECP, would remain in place. Goals and Objectives for sensitive areas would be amended under Alternative A, as required, to allow surface and subsurface geothermal leasing and development. CMAs identified in the CDCA Plan, as amended, by the DRECP LUPA would be applied to protect sensitive resources.

The foreseeable and potential impacts to wild horses and burros under Alternative A would be similar to those discussed above under General Impacts. The location of disturbance under Alternative A is not restricted within the HGLA, and disturbances may occur anywhere within the footprint which may be used by wild horses and burros, including all ACEC/CDNCLs, SRMA, and DFAs within the HGLA. The anticipated impacts under Alternative A are expected to be low due to the limited occurrence of wild horses and burros within the HGLA. In the event that future site-specific permitting studies would identify the presence of these animals, or of sensitive resources like water sources, the BLM would stipulate appropriate, project-specific mitigation measures to protect them. Three DFA CMAs specific to the protection of wild horses and burros are included in the DRECP. These CMAs include the inclusion of the Wild Free-Roaming Horses and Burros Act of 1971 into any project or activity proposal, prohibit development that would allow wild horses and burros access to forage, water, shelter, or space, and requiring any project-specific mitigation to occur where wild horses and burros were found at the passage of the Wild Free-Roaming Horses and Burros Act of 1971.

Alternative B - Potential impacts to wild horses and burros under Alternative B would be similar to those described under General Impacts and Alternative A. The major distinction is that impacts to the surface (i.e., disturbance and habitat removal) would only be permitted in non-sensitive areas. Non-sensitive areas include those designated as DFAs in the CDCA Plan, as amended by the DRECP. No surface occupancy would be allowed in sensitive areas identified in the CDCA Plan, as amended by the DRECP, which includes ACEC/CDNCLs and SRMAs.

Implementation of Alternative B would approve the three current lease applications with the NSO stipulation in place for ACEC/CDNCLs and SRMAs within the HGLA. The RFD scenario would be achieved; however, all disturbances would be limited to DFAs in the western and southern portion of the HGLA. All 276 acres of permanent disturbance and all 128 acres of temporary disturbance would occur in DFAs and would not occur in ACEC/CDNCLs or SRMAs. Alternative B would minimize potential impacts on wild horses and burros from habitat fragmentation by limiting ground disturbing activities to DFAs. Surface occupancy would not be allowed in sensitive areas which have not been previously disturbed.

Under Alternative B wild horses and burros, their watering areas and other key habitat features, would be further protected in the areas of NSO. Impacts under Alternative C are expected to be low based on the limited occurrence of wild horses and burros on the HGLA, and adherence of geothermal exploration, development, and operation activities to applicable laws, regulations, formal orders, terms and conditions and CMA requirements. The three CMAs described under Alternative A were specific to activities within DFAs and would also apply under Alternative B.

Alternative C - Potential impacts to wild horses and burros under Alternative C would be similar to those described under General Impacts and Alternative B. From the perspective of wild horses and burros, Alternative B and Alternative C are essentially the same. Alternative C would restrict geothermal development to DFAs, while Alternative B would allow geothermal development throughout the HGLA but would restrict all surface disturbances to DFAs. Surface disturbance which may impact wild horses and burros would only occur on DFAs under both Alternative B and Alternative C, making potential impacts essentially the same.

Alternative D – Impacts to Wild Horses and Burros from the No Action Alternative are described in the DRECP under Chapter IV.17 Wild Horses and Burros.

4.15 GRAZING

4.15.1 General Impacts

The entire HGLA is subject to grazing permits. The potential impacts to livestock grazing from geothermal exploration, development, and utilization could include temporary disturbance from construction activities, loss of vegetation that would temporarily decrease the amount of available forage for livestock, and disruption of livestock movement. Based upon the Haiwee RFD scenario, up to 404 acres of grazing lands would be disturbed, including the permanent disturbance of 276 acres and the temporary disturbance of 128 acres. Those acres of temporary disturbance would be available for grazing following initial reclamation. Exploration activities could also have a temporary effect on grazing patterns by shifting and/or intensifying livestock grazing over other areas, potentially resulting in impacts to native vegetation and wildlife in areas outside the authorized grazing areas.

4.15.2 Impacts By Alternative

Alternative A (Preferred Alternative) - The foreseeable and potential impacts to grazing privileges under Alternative A are discussed in general impacts and are considered low. The degree of actual impacts would depend on the locations of future RFD facilities, which would be allowed throughout the HGLA under Alternative A. The RFD would result in the permanent loss of 276 acres and temporary loss of 128 acres of available grazing lands could be distributed through two existing grazing allotments (Tunawee Common and Lacey-Cactus-McCloud) that overlap the HGLA. There are 2,408 acres (four percent) of the Tunawee Common Grazing Allotment, and 1,449 acres (three percent) of the Lacey-Cactus-McCloud Grazing Allotment, that overlap with the three pending noncompetitive lease application areas CACA-043993, CACA-043998 and CACA-044082. If the Haiwee RFD scenario would be fully implemented, future geothermal development would result in the temporary disturbance of 128 acres and permanent loss of 276 acres, or approximately one to two percent of each of the allotments.

It should be noted that, under BLM regulations, grazing allotment permits are held subject to other uses of the public lands. If the BLM approves other (non-emergency) uses that would limit grazing within existing allotments, the BLM issues the permit holders two years notice of the planned reduction in the allotment. Since even at full build-out BLM's RFD scenario would disturb only a small percentage of acreage within the allotments, the impacts of Alternative A on the grazing resources with the Tunawee Common and Lacey-Cactus-McCloud grazing allotments are considered low. At full build-out the Haiwee RFD facilities would only occupy approximately one percent of the HGLA. In the event that future geothermal activities or facilities would result in potential conflicts with existing grazing privileges, the BLM would stipulate appropriate, project-specific onsite mitigation measures.

Alternative B - Potential impacts to grazing under Alternative B would be similar to those described under General Impacts and Alternative A. The major distinction is that impacts to the surface (i.e., disturbance and vegetation removal) would only be permitted in non-sensitive areas (DFA). No surface occupancy would be allowed in sensitive areas, which includes ACEC/CDNCLs and SRMAs.

Although not expected to be an issue since grazing privileges are held subject to other authorized uses, Alternative B contains NSO requirements for specific areas of the HGLA, which could resolve potential conflicts between existing grazing privileges and future geothermal leases and activities.

Alternative C - Potential impacts to grazing under Alternative C would be similar to those described under General Impacts and Alternative B. From the perspective of grazing resources, Alternative B and Alternative C are essentially the same. Alternative C would restrict geothermal development to DFAs, while Alternative B would allow geothermal development throughout the HGLA but would restrict all surface disturbances to DFAs. In simple terms, surface disturbance which may impact grazing resources would only occur on DFAs under both Alternative B and Alternative C, making potential impacts essentially the same.

Alternative D – Impacts to Grazing from the No Action Alternative are described in the DRECP under Chapter IV.16 Livestock Grazing.

4.16 RECREATION

4.16.1 General Impacts

General impacts to recreational resources are described in Section 4.16.2.1 of the DEIS/PA and have not changed with the alternatives presented in this FEIS. These may include noise, vibration, dust, visual impacts, and odor from geothermal energy exploration, development, and operations, which could disrupt the recreational enjoyment of the area. Views of construction equipment, or the addition or change of industrial structures such as pipelines, power lines, and generating facilities conflict with the natural background of many of these recreational resources, and lead to a low to medium, long-term aesthetic impact. Intermittent noise associated with construction, visual impacts, and the temporary loss of access for recreational use during the exploration phase would result in a low risk of a significant and temporary impact on the recreational experiences available within the HGLA.

Geothermal development could also temporarily limit the amount of land available for OHV use, driving for pleasure, hiking, photography, rockhounding, hunting, primitive camping, dual sport motorcycle, equestrian events, rock climbing, and wildlife viewing. During certain phases of construction (e.g., pipeline construction), access via designated routes of travel may require use of alternate routes for short periods of time. Signage and public notices concerning such temporary route closures would serve to reduce conflicts with recreational users by directing them to areas unaffected during these construction periods. Most OHV vehicles gain access to the HGLA via Gill Station Road and various unimproved roads. Geothermal development in the area is not expected to significantly restrict or reduce access to public lands with OHVs.

4.16.2 Impacts By Alternative

Alternative A (Preferred Alternative) - Opening the entire HGLA to geothermal development would require a long-term commitment of up to 276 acres of BLM, state, and private lands under the RFD scenario, which could become unavailable for recreational uses for the life of the geothermal leases if project facilities displace recreational activities.

Alternative A would likely impact dispersed recreational opportunities in the immediate vicinity of land disturbance activities. The primary effect would be the change of the recreational experience on larger scale activities such as OHV use of existing roads in the area. Short-term impacts to recreation within the HGLA would primarily result from all phases of the construction process. Activities associated with the upgrade of existing roads, construction of new roads and well pad sites, and setup of the well rigs would temporarily alter use of roads for the duration of the construction activities. Conflicts with recreational users would occur when construction vehicles travel to and from construction sites. Construction vehicles would be parked off-road in designated staging areas to minimize conflicts with access to recreation areas during construction. Where possible, based on the locations of suitable geothermal resources, the siting of construction sites will be located away from designated recreational routes of travel to minimize conflicts with other users of public lands. Since cross country travel is not permitted on the BLM- managed portion of the HGLA, only designated routes of travel would be potentially affected. The development of new roads could also increase public land access, and generate additional roads and trails in previously un-roaded landscapes.

Due to the temporary nature of construction activities, the relatively small number of people who use the area (see Section 3.19.2.1 of the DEIS/PA), and availability of adjacent alternative areas, the effects of Alternative A on the recreational resources would be considered low. In addition, there are no parks or other federal, State, or county facilities in the immediate area. The Coso Range Wilderness Area is located approximately one mile northeast of the HGLA and would not be affected.

With the inclusion of the BMPs described in Appendix A, the anticipated impacts to recreation resources would be mitigated to the greatest extent feasible. The resulting degree of impact would be low to medium.

Alternative B - The foreseeable and potential impacts to recreational activities in the HGLA under Alternative B would be similar to those described under Alternative A. However, Alternative B has NSO requirements for some areas which could reduce potential conflict between recreational and geothermal activities in ACEC/CDNCLs and SRMAs. Although dependent on the specific locations of the Haiwee RFD facilities, the impacts under Alternative B are considered low.

Alternative C - The foreseeable and potential impacts to recreational activities in the HGLA under Alternative C would be similar to those described under Alternative B. However, Alternative C closes part of the HGLA which could limit potential conflicts between recreational and geothermal activities. The impacts under Alternative C are considered low.

Alternative D – Impacts to Recreation from the No Action Alternative are described in the DRECP under Chapter IV.18 Outdoor Recreation.

4.17 AREAS OF SPECIAL DESIGNATION

4.17.1 General Direct

Congressionally-designated areas are typically withdrawn from geothermal development. Administrative designations are not automatically withdrawn from geothermal development; however, activities likely to affect the resources and values identified for protection under these designations would be precluded. There are no congressionally designated lands within the HGLA.

ACECs are administratively established BLM designations. Special Unit Management Plans for the HGLA ACECs are located in Appendix B of the DRECP LUPA, and where applicable, detail Nationally Significant Values, Overarching Goals, Desired Future Conditions (Objectives), Allowable Uses, and Management Actions for resources for resource areas such as ROWs, renewable energy, minerals and non-energy leasables, livestock grazing, travel management, recreation, and visual, natural and cultural resources. All ACECs designated in the DRECP LUPA are closed to geothermal leasing and development unless they overlap with a DFA where geothermal is allowed. Where they overlap, ACECs are open to geothermal leasing with an NSO stipulation. Land use authorization proposals for new, renewing, and amending ROWs will be analyzed on a case-by-case basis to assess whether they are compatible with the ACEC and its management goals. The Sierra Canyons ACEC has an additional Management Action related to ROWs that prohibits land use authorizations that alter groundwater regimes.

4.17.2 Impacts By Alternative

Alternative A (Preferred Alternative) – The portions of the CDNCLs, Ayer's Rock ACEC, Rose Spring ACEC, Mohave Ground Squirrel ACEC, and the Sierra Canyons ACEC within the HGLA will no longer have the NSO requirement for geothermal development. The potential for impacts to the Relevance and Importance Criteria for these ACECs will be determined in future NEPA assessments and permitting studies for site- and project-specific proposals. Incorporating sufficiently large buffer zones, responsibly siting facilities, and the use of stipulations would minimize or eliminate potential adverse impacts associated with geothermal development within ACECs/CDNCLs. Leases issued under Alternative A would have the appropriate stipulations, conditions of approval, and BMPs to minimize impacts to special designated areas. As such the effects of geothermal exploration, development, utilization, and ultimate reclamation on ACECs/CDNCLs would be expected to have little to no adverse impacts. There would be no conflict with the establishment of ROWs with the ACECs/CDNCLs because these would be authorized on a case-by-case basis.

Alternative B - Alternative B would not result in any impacts to special designated areas because the alternative imposes NSO requirements which will limit or avoid geothermal lease impacts to the ACECs/CDNCLs.

Alternative C - Alternative C would avoid impacts to ACECs/CDNCLs because geothermal development is not an allowed use in these areas under the current CDCA Plan, as amended by the DRECP LUPA. Pending lease applications would be approved, but development of geothermal resources would not occur in ACECs/CDNCLs. As such, no impacts to areas of special designations under Alternative C are expected.

Alternative D – Impacts to Areas of Special Designation from the No Action Alternative are described in the DRECP under Chapter IV.14 BLM Land Designations, Classifications, Allocations, and Lands with Wilderness Characteristics.

4.18 TRAFFIC/TRANSPORTATION

4.18.1 General Impacts

General impacts to traffic/transportation are described in Section 4.18.2.1 of the DEIS/PA and have not changed with the alternatives presented in this FEIS. Project-related vehicular traffic estimates and impacts on US 395 and other roads in the area related the RFD buildout detailed in the DEIS/PA remain applicable to the FEIS alternatives.

It is important to note that Inyo County and Caltrans are planning to widen US 395 between milepost 29.2, just south of Olancha and milepost 41.8, just north of Cartago. US 395 is primarily a four-lane divided highway, but narrows to two lanes between these mileposts. Widening the road to a four-lane facility would improve its current LOS D condition to an expected LOS A condition and reduce vehicle collisions in this area. Inyo County's goal is to widen the road by 2020. Between 2000 and 2010, 14 fatalities and 134 accidents occurred along this segment of US 395 (Inyo County 2015).

4.18.2 Impacts By Alternative

Alternative A (Preferred Alternative) - Impacts to traffic volumes and the transportation network surrounding and accessing the HGLA under Alternative A would be considered low. More specifically, the project's personal vehicle and construction vehicle traffic would be expected to represent a negligible increase in the region's traffic flow. LOS conditions would be expected to approximate existing conditions in and around the HGLA. This assessment is based on the projected levels of adverse impacts to the existing transportation patterns and systems, levels of service on public roads and highways, and highway safety.

No changes would occur to existing OHV route designations in implementing Alternative A. BLM-administered roads and trails that are designated as open, closed, and limited to public use would remain as such. However, changes to road and trail designations may occur pending changes to BLM policies and travel management goals and objectives. During well development activities, approximately 54 acres of access roads would be needed for each 30 MW power plant. The BLM would work with geothermal project developers to ensure that proposed access roads are designed, constructed, and maintained per BLM standards and to accommodate oversized and/or overweight shipments of project equipment. During power plant development activities, approximately 22 acres of access roads would be needed and would comport with BLM standards and to accommodate shipments. Upon project decommissioning, permanent access roads would be returned to pre-construction conditions or in a condition acceptable to the responsible land management agency and/or landowner. Constructing access roads to support geothermal project-related activities would not be expected to cause moderate nor major disruptions to the existing transportation system on BLM-administered roads and trails. During access road construction, minor disruptions to recreational traffic may be expected near these roads and trails.

Alternative B - In implementing Alternative B, impacts to traffic volumes and the transportation network surrounding and accessing the HGLA would be similar to those described for Alternative A. However, Alternative B’s NSO stipulation would prohibit developing aboveground project facilities in sensitive areas, which include ACECs/CDNCLs and SRMAs and surface development would be restricted to DFAs.

Project facilities include access roads for well development and for power plant construction, operation, and maintenance activities. As with Alternative A, in implementing Alternative B, the BLM would ensure that access road design, construction, and maintenance comports with BLM standards and accommodates oversized and/or overweight shipments of project equipment. Additionally, no changes would occur to existing OHV route designations. BLM-administered roads and trails that are designated as open, closed, and limited to public use would remain as such. However, changes to road and trail designations may occur pending changes to BLM policies and travel management goals and objectives. The same acreages for access roads mentioned above for Alternative A would be expected to be needed for Alternative B, but would be sited outside of NSO areas. Upon project decommissioning, permanent access roads would be returned to pre-construction conditions or in a condition acceptable to the responsible land management agency and/or landowner. Constructing access roads to support geothermal project-related activities would not be expected to cause moderate nor major disruptions to the existing transportation system on BLM-administered roads and trails. During access road construction, minor disruptions to recreational traffic may be expected near these roads and trails.

Authorizing the pending leases or the implementation of the RFD in other areas of the DFA would also mean concentrating construction-related traffic flows into such areas along BLM-approved routes. Concentrating traffic onto a limited number of access roads might cause traffic congestion along US 395 in the vicinity of the HGLA as tractor trailers, other heavy trucks, and construction crew vehicles travel to and from project sites in the HGLA. Stacking traffic along a limited number of routes might also increase the potential for delays and traffic accidents.

Alternative C - In implementing Alternative C, impacts to traffic volumes and the transportation network surrounding and accessing the HGLA would be similar to those described for Alternative B because the RFD scenario and associated effects on traffic would remain, but occur in a different location within the HGLA. Authorizing leaseholders to proceed with geothermal project development activities in areas established as DFAs would prohibit constructing aboveground facilities, including access roads, in ACECs/CDNCLs and SRMAs.

Alternative D – Impacts to Traffic/Transportation from the No Action Alternative are described in the DRECP under Chapter IV.19 Transportation and Public Access.

4.19 SOCIOECONOMICS

4.19.1 General Direct

General impacts to Socioeconomic resources are described in Section 4.19.2.1 of the DEIS/PA and have not changed with the alternatives presented in this FEIS. Section 4.19.2.1 describes these impacts in detail.

Total Costs - The RFD scenario does not include any estimate of expenditures for plant construction or operation. However, there are alternative methods for estimating total costs, including a range of $3,885 to $4,387 per kilowatt hour (2017 dollars), and an average labor to total cost ratio of 41 percent. These costs, using "burdened" labor costs (wages, salaries, benefits, and contractor overheads assumed at 30 percent) indicate a total cost estimate through construction of about $229-$367 million in 2017 dollars. Using the average of these two estimates, results in a total estimate of costs through construction of $297.5 million in 2017 dollars.

Operation costs have also been estimated in Hance (2005) as comprised of 42-74 percent labor costs. Using total burdened labor costs (wages, salaries, benefits, and 30 percent for overheads), and a midrange of 58 percent of total operations and maintenance costs accounted for by labor, the annual operating costs would be over $19.09 million in 2017 dollars.

Annual and cumulative construction costs were derived by allocating all costs according to the workforce schedule. The resulting year-by-year cost estimates, updated for the FEIS, are shown in Table E-8, Appendix E. Since the first geothermal plant is assumed to be in operation during the construction of the second geothermal plant, the actual costs for construction and operation the first plant would be somewhat higher than shown.

4.19.1.1 Impacts on Employment and Income

This socioeconomic assessment used the input-output economic model *Impact Analysis for Planning* (IMPLAN, trademark IMG, Inc.) to estimate secondary employment impacts of the program. Additional details regarding the implementation of the IMPLAN model are provided in Section 4.19.2.1 of the DEIS/PA.

4.19.1.2 Impacts on Population and Housing

As discussed in Section 4.19.2.1 of the DEIS/PA, the impacts on housing and population from BLM's proposed alternatives are likely to be very minimal during the years before construction begins, less than moderate during the peak of construction, and again minimal during operations because operations housing demand will be for rental or ownership housing, supplies of which are ample in the SSA. Table 4.19-4 of the DEIS/PA summarizes the results for the projected population and housing impacts.

4.19.1.3 Impacts to Public Services

As discussed in Section 4.19.2.1 of the DEIS/PA, the impact on public services as a result of the RFD buildout would be low. The degree of potential adverse impacts to public services typically corresponds primarily to the level of population increase in their jurisdictions, and secondarily on employment and income increases, and the associated infrastructure demands compared to existing capacities or difficulty of expansion of services.

4.19.1.4 Impacts to Public Revenues

As discussed in 4.19.2.1 of the DEIS/PA, current uncertainties in potential geothermal royalty payments to Inyo County affect whether the proposed action leads to geothermal energy projects that "pay for themselves" in fiscal balances. This issue is important especially in light of the cross-jurisdictional nature of impacts of the proposed action. Inyo County would carry the full cost of road maintenance in the site vicinity, particularly to US 395, but most of the workers for the proposed action would live in Kern County where they would generate sales taxes, property taxes, hotel occupancy taxes, and various other revenues. Additional impacts are described in detail in Section 4.19.2.1 of the DEIS/PA. Also refer to Appendix E of this FEIS/PA.

4.19.2 Impacts By Alternative

Alternative A (Preferred Alternative) - The foreseeable and potential socioeconomic impacts associated with Alternative A are discussed above in Section 4.19.1 The data show that impacts to Inyo County and surrounding counties from implementation of the RFD will likely be an increase in employment (including secondary employment), economic benefits, and public revenues (as a result of royalty payments and property taxes). Other potential impacts may include a decrease in available housing or public services and are expected to be low and short-term based on the characteristics of the exploration and construction work force, and those of the long-term operations workforce.

Alternative B - Impacts associated with Alternative B would be equal to or less than those of Alternative A because Alternative B would be essentially the same as Alternative A in regards to the RFD scenario, but would only restrict the location of surface development activity. Authorizing the three pending leases within the DFA, but limiting the location of surface occupancy, would help expedite project permitting and approval processes. However, limiting surface development to the DFAs may prompt developers to seek project opportunities outside of the HGLA, thereby contributing to other communities' economic growth and development. As the socioeconomic impacts of Alternative A were assessed as low, and the development likely to occur per Alternative B would be less than or equal to (but not greater than) those of Alternative A, the socioeconomic impacts of Alternative B are assessed as low.

Alternative C - Implementing Alternative C would have similar socioeconomic impacts as Alternatives A and B. Authorizing the three pending leases to occur on land established as DFAs may help expedite project permitting and approval processes. However, limiting project development to DFAs may prompt developers to seek project opportunities outside of the HGLA, thereby contributing to other communities' economic growth and development. Overall, the impact of implementing Alternative C would be assessed as low.

Alternative D – Impacts to Socioeconomics from the No Action Alternative are described in the DRECP under Chapter IV.23 Socioeconomics and Environmental Justice.

4.20 LANDS WITH WILDERNESS CHARACTERISTICS

4.20.1 Methodology and Impact Criteria

The potential for impacts on lands with wilderness characteristics resulting from any future geothermal exploration or development in the HGLA are assessed with respect to the following criteria. Significant impacts on LWCs could occur if:

- Realization of the RFD scenario fragments the integrity of the LWC, significantly reducing the size of the unit, thus disqualifying all or a significant part of it from future consideration as wilderness. This could occur if exploration and/or development activities required construction of new corridors for roads, pipelines, and transmission lines, or if new corridors and developments were centrally located within the LWC unit.
- Realization of the RFD scenario detracts from naturalness and/or opportunities for solitude and primitive and unconfined recreation in a significant part of the LWC or within the LWC as a whole. This could occur if new corridors and developments were very visible, extensive, and centrally located within the LWC, without benefit of topographic screening, or other mitigating circumstances.
- Realization of the RFD scenario allows multiple exploratory leases or multiple geothermal plants to be developed within the LWC at the same time.
- Realization of the RFD scenario causes impacts to occur over a long time span, (e.g., over the 30-year life of a geothermal plant) rather than over a relatively short time span (e.g., four to six months required for exploratory drilling).
- Realization of the RFD scenario causes ground disturbances so severe and extensive that they could not be mitigated and/or successfully reclaimed to standards approximating previous (wilderness) conditions.

Impact levels have been assigned based upon the size of the areas that might be impacted in WIU #CDCA 131-1 so that these areas no longer have wilderness characteristics under the RFD Scenario. Sizes are based upon direct and indirect impacts 1) acreage directly and permanently impacted by geothermal exploration and development; and 2) surrounding acreage indirectly impacted by those activities.

4.20.1.1 High

High impacts would be expected to occur when:

(1) More than one exploratory drilling and/or geothermal plant is operating within the LWC at a time;

(2) If multiple open designated vehicle routes are improved or extended as corridors for access, pipelines, and transmission lines. This would create several new wilderness inventory roads and developments. These would eliminate wilderness characteristics from most if not all of the lands within the HGLA by splitting contiguous areas up into smaller units of insufficient size;

(3) If new wilderness inventory roads and corridors are constructed in areas where no open, designated routes currently exist to provide for access, pipelines, and transmission lines. These new roads and developments could compromise lands with the most pristine wilderness characteristics. They could isolate some of the largest and most pristine areas within the HGLA and eliminate wilderness characteristics by splitting contiguous areas up into smaller units of insufficient size;

(4) If new operations and facilities are located centrally within the LWC; or

(5) In open terrain where they can be seen for miles, thus affecting wilderness character and quality in the larger surrounding area.

Impacts under these circumstances would be high and could possibly eliminate most, if not all, of the wilderness characteristics from lands within the HGLA. The highest impacts would result in more than 2,000 acres being excluded from the LWC. This would drop the acreage of LWC within HGLA below the 5,000-acre minimum for lands with wilderness characteristics.

4.20.1.2 Moderate

Moderate impacts would be expected to occur from exploration activities on public land within the LWC. Impacts would include installation, operation, and reclamation of the drill sites as well as improvement and extension of existing open designated routes for short distances to access drill sites. Water would be trucked in and new ground disturbance would be kept to a minimum. New road construction would be limited to two miles and total road work, including new construction and improvement of existing open routes, to less than five miles. If exploration did not lead to development, drill sites and newly constructed roads could be reclaimed. There would be no significant areas of disturbance left, no net gain in number of routes or miles of route intruding into the LWC, and no loss of contiguous, eligible lands. There would only be loss of the improved sections of existing open designated routes as they would need to be reclassified as wilderness inventory roads and excluded from the LWC. Loss acreage would not be expected to exceed 15 acres.

Moderate impacts could occur from the development of a geothermal resource on the LWC. However, this probably could only occur under special circumstances. Most if not all of the following circumstances would have to apply:

(1) If only one geothermal lease or plant is operating within the LWC at one time;

(2) If an existing open vehicle route is not improved or extended significantly in ways that would split contiguous areas up;

(3) If the same corridor used for access can be used for all pipelines and transmission lines;

(4) If geothermal development is located near the periphery of the LWC rather than in its center; and/or

(5) If the bulk of the development, i.e., the geothermal plant itself, is isolated, secluded, and hidden by topography.

Up to 400 acres within the utility corridor and on the plant site would no longer have wilderness characteristics as a result of geothermal development. However, this would result in only a six percent reduction in the size of the LWC within the HGLA and a two percent reduction in size for the LWC overall. At 7,000 and 20,822.5 acres respectively, the LWC within the HGLA and LWC generally would still exceed the 5,000-acre minimum for inventoried lands with wilderness characteristics. If all impacts could be kept to a single corridor and to the site of the geothermal plant itself, impacts could be moderate. Even if another 100 acres of land in the immediate vicinity of the corridor and plant were compromised by the proximity of development, the vast majority of the LWC within the HGLA would remain unimpacted.

4.20.1.3 Low

Low impacts would occur from improvement of existing open designated routes across public land for exploration on State and/or private lands within the boundaries of the LWC. It is assumed that water would be trucked, not piped in, and that ground disturbance related to route improvement would be kept to a minimum. It is thought that up to 3.5 miles of existing open route could be improved within the LWC without significantly diminishing its integrity. Improved roads would no longer contain wilderness characteristics, but loss acreage after reclamation would probably not exceed 10 acres.

If exploration did not lead to development, there would be no net gain in number of routes or miles of route intruding into the LWC and there would be no loss of contiguous, eligible lands. There would only be the loss of the improved portion of the existing route as it would need to be reclassified as a wilderness inventory road and excluded from the LWC.

4.20.2 General Impacts

Geothermal exploration and development would diminish the naturalness at specific locations within the Land with Wilderness Characteristics (LWC) and possibly within the LWC as a whole. The degree of contrast and amount of change in the viewshed determine severity of impacts. BLM would consider the following factors when analyzing impacts of geothermal exploration and development on lands with wilderness characteristics:

(1) Type of development (small or large).

(2) Number of developments (how many in close proximity) within the same general area.

(3) Intensive/extensive developments.

(4) Location/topography (visibility) of developments.

(5) Time frames (short term/long term, temporary/permanent) for development.

(6) Prospects for full recovery and return to a more natural condition.

(7) Any one factor could impact all or portions of the LWC so that these characteristics are no longer present.

Outstanding Solitude: Solitude is a function of the presence and activity of others. Geothermal exploration and development could increase numbers of people and levels of activity within a specific area or within the area as a whole, diminishing opportunities for solitude.

Severity: Losses could range from barely perceptible to inescapable, depending on numbers and levels. Losses could be intermittent or continuous, of short or long duration, temporary or permanent.

Extent and significance: The extent to which opportunities are lost, the size of the area impacted, and the impacts on the LWC overall, would be based upon a hypothetical visitor's sight and sound distance from the proposed project site(s).

Outstanding Primitive and Unconfined Recreation: Outstanding opportunities for primitive and unconfined recreation exist where there are no developed recreation facilities such as roads, campgrounds, trails, water facilities. The improvement and extension of existing vehicle routes, and more particularly, the construction of new roads into roadless areas, would diminish opportunities for primitive and unconfined, non-motorized recreation. This would be especially true if road extensions and new roads are not fully reclaimed upon project completion but are left open and available to the general public for motorized recreation (i.e., if roadless areas become roaded).

Supplemental Values - All considerations reiterated with respect to naturalness would apply, particularly with respect to landscape-scale considerations (i.e., loss of scenery, fragmentation of habitat, and loss of a culturally significant landscape). In addition, site-specific considerations may include:

(1) Areas that are exceptionally scenic, containing impressive boulder outcrops and/or extensive unique forests.

(2) In Mohave ground squirrel habitat or in the vicinity of known raptor nests.

(3) On or in the vicinity of significant cultural sites, historic mine workings, lithic scatters, and especially at unique sites like Ayers Rock, a rare pictograph site on the NRHP.

4.20.3 Impacts By Alternative

Alternative A (Preferred Alternative) - This analysis is based upon the RFD scenario described in Section 2.2 of the FEIS, and in Appendix B. However, the analysis for the impacts of exploration departs somewhat from the RFD, as the RFD presumes all exploration would result in development (i.e., that exploration would come up with a positive finding). That may not in fact occur. This point is critical for analyzing impacts on lands with wilderness characteristics.

Exploration: Alternatives A, B, and C would authorize all three pending leases for geothermal exploration within the HGLA at the same time to some degree or another. Two of the three leases appear to include private lands outside of the LWC. The third lease (CACA 043998) appears to extend over one section (640 acres) of the LWC on its western extremity; this pending lease area is also located in land currently allocated as an ACEC/CDNCL (Mohave Ground Squirrel ACEC).

Exploration could result in low to moderate impacts to the 7,000-acre part of the HGLA found to have wilderness character. Low to moderate impacts would be expected where no geothermal resources were found and the sites never went into development. This could occur if exploration sites were located on private lands and public lands were being used only for transport. It could also occur if exploration sites were located on public lands peripheral to the LWC instead of central to it. Impacts from exploration could be kept to low or moderate levels, if the following stipulations were followed within the LWC-eligible part of the HGLA:

(1) Vehicle use was confined to existing vehicle routes, totaling 3.5 miles. This would result in improvements to some existing vehicle routes, but would not lead to a net expansion of the vehicle route network.

(2) New road construction was kept under two miles and total road work, including new construction and improvement of existing routes was kept under five miles.

(3) New drilling roads were sited to avoid impacts to sensitive resources and were designed to be as non-intrusive as possible.

(4) Water for exploratory drilling was trucked in, instead of piped in to the drill sites.

(5) Temporary pipelines, if constructed, were installed above-ground and within the same corridor used for vehicle access.

(6) All visible traces of exploration, drill pads, new roads, pipelines, etc., were removed and reclaimed promptly upon termination with a negative finding, to its previous natural condition.

Under these circumstances, impacts to size, naturalness, solitude, primitive and unconfined recreation, and supplemental values could be kept relatively small, temporary, and reversible. Impacts to naturalness would occur from fresh ground disturbance and construction of new linear manmade features (roads and pipelines), new facilities (well pads and wells), and placement of drill rigs on-site for exploration. However, these impacts would be temporary, persisting only for the duration of the project and only for as long as it would take for the area to fully recover. However, in areas of a desert vegetation community, recovery of natural vegetation often takes longer. The BLM may require reseeding the disturbed areas with a native seed mix to enhance and speed up the recovery time.

Impacts to solitude would occur as a result of increased activity and noise generated by exploration activities along transport routes and at the sites themselves. These impacts would be temporary, lasting only as long as exploration activities continued.

Opportunities for primitive and unconfined (non-motorized) recreation would be lost in some areas, especially where new roads opened up previously roadless areas to vehicle use. However, these opportunities would be regained from effective closure and reclamation of these new roads once they were no longer needed for exploration.

All 3.5 miles of existing vehicle route could be upgraded to wilderness inventory roads. These improved roads would bring more people into the area. However, these roads would not open up new areas to motorized vehicles. They are not long enough or in close enough proximity to other routes to split up contiguous, eligible lands.

Permanent impacts to the size of WIU #CDCA-131-1 would be sustained; however, if SE756 were upgraded to a wilderness inventory road for its entire length between SE435 and SE771, this could eliminate wilderness characteristics in 1,600-acres of the 21,322.5 LWC. It also would remove Ayers Rock, a significant cultural feature from the unit.

Development: The RFD scenario assumes two 30-MW geothermal power generation facilities would be developed and would be operating somewhere within the HGLA in the future. Lands with wilderness characteristics would be moderately to highly-impacted if one or more facilities were located on public lands within the 7,000-acre portion of the HGLA found to have wilderness character. How much of an impact such a facility or facilities would have would depend on location and extent of development within the LWC.

Size: If the RFD scenario were to be located on private, not public lands, development associated with these leases would likely be mostly or entirely outside of the area identified to have wilderness characteristics. State Land Section 16 (Deep Rose) is also excluded from the LWC, but is centrally located within the boundaries of the LWC, rather than along its periphery. Additional geothermal leases could be developed entirely on public lands within the HGLA, well within the area identified to have wilderness characteristics.

A total of 67 miles of upgraded and mostly, newly-constructed roads, pipelines and transmission lines could be built across BLM lands within the LWC-eligible part of the HGLA in support of two geothermal power generation facilities. Some or all of the facilities may be located on private and/or State lands. Still, the infrastructure required on public lands to support these facilities is significant as described, and could eliminate wilderness characteristics on much or all of the 7,000-acres of LWC found within the HGLA, depending on where it was located.

One ROW for geothermal exploration has been approved in this area. Deep Rose is located on State Land Section 16 in the heart of WIU #CDCA 131-1. If the ROW were exercised, it would improve and reroute parts of two open designated routes (SE756 and SE870) and would construct a new connecting route between them. The ROW would provide access to State Section 16, where Deep Rose, a geothermal company plans to do exploratory drilling. This ROW has not yet been developed. The proposed drilling and geothermal site is entirely on State lands. It sits in a bowl surrounded by mountains. Development of this ROW need not significantly diminish the area's size or affect wilderness characteristics in WIU 131-1, providing conditions of use and requirements for rehabilitation are adequate.

However, given the RFD, it is difficult to see how Deep Rose or any other geothermal plant centrally located within the HGLA or within the area identified to have wilderness characteristics could result in anything other than high level impacts to WIU #CDCA 131-1. Using RFD projections, one geothermal plant would require up to 33.5 miles of new linear developments, including roads, pipelines, and transmission lines. Most of these miles would be concentrated around the drill pads. Presumably, with Deep Rose, most of these miles would be located within State Section 16, outside of the LWC. Additional miles of development would be required across the LWC for access and to bring water to the geothermal site and to send power out of it. However, these needs could be consolidated into one 5.0-mile corridor rather than multiplied into three separate 5.0-mile corridors. The result would be a net gain of only five miles of new linear development within the LWC rather than 15 miles. This could be enough, along with the topographic isolation of State Section 16, to keep impacts to the LWC from geothermal development at Deep Rose to moderate levels.

Impacts probably could not be kept to moderate levels where geothermal development occurred exclusively on public lands within the LWC. Currently, WIU #CDCA 131-1 supports 23 miles of unimproved vehicle routes across 21,322.5 acres. The 7,000-acre portion of the WIU that falls within the HGLA supports only 3.5 miles of these 23 miles. Impacts to the LWC of an additional 33.5 miles of linear development (one facility) or 67 miles of linear development (two facilities) within these same 7,000 acres could potentially be high. Impacts would be higher still if most of these new developments were widely distributed across the 7,000 acres, rather than concentrated. In this case, geothermal development would almost certainly result in disqualification of most if not all of the LWC-eligible 7,000 acres within the HGLA from further wilderness consideration.

Naturalness: Naturalness would be deeply impacted by an operating geothermal plant as described in the RFD, particularly if the plant's impacts were extensive, distributed widely across the landscape, rather than intensively concentrated. Impacts would be greatest at or near the site of development. Severity would be measured by degree of change. Extent of impacts would be determined by location and topography.

Solitude: Solitude would be impacted by increased traffic through the area and by activities at the plant within a visitor's sight and sound distance of the plant. High levels of noise would be generated by diesel engines powering the drilling rigs and air compressors/mud pumps, as well as from drawworks, drawworks brake, racking of pipe and well testing. As stated in the RFD, up to three drilling rigs could be in operation simultaneously and drilling would be expected to take place 24 hours a day, seven days a week. Sight and sound distance would vary by location, depending on topography, but could have a radius of up to one mile, affecting potentially 2,009 acres.

Opportunities for Primitive and Unconfined Recreation: Opportunities for primitive and unconfined recreation would be impacted by the permanent loss of substantial, contiguous areas of undeveloped, roadless lands.

Impacts to the WIU could still be considered moderate with a relatively small amount of loss acreage with geothermal development on private, State, or federal public land, under the following special circumstances:

(1) if only one geothermal lease or plant is operating within the LWC at a time;

(2) if existing open vehicle routes are not improved or extended significantly in ways that would split contiguous areas up;

(3) if the same corridor used for access is used for all pipelines and transmission lines extending out from the plant;

(4) if geothermal development is located near the periphery of the LWC rather than near its center; and/or

(5) if the bulk of concentrated development, i.e., the geothermal plant itself, is on private rather than public land; and/or

(6) is well isolated, secluded, and hidden by topography.

Geothermal development within the WIU would result in that portion of the WIU no longer qualifying as lands with wilderness characteristics. How much of the WIU would no longer qualify would depend on the number of plants involved, their locations, and the extent of their operations. If impacts could be limited to one plant site and one corridor serving all access, pipeline, and transmission needs, then perhaps only 500 acres or less would need to be removed from the WIU. This would amount to a two percent reduction in the size of the WIU unit overall. Sixty-five hundred acres of LWC could still remain within the HGLA.

Alternative B - This alternative would protect the most of the WIU from surface geothermal development and would preserve its values and integrity as lands with wilderness characteristics. Most of the WIU is located within an area that would be protected from surface development by the NSO stipulation implemented as part of this alternative that would protect wilderness characteristics. Depending on the location of RFD, development occurring within the DFA where it overlaps the WUI could impact wilderness characteristics as described in Alternative A. This is a small area of the DFA, however, and surface development could be relocated to areas outside of the WUI. Consistent with CMA LUPA-WC-5, this WUI is not currently managed to protect wilderness characteristics.

Alternative C - Impacts on wilderness characteristic created as a result of Alternative C would be the same as those described in Alternative B. This alternative would protect the most of the WIU from surface geothermal development and would preserve its values and integrity as lands with wilderness characteristics because the WIU overlaps an ACEC/CDNCL. Geothermal development within ACECs/CDNCLs would not be an allowable use under this alternative.

Alternative D – Impacts to LWCs from the No Action Alternative are described in the DRECP under Chapter IV.14 BLM Designations, Classifications, Allocations, and Lands with Wilderness Characteristics.

4.21 CUMULATIVE IMPACTS

4.21.1 Past, Present and Reasonably Foreseeable Future Projects and Actions

Past, present, and reasonably foreseeable future projects and potential resulting impacts were revised from the DEIS/PA for this FEIS/PA. The impact methodology and criteria were identical to those detailed in Sections 4.20.1 and 4.20.2 of the DEIS/PA. The BLM consulted internally and with the following agencies for this FEIS/PA: China Lake NAWS, Coso Operating Company, Inyo County Planning, Road, and Public Works Departments, and LADWP to identify the projects.

Renewable Energy Projects: Renewable energy resources and projects are present throughout the HGLA region. The State of California, BLM, and Inyo County have approved geothermal exploration-related facilities in the HGLA cumulative effect area, for example the Deep Rose Geothermal Exploration Project and the Coso Geothermal complex that generates power on the China Lake NAWS. Several hydroelectric power generation facilities are located in the Owens Valley and electricity generated at these facilities is generally routed towards population centers to the south on transmission lines in the Owens Valley, or lines leading south from the Coso complex through the Naval Station and the Ridgecrest area. The West-wide Energy Corridor Programmatic EIS identifies energy corridors through the Owens Valley. The Renewable Energy Transmission Initiative has also identified similar corridors. Additional transmission upgrades into and through the Owens Valley have been discussed for geothermal energy development in Western Nevada.

Coso Geothermal Leasing Area - The Coso Geothermal Field is located in the NAWS, just to the east of the HGLA. The field's reservoir is in a Mesozoic granitic/metamorphic complex underlying the Quaternary Coso Volcanic Field. It currently produces approximately 200 MW from four geothermal plants. More than 100 wells have been drilled throughout the field, with production depths from 2,000 to 12,000 feet, and geothermal resource temperatures from 200 to 350 degrees Celsius (°C).

In 1987, the Coso Geothermal Field began generating electricity. Since then, improvements have resulted in more efficient use of the resource. Together with annual well rehabilitation, these improvements have helped keep the geothermal field producing above its contract capacity. Improvements to the field's injection system and injection augmentation are described below for the Hay Ranch project.

Solar Energy Projects **-** The BLM does not have any current applications for solar energy projects. However, interest has been expressed in solar energy development at Hay Ranch by Terra-Gen Power LLC on about 700 acres on private land near Coso Junction along US 395 south of Lone Pine.

Wind Energy Projects - The BLM does not have any current applications for wind energy projects and there are no known wind energy projects on private land in the area.

4.21.1.1 Other Relevant Projects and Actions

A description of several other notable projects in the vicinity of the HGLA is included in this section. These projects have the potential to contribute to cumulative impacts when considered with the proposed action.

Hay Ranch Water Extraction and Delivery System - The Coso Operating Company, LLC has recently constructed a groundwater extraction and pipeline delivery system from the Coso Hay Ranch to the water distribution station and injection system located at the Coso Geothermal Field. The project included an approximately nine-mile-long pipeline within a 50-foot-wide ROW across public lands located in the HGLA. The pipeline was constructed to convey water to the Coso Geothermal Project for supply of injection water to replace geothermal fluid that is evaporating from the geothermal project's cooling towers during the summer months. In addition to the pipeline, the project includes an associated electric power substation, pumping equipment, and holding tanks. Six acres of the project is located on private property, 32 acres are on BLM-managed public lands, and 16 acres are located on the China Lake NAWS (see Figure L-4, Appendix L). The BLM authorized the ROW on July 23, 2009 (CACA-046289).

The US Department of Energy has established the West Flank Frontier Observatory for Research in Geothermal Energy on China Lake NAWS. Water supplied to this research facility currently comes from Hay Ranch in Rose Valley. The new development is a competitive use for a limited water supply. Managers of new geothermal leases on BLM lands in Rose Valley may be a further source of new consumption and may stress efforts at achieving groundwater sustainability for the Rose Valley Groundwater Basin. Grazing operations in Rose Valley may experience greater costs and dwindling water availability. The local longstanding diversity of economic activity may be at risk (Sabin et. al. 2016).

US 395 Improvement Projects - Caltrans has various improvement projects located along or on US 395, which are completed or planned, such as shoulder widening, constructing rumble strips, roadway rehabilitation and resurfacing, and replacing end treatments, guardrails, and delineators. Most applicable in this analysis is the safety roadside rest area rehabilitation project at Coso Junction. In October 2008, Caltrans completed this rehabilitation project. The majority of US 395 through Inyo County has been widened to four lanes. The remaining two-lane section that is slated to be developed as a four-lane expressway (Olancha/Cartago) has been programmed through ROW acquisition and archaeological pre-mitigation for expansion. The goal of the Inyo County Local Transportation Commission is to proceed with and complete this project as quickly as possible (Inyo County Local Transportation Commission 2017).

Inyo County Road Improvements - The Inyo County Road Department completed improvement to a 5.5-mile-long section of Gill Station Road (also known as the Coso-Gill Station Road), from US 395 at Coso Junction to the China Lake NAWS entry gate, just east of the HGLA boundary in 2012. The project included realigning, widening, and repaving Gill Station Road. The Inyo County Road and Public Works Departments have no current or proposed projects in the southern portion of the county except general maintenance activities.

Southern California Edison Transmission Line Rating Remediation Project - The Ivanpah-Coolwater-Kramer-Inyokern, 220 kV transmission line is scheduled for an upgrade and the line generally runs north and south, along US 395 from Kramer Junction substation to Inyokern substation.

Mineral Development - Currently, pumice is the primary economically viable mineral resource in the area. There are many potential mineral development projects in the HGLA cumulative effects area. Other active mines in the area include the TXI Olancha Pumice Mine east of Haiwee Reservoir on private land, and LADWP quarry sites for stone immediately south of Haiwee Dam.

An authorized material site (CACA-41832) on BLM public land is situated in the HGLA. The site's products serve for maintaining US 395 along Inyo County's front range near Coso Junction. The material site is owned and operated by the California Department of Transportation.

McKayla II Quarry Development is a Coso Pumice Mine proposal on 47 acres located at the edge of Rose Valley.

4.21.2 Cumulative Impacts by Resource

Cumulative impacts by resource are described in detail in Section 4.20.4 of the DEIS/PA. Additional information for specific resources follows.

4.21.2.1 Air Quality:

Air quality impacts of past and present projects that are currently operating in the vicinity of the HGLA are accounted for in background concentrations of air pollutants as measured at the air monitoring stations located in Death Valley, Olancha, and Keeler. Table N-2, Appendix N summarizes these concentrations. The currently operating projects are also accounted for in the attainment status of the air basin and there would be negligible cumulative impacts from these and other reasonably foreseeable projects on Air Quality.

Cumulative operational impacts to air quality would result if all projects that result in air emissions during operations have a significant impact on air quality. Through the air permitting process with the GBUAPCD, projects with operational emissions that degrade air quality would not be allowed. Once constructed, most of the projects identified above would result in minor amounts of air emissions from inspection and maintenance activities. Potential mineral development in the HGLA also has the potential for air emissions from operations associated with mineral extraction processes. However, the cumulative impact from geothermal development in the HGLA to air quality is considered negligible. As such, combining the other existing or planned projects and activities in the HGLA with those related to geothermal development in the HGLA would result in negligible increases to air quality standards.

4.21.2.2 Noise:

The cumulative impact of development in and around the HGLA would generate short-term, local noise. The majority of this noise would be expected to originate from the projects mentioned above. Caltrans proposal to upgrade the remaining two-lane section of US 395 to a four-lane expressway would be expected to contribute to an increase in noise levels.

While it is unlikely that all of the projects would occur at the same time, construction vehicles, personal vehicles, and construction noise associated with the projects could add to the noise levels.

It is important to note that the cumulative noise from multiple sources, such as well-drilling and grading equipment from both on- and off-site developments, is determined based on the addition of sound intensities from the sources instead of the addition of their sound pressure levels. The combined noise level of multiple sources is the logarithmic sum of the sound intensity of each source. For example, two construction equipment noise levels of 90 and 45 dBA result in a combined audible noise level of approximately 90 dBA. Drilling and testing wells would subject persons in close proximity to intermittent loud noises. However, none of the projects mentioned above would generate long-term, local noise.

4.21.2.3 Topography, Geology, and Seismicity:

The disturbance areas of a potential Deep Rose project and pumice mining areas are undetermined, the Terra Gen project could disturb 700 acres, and the McKayla II Quarry could disturb 47 acres. The HGLA RFD is estimated to permanently impact 276 acres; however, without specific data on the design location, layout, and engineering details of the reasonably foreseeable projects, quantitatively estimating cumulative impacts would be speculative. Concerning geology and seismicity, exploration and construction activities from specific projects would be expected to create local changes in these resources. However, the cumulative impacts to these resources in the HGLA and adjoining areas are expected to be minor. While geothermal projects proposed by Deep Rose LLC and BLM lease applicants would impact the HGLA's geology and add to the Coso Geothermal Field's impacts, these projects are not expected to create regional geological impacts or trigger seismic events. Similarly, the Coso Operating Company's recently completed pipeline and wind proponents' excavation and installation activities for wind tower foundations and placement are also not expected to create regional geological impacts or trigger seismic events. However, given the footprints and associated ancillary facilities of the facilities relative to the geographical scope of area covered by the cumulative effects, and the cumulative impacts on topography, geology and seismology will be minimal.

4.21.2.4 Soils:

Combining the anticipated impacts associated with the proposed action with impacts from other potential projects and activities in the area may create additive soil impacts. This combination of impacts could potentially generate other impacts such as increased sedimentation of waterways, impacts to aquatic species, deterioration of visual quality from fugitive dust during high wind events, liberation and suspension of particulate matter, and loss of topsoil to allow vegetation growth.

Without specific data on the design location, layout, and engineering details of the reasonably foreseeable projects, quantitatively estimating cumulative impacts on soils would be speculative. However, given the footprints and associated ancillary facilities of the facilities relative to the geographical scope of area covered by the cumulative effects (potentially 5,700 acres considering the HGLA RFD, Terra-Gen Project, and the McKayla II Quarry Project), and the soil erosion and sediment control mitigation measures that would be necessary as part of project implementation, cumulative impacts on soils will be minimal.

The probable increase in miles of new roads in the HGLA, as well as surrounding areas, from geothermal development and other projects and activities could result in an increase in OHV traffic, which would lead to increased soil erosion, especially during intense rainfall events. Unless properly mitigated and depending on the locations of the RFD facilities, the cumulative disturbance of soils from other projects could potentially contribute sedimentation to Haiwee Creek, Little Lake, and Haiwee Reservoir. However, it is anticipated that the cumulative impacts of soil erosion or sedimentation would be minor because of the generally required implementation of mitigation measures and lack of significant rainfall throughout the year. Flash flood events do cause significant erosion but, given the sparse existing vegetation cover, impacts from these natural events would not be exacerbated by the proposed activities in the HGLA. The cumulative impacts of activities associated with development in the HGLA would have a minor increase in soil erosion or sedimentation.

4.21.2.5 Water Resources:

The cumulative impacts of implementing one or more groundwater development projects in Rose Valley depends on the pumping rate, project duration, extraction location, and schedule relative to other groundwater development projects in the valley. As discussed above, additional water would likely be needed to sustain operation of the realized RFD assumed geothermal plants during a 30-year useful life, and would also be necessary for the ongoing operation at the Coso Geothermal Leasing Area. At least some of the water supply would likely come from groundwater extraction in the Rose Valley, which is also being used for operation of the Coso geothermal plant. Though these pending projects might be required to extract any groundwater from outside the HGLA, they would be the largest users of groundwater in Rose Valley. Based on the calculated recharge rates and observed impacts at the Coso geothermal facilities, the combined groundwater withdrawal is predicted to cause the lowering of the groundwater table and decrease water available to wells, wetlands, and Little Lake. However, all alternatives proposed tie water consumption to the safe yield in the basin; therefore, it is unlikely that any geothermal leasing will negatively impact water resources.

Excessive inundation may be a risk from two external sources. LADWP may at some point need to shunt excess water into Rose Valley, as occurred, in 2017 in future high-precipitation winters. The earthen South Haiwee Dam may fail in the event of a powerful earthquake flooding Rose Valley. Existing geothermal energy infrastructure may become damaged or inoperable by unpredictable seismic force and/or inundation.

<u>Geothermal Well Drilling, Plant Construction, and Dust Control</u>

Low to moderate short-term impacts are expected from groundwater extraction to support geothermal well drilling, facilities construction, dust control, and other minor water needs associated with geothermal exploration and development under the HGLA RFD scenario. This prediction is based on the generally short-term nature of well drilling or construction activities, likely minor water needs associated with individual well drilling projects, or routine dust control measures, and, the apparent lack of significant impact from comparable current activities including groundwater extraction for domestic uses in the valley and groundwater extraction for the surface mining operations in the valley. The estimated amount of groundwater needed for a geothermal well drilling project is approximately 12 acre-feet of water per well. This amount is considerably less than the extraction rate of 790 acre-feet/year estimated via the Groundwater Flow Model (See Appendix G) to be sustainable for the Hay Ranch groundwater diversion project. In this way, it appears that wells could be drilled without measurable impacts to groundwater resources.

In the event that a number of concurrent geothermal drilling or construction projects are undertaken in the valley, cumulative impacts could be more significant. It should be noted that groundwater extraction for the Hay Ranch groundwater diversion project, which has started operation at an initial extraction rate of approximately 3,000 acre-feet per year, is not expected to reduce groundwater flow towards the Little Lake Ranch property at the south end of the valley by more than 10 percent. 10 percent was identified as a critical protective threshold in the draft EIR (MHA Environmental Consulting 2008) so that stipulations are in place curtailing pumping if certain drawdown triggers are reached in nearby wells. This same protective threshold is included in all of the action alternatives that authorize leases.

The estimated amount of groundwater needed for a geothermal well drilling project is approximately 12 acre-feet (ac-ft) of water per well. This amount is considerably less than the extraction rate of 790 ac-ft/yr estimated via the Revised Groundwater Flow Model (Stephens & Associates 2011) to be sustainable for the Hay Ranch groundwater diversion project. In this way, it appears that wells could be drilled without measurable impacts to groundwater resources.

Extraction to Augment Geothermal Reservoir Fluid Levels -
In contrast to the projected low impacts from geothermal well drilling and similar short-term projects, long-term extraction to augment geothermal reservoir fluid levels would likely have significant impact on sensitive receptors and, in particular, to surface water features at the south end of the valley on the Little Lake Ranch property. The Hay Ranch groundwater diversion project is currently operating at a permitted extraction rate of 3,000 acre-feet per year, comprising a significant fraction of the estimated 5,100 acre-feet per year annual recharge to the Rose Valley aquifer. In addition, LADWP has a proposal to extract approximately 870 acre-feet of groundwater on property they own at the north end of Rose Valley. The timeframe for the LADWP project has not been identified. As discussed above, potentially significant impacts to the groundwater resources of Rose Valley are predicted for even modest long-term pumping to augment geothermal reservoir fluid levels.

Appendix G presents a report on groundwater flow modeling analysis. Results indicate that groundwater extraction for just one or two geothermal plants would likely reduce groundwater flow to Little Lake Ranch. This extraction would exceed the 10 percent flow reduction threshold identified in the Hydrologic Monitoring and Mitigation Plan for the Hay Ranch project (MHA 2008). The analysis presented in Appendix G indicates that a 30-year pumping rate of approximately 1,150 acre-feet per year from a well located at the northern end of the HGLA could be sustained.[5] This would not reduce groundwater flow to Little Lake by more than 10 percent. However, the analysis also indicates that the maximum predicted drawdown at the Little Lake Ranch North well, located near the north end of the Little Lake Ranch property, could exceed 3.5 ft approximately 30 years after the start of pumping at that rate. This would exceed the Maximum Acceptable Drawdown threshold of 0.4 feet established for this well in the Hay Ranch HMMP. Considering the Hay Ranch project, significant long-term groundwater extraction, without restraints, is unlikely to be sustained without impacting the surface water at Little Lake Ranch. However, BLM would require water production stipulations of the action alternatives (e.g., trucking water to the site) which should minimize long-term impacts from geothermal development.

4.21.2.6 Biological Resources:

Several developments have already disturbed or removed vegetation communities in the HGLA. These developments include roads, transmission lines, the Coso Geothermal complex, the Hay Ranch water pipeline project, and grazing. The increased traffic and ground disturbance associated with future projects might introduce

[5] The Argonne National Lab Report (Argonne 2016) includes revised estimates of anticipated annual water consumption by the RFD scenario and other plant technologies.

non-native, invasive weed populations to the HGLA and adjoining areas. Furthermore, the West-wide Energy Corridor Final Programmatic EIS (United States Department of Energy 2009) identified a portion of the HGLA as a utility corridor, raising the possibility that future transmission projects could also be developed in the area.

Non-native, invasive weed populations not only displace native plants, but can also impact wildlife. More specifically, these weed populations can degrade the quality and quantity of forage available to native wildlife. In this way, wildlife habitats may become fragmented and degraded. Fragmentation causes the core wildlife area size to decrease and reduces the patches that are uninterrupted by human disturbance. As fragments increase, edge areas increase. This phenomenon reduces habitat connectivity, may favor the habitat generalist wildlife species over the desert-adapted species, and could threaten species richness or diversity at regional scales (Rogers et al.1996). However, based on the limited amount of habitat modification relative to the total HGLA acreage, fragmentation and loss of habitat is not expected to significantly impact the diversity or abundance of the HGLA fauna. Additionally, disturbance caps identified in the DRECP amendment to the CDCA plan, along with CMAs specific to species and species habitat, would reduce the impact of fragmentation.

Concerning listed species, the accelerated loss of habitat, combined with the increased potential for losses of burrowing or slow-moving species, such as the Mohave ground squirrel and desert tortoise, would represent the most significant cumulative impact from the HGLA RFD and other nearby developments. Development consistent with the proposed action, in conjunction with other projects, would diminish habitat availability and quality, and potentially result in the “taking” of these species. CMAs, stipulations, permitting requirements, and agreements between the CDFW and the BLM, including compliance with Section 7 of the ESA, could minimize such impacts. An increase in the number of roads and transmission lines would result in additional losses from collisions.

4.21.2.7 Cultural Resources:

Any BLM projects planned in and around the HGLA would be subject to Section 106 of the NHPA per the terms of the DRECP LUPA. In accordance with Section 106, the BLM would assess project-related effects on historic properties. Without specific data on the design location, layout, and engineering details, quantitatively estimating cumulative impacts on cultural resources would be speculative. However, given the footprints and associated ancillary facilities relative to the geographical scope of area covered by the cumulative effects analysis, cumulative impacts on cultural resources will be minimal. In many cases, implementing BMPs, CMAs and mitigation measures into the project’s design would reduce or eliminate effects on significant cultural resources and historic properties.

The project area is crossed by numerous utility and transportation corridors including US395, several high voltage transmission lines generally paralleling US395, local roads, mining activity and water pipelines especially in the westernmost section of the Project Area where US395 is located. Some of these facilities were built more than 100 years ago, and some may be upgraded in the near future. The scope of these developments in and near the HGLA may have resulted in the loss of historic properties by construction as well as visual intrusions to historic properties located in the vicinity of the HGLA.

Reasonably foreseeable future actions inside the HGLA could cumulatively impact cultural resources. The cumulative effects are manifested in terms of the loss of historic properties due to ground disturbance associated with construction or operations and maintenance and any alterations of the significant characteristics of historic properties, such as visual, auditory, or atmospheric intrusions. Those historic properties considered to be especially sensitive to indirect effects are typically those for which integrity of setting, feeling, and association are contributors to the property’s NRHP eligibility and its ability to convey a sense of its own significance. Increased visual, auditory, or atmospheric degradation to properties that are eligible under NRHP Criteria A, B, and C, and that retain integrity of setting, feeling, and association, would result in permanent cumulative impacts. However, most of the land in the project area is under Federal jurisdiction and, therefore, is subject to protection afforded by cultural resource laws and evaluation of effects in accordance with NEPA and Section 106 of the NHPA, and cumulative impacts would be minimal or unlikely.

4.21.2.8 Paleontology:

Paleontological resources are rare in areas near the HGLA, but it is possible that past, present, and reasonably foreseeable future projects and actions in southern Inyo and northern Kern counties could impact these resources. The HGLA has a low potential for containing paleontological resources, and impacts from later development of geothermal resources associated within the HGLA are not likely. In this way, the proposed action or alternatives would not contribute to other projects' cumulative impacts on paleontological resources.

4.21.2.9 Visual Resources:

Geothermal development in the HGLA, combined with other energy projects, could potentially alter the existing landscape in a number of ways, including negatively affecting sensitive viewers and the scenic quality of the landscape. Potential projects that may contribute to cumulative visual impacts include geothermal energy, solar energy, and wind energy developments as well as new roadway and transmission lines or upgrades.

Geothermal development in the HGLA and such other projects could increase the number of visible man-made structures in an area where such alterations to the landscape are generally absent, thus reducing the undeveloped nature of the landscape. They could also introduce elements such as night lighting and cooling tower plumes that would disrupt the existing visual environment.

Cumulative impacts to the scenic quality of the landscape could result from the combined visual contrast of multiple projects caused by visible structures, vegetation clearing, and ground disturbance impacting the existing landscape character and diminishing the overall aesthetic appeal of an area.

Impacts to sensitive viewers at viewpoints such as communities, recreation and preservation areas, travel corridors, and cultural sites could result when the visual contrast of multiple projects across the landscape is observed. The sensitive viewpoints identified in the HGLA and vicinity are typically stationary viewpoints where cumulative impacts would occur if the combined contrast of multiple projects across the landscape is observed in a single vista. However, cumulative impacts to sensitive viewers traveling along the U.S. Highway 395 corridor could also result if multiple projects were observed in succession along the corridor, substantially altering the viewer's visual experience.

Interest has been expressed in solar energy development at Hay Ranch, near Coso Junction along the highway. If a solar energy project is constructed, solar collection components, transmission lines, vegetation clearing, and ground disturbance could contribute to cumulative visual impacts to sensitive viewers traveling along U.S. Highway 395 and to the community of Coso Junction. Cumulative impacts could occur for additional sensitive viewers who may have more distant views of solar energy projects. However, these potential impacts are expected to be low.

The existing Coso Geothermal complex's cooling tower plume, along with other energy projects' cooling tower plumes, may contribute to cumulative visual impacts to sensitive viewers. Viewers in nearby communities along U.S. Highway 395, and in recreation and preservation areas could have views of cooling tower vapor plumes, depending on the location of the facility and atmospheric conditions. Typically, the closer facilities are located to sensitive viewpoints, the greater the dominance of the vapor plume in the visual setting, and the greater the potential impacts that may result.

Agency management objectives may not be met due to the cumulative impacts of multiple projects. The cumulative impacts of the proposed action and other planned or potential projects are not likely to meet the VRI/VRM Class II objective, which seeks to retain the existing character of the landscape. Similarly, the cumulative impacts may not meet the VRI/VRM Class III objective, which seeks to partially retain the existing character of the landscape. However, implementing the BMPs described in Chapter 2 and Appendix A would likely reduce the cumulative impacts to a level that would meet the VRI/VRM Class III objective.

To meet the VRI/VRM Class III objective, mitigation measures may include locating facilities and related disturbance so as not to dominate the landscape, and at the maximum distance from sensitive viewpoints. Additional measures to minimize cumulative impacts would include co-locating pipelines and transmission lines, particularly with existing linear facilities.

The CDCA, as amended by the DRECP LUPA, also includes numerous CMAs which would reduce potential impacts to visual resources. CMAs contained in the DRECP LUPA are a mix of general applications (LUPA-VRM-*) and those specific to ACECs (ACEC-VRM-*) and DFAs (DFA-VRM-* or DFA-VPL-VRM-*) and would be applicable depending on the location of development. The CMAs to protect visual resources include, but are not limited to siting associated transmission lines to ensure consistency with VRM Classes, use of alternative transmission line structures and non-specular conductors, using approved colors from the BLM Standard Environmental Color Chart for facilities, incorporation of the most current visual design standards and BMPs, use of BMPs to minimize impacts to night skies, and mitigation based on underlying visual values.

4.21.2.10 Lands and Realty:

Cumulative impacts from management of lands and realty are limited to direct on-the-ground impacts to other resources such as visual quality, water quality, and biological resources. Therefore, leasing of geothermal resources in the HGLA would not have a cumulative impact on the HGLA's land and realty resources.

4.21.2.11 Public Health and Safety:

Regardless of which project or action is implemented, if project proponents follow all applicable health and safety regulations, cumulative impacts to public health and safety are expected to be negligible. Though there is a potential for hazardous spills, BMPs would contain the spills, which would not be large enough to combine with spills at other project sites. The potential for cumulative impacts from the hazardous or solid wastes produced by Alternatives A, C, and D would be minimal.

4.21.2.12 Mineral Resources:

Currently, pumice is the primary economically viable mineral resource in the area. Cumulative impacts to this mineral would occur if developmental impacts associated with the proposed action are combined with impacts of other renewable energy projects. Though it is unlikely that all of the proposed/potential renewable energy projects in the region would be constructed, it is reasonable to assume that some of the projects would be constructed. Should the BLM lease land for geothermal energy project development, it might limit future mineral development in the HGLA. Other activities proposed in the area might also limit certain mineral development opportunities. However, because pumice exists throughout the region, the cumulative impact to this mineral resource is expected to be minimal, regardless of whether the proposed action, alternatives, or the other projects and actions mentioned above are implemented.

4.21.2.13 Wild Horses and Burros:

Based on the level of occurrence of wild horses and burros in the HGLA, and availability of appropriate stipulations and BMPs, any cumulative impacts to wild horses and burros from geothermal leasing and other future developments would be expected to be negligible.

4.21.2.14 Grazing:

In implementing the proposed action or alternatives, the amount of land that might be leased is small compared to the amount allotted for grazing. In this way, the acreage available for grazing and the number of livestock are not expected to be reduced significantly. Should additional geothermal projects be constructed in the region, the cumulative impact could create conditions whereby ranchers no longer view grazing as an economically viable operation. Ranchers might then retire grazing agreements and relocate operations to another area. However, royalties that leaseholders pay to ranchers may lessen the economic burden of relocating grazing operations.

4.21.2.15 Recreation:

The cumulative impact of implementing the proposed action, alternatives, or any of the other projects and actions mentioned above, would be expected to diminish the public's access to passive and active recreation in and around the HGLA. More specifically, most of the indirect impacts to recreation from all Alternatives concern possibly limiting access, disturbing wildlife, and reducing recreational enjoyment. Wildlife gathering areas would be subject to these impacts, which might reduce the public's ability to enjoy these areas for photographing nature and viewing wildlife.

In California, OHV popularity continues to increase, while legal opportunities for OHV recreation continue to decrease. As the pressure to develop land increases, the amount of land available for OHV use is expected to decrease. Implementing any of the projects and actions mentioned above, alone or in combination with other land development activities, might compel OHV enthusiasts to seek out new places to recreate. In this way, such a shift could overcrowd other existing recreation areas, adversely impact previously undisturbed areas that might include sensitive plant and wildlife habitat, and/or lead OHV enthusiasts to use undeveloped, vacant land illegally. New routes created by geothermal projects might require a CDCA plan amendment for route designation. Also, BLM law enforcement may need to focus more staff in patrolling the HGLA so that the safety of recreation visitors and the geothermal infrastructure is secured and so that the natural resources are not further impacted by unauthorized travel off designated BLM trails. However, implementing appropriate mitigation measures would be expected to reduce cumulative impacts to passive and active recreation resources.

4.21.2.16 Traffic/Transportation:

With regard to impacts to the existing traffic and transportation systems it is important to identify past, present, and reasonably foreseeable future projects and actions that, when added to the projected impacts from geothermal development in the HGLA above, could provide additional impacts to the transportation network and traffic flows in and around the HGLA. However, such actions, as presented below, would not be expected to degrade the levels of service to below acceptable levels along the roadways of southwestern Inyo County and northeastern Kern County. More specifically, further development in the Coso geothermal development area and the Deep Rose geothermal exploration area would introduce construction and personal vehicles to US 395 in the vicinity of the HGLA. Inyo County reconstructed the Gill Station-Coso Road, which will help mitigate impacts associated with an increase in construction and personal vehicle traffic en-route to and from the Coso geothermal area.

In addition, the Caltrans plans to widen US 395 to a four-lane facility in Independence, and between Olancha and Cartago (Inyo County 2009). No estimates are given in the Regional Transportation Plan as to capacity increase of the improved highway. Such a project would help mitigate the increase in construction and personal vehicle traffic associated with developing the RFD scenario in the HGLA.

Finally, one of Kern County's goals is to develop additional access points to the NAWS, if deemed necessary by Navy officials (Kern County 2007). Providing more access to this naval facility could help reduce the amount of traffic along US 395.

Socioeconomics: Cumulative socioeconomic impacts could occur if multiple projects increase populations, which could impact housing, public services, local public finances, or low-income and minority populations. The following analysis describes cumulative impacts that might occur should the HGLA RFD scenario be combined with other renewable energy projects and non-energy-related construction projects. Additional analysis is described in detail in the DEIS/PA.

<u>Additional Renewable Energy Projects</u> - During the foreseeable future, it is expected that wind and solar generation projects and their associated transmission lines would be needed to serve Southern California markets largely due to the California's Renewable Portfolio Standard Program calling for 50 percent of California's energy to be derived from renewable sources by 2030.

Another significant potential for energy development would be continuing wind energy generation and distribution from the Tehachapi Wind Resource Area (TWRA). The TWRA currently consists of about 3,800 wind turbines producing over 907 MW of power. There is continuing interest in increasing the TWRA's generating capacity. Implementing these projects would greatly increase Inyo and Kern counties' populations, demands for housing and public services, personal incomes, and tax revenues. Individual or cumulative employment estimates for these projects are not available.

Should the RFD and all of the other proposed projects named above be constructed, their direct and indirect impacts would be substantial and spread throughout northern Los Angeles, Kern, and northwest San Bernardino counties.

Though it is unlikely that all of the proposed/potential renewable energy projects in the region would be constructed, it is reasonable to assume that some would be constructed. However, it is important to note that renewable energy project development is speculative and long-term operation would require small work forces.

Non-Energy-Related Construction Projects - Analysis of cumulative effects from non-energy related construction projects is described in detail in the DEIS/PA. In addition to that analysis the California High Speed Rail Project is the only major project with information that can be used to evaluate cumulative impacts. The project's 60-minute commuting radius for construction workers would overlap the SSA. This project would link the San Francisco Area and the Los Angeles/San Diego area with high-speed rail. The rail line would pass through Bakersfield in Kern County and Palmdale in Los Angeles County. The High Speed Rail Authority officially broke ground on the project in Fresno back in early 2015. Since then, construction crews have been working on a 119-mile segment of track in the Central Valley. The project is to open in legs with the first, connecting San Jose to the Central Valley, scheduled to begin passenger service in 2025. The second leg is expected to open in 2029. The environmental reviews, which will finalize the route the train will take, are scheduled to be completed by 2020. During peak construction, the project is expected to employ approximately 160,000 construction workers.

No annual workforce estimates have been published for the Kern County portion of the project alone. However, based on construction cost estimates published by the California High-Speed Rail Authority (CHSR) (CHSR 2009) for the two segments passing through Kern County, the annual construction work force could be approximately 3,000 workers in 2018-2022, with peak-year employment of approximately 4,000. The size of this construction project could have significant impacts on the demand for Kern County construction workers, as well as on Kern County's population, particularly in the SSA's southern portion.

As mentioned above, residual impacts from realization of the RFD scenario are expected to be minimal. However, if considered along with the other potential energy projects and the CHSR Project, there would likely be a need for temporary workers beyond those that are locally available. This may cumulatively result in significant, temporary impacts on local populations, housing, and public services; and temporary cumulative impacts to the region.

4.22 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA requires an analysis of significant irreversible or irretrievable commitment of resources. Resources irreversibly or irretrievably committed are those utilized on a long-term or permanent basis, or consumed through implementation of the action. Any decision to amend the CDCA Plan (or not) would not result in an irreversible or irretrievable commitment of resources because the plan amendment does not authorize the development of any geothermal resources or any specific geothermal project. It is possible that the HGLA RFD will not be realized, even if the CDCA Plan is amended to allow for geothermal development within the HGLA in areas where it is currently not an allowed use.

4.23 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

The relationship between the anticipated short-term use of environmental, land use, and socioeconomic resources, and the maintenance and enhancement of long-term productivity, typically considers short-term construction impacts versus the long-term benefits of the project. If geothermal leases are issued, short-term impacts are typically associated with the exploration, construction, and maintenance phases, and include activities such as access road construction, increased traffic volumes and human disturbance, well construction and development, and construction and testing of the geothermal power plant facilities and associated infrastructure. Long-term impacts are typically associated with operation of these facilities during their projected life. These impacts were found to include the long-term loss of vegetation and displacement of wildlife from developed areas; minor adverse air quality impacts from plant facilities and vehicles; negligible noise impacts from plant facilities such as cooling towers and steam vents; visual impacts; generation of wastes; and possible conflicts with recreational use, livestock grazing, mineral extraction, and access to public lands.

The extent of both short- and long-term impacts will be dependent, to a large degree, on the site-specific conditions at future geothermal development sites. Future NEPA studies and permitting efforts will identify the suitability of candidate locations. Potentially adverse impacts will be mitigated, to the greatest degree feasible, by the various

BMPs, stipulations, and lease terms described in Chapter 2. As described below in Section 4.24, not all of the impacts will be able to be fully mitigated; there will be some residual adverse effects of development of geothermal resources. However, the generation of jobs and other economic benefits, along with the generation of clean, renewable energy production, will clearly provide long-term benefits to Inyo County and surrounding areas under this program. As stated in BLM's PEIS for Geothermal Leasing in the Western United States (BLM 2008a) and noted in the DEIS/PA, over the long-term geothermal plants would be producing a low-cost, clean source of renewable energy for the region, providing employment opportunities and sources of local revenue. Geothermal energy development offsets the use of irretrievable resources such as coal and oil resulting in less pollution, fewer greenhouse gas emissions, less dependence on foreign energy sources, and a possible reduction in the trade deficit.

4.24 RESIDUAL IMPACTS

Under the BLM's three action alternatives approving/denying pending leases and/or opening portions of the HGLA to geothermal leasing that are currently closed to surface and subsurface exploration and development, and amending the CDCA Plan to reflect that decision, any future geothermal exploration and development in the HGLA would result in a number of short- and long-term residual impacts as discussed throughout previous sections of Chapter 4. Residual impacts are those impacts that would remain after mitigation measures have been applied. If geothermal leases were developed and issued following thorough NEPA analyses, evaluation of alternatives, and meeting the appropriate permitting requirements, the general residual impacts would be identical to those described in Section 4.23 of the DEIS/PA.

4.25 PLAN CONFORMANCE

The HGLA is located within land that has been designated as ACEC/CDNCL, SRMA, or DFA as part of the DRECP LUPA. These land allocations govern the type and degree of land-use action allowed within the each area. Land use actions and resource-management activities on public lands within a particular land allocation should meet the objectives/desired future condition, allowable use, and be consistent with management actions for that class as defined in the DRECP LUPA. ACECs/CDNCLs and SRMAs management currently does not allow surface or subsurface development of geothermal power plants (or other renewable energy projects) under the DRECP LUPA. The land use plan amendment decision to be made by the BLM would make available for geothermal exploration and development, 22,805 acres of BLM-administered lands within the HGLA. New, renewed, and amended ROWs may be allowed on a case-by-case basis. Geothermal exploration, leasing, and development are allowed within the DFA land allocation within the HGLA. The specific application of the land allocation designations and resource management guidelines for a specific resource or activity are further discussed in the plan elements section of the CDCA Plan and the DRECP LUPA.

The HGLA site location for the project meets the requirements set forth in the CDCA plan, as amended (as applicable to the particular project/alternatives/site locations) for the following reasons:

1. <u>Agriculture:</u> Agricultural uses, excluding livestock grazing, are not allowed on BLM-administered land within the DRECP LUPA Planning Area. The site is not currently used for agriculture, and none of the project alternatives would involve use of the site for agriculture. Therefore, all four alternatives would be in conformance with this guideline.

2. <u>Air Quality:</u> BLM land within the DRECP LUPA Planning Area, including the proposed site location and the alternatives, are to be managed to protect their air quality and visibility in accordance with Class II objectives of the Federal Clean Air Act Amendments, unless otherwise designated under another class by the State of California as a result of recommendations developed by any BLM air quality management plan. These Class II objectives include, among others, attainment and maintenance of the ambient air quality standards and protection of visibility within the CDCA. The air emissions that would be associated with the proposed project are discussed in Section 4.2. These values have been compared to emissions objectives for air quality and visibility associated with Class II areas, and are all well below the limitations required for Class II areas. The emissions associated with Alternatives A, B, and C would be similar, and there would be no emissions associated with Alternatives D. Therefore, all of the alternatives would conform to the Class II objectives referenced in the CDCA Plan guidelines as amended by the DRECP.

3. Water Quality: ACEC/CDNCL lands will be managed to minimize the degradation of the water resources. BMPs, developed by the BLM during the planning process outlined in the Clean Water Act, Section 208, et seq., will be used to avoid degradation and to comply with Executive Order 12088. Section 4.6 evaluated the Alternatives for groundwater use conflicts, the potential to impact groundwater quantity and quality, and the potential to impact surface water resources. As analyzed in Section 4.6, Alternatives A, B, and C could utilize groundwater but would not result in degradation due to the withdrawal restriction requirements built in to the alternatives. Without the exact siting of a geothermal project, it is difficult to project exact impacts to surface water. However, with the conditions built into the action alternatives, there would be no degradation of the surface water. Potential impacts to groundwater and surface water from Alternative D would be described in the DRECP under Chapter IV.6, and would conform to current land use plan requirements through implementation of BMPs and CMAs.

   It is unlikely that surface water would be impacted under Alternatives B and C. Alternative A would open areas that have the highest potential for surface water for geothermal development, but would minimize impacts with the implementation of BMPs and CMAs. BLM's standard terms and conditions requiring compliance with other federal, state, and local regulations would result in compliance with EO 12088. The measures would be applicable to all project alternatives, and would, therefore, conform to the guidelines of the CDCA Plan.

4. Cultural Resources: Significant cultural resources will be preserved and protected. Procedures described in 36 CFR Part 800 and the DRECP LUPA will be observed as applicable. Section 4.8 describes the impacts on cultural resources associated with the project. All four alternatives would conform to the guidelines. All of the alternatives would protect cultural and tribal resources as established by the CDCA Plan as amended by the DRECP.

5. Paleontological Resources: Paleontological resources will be preserved and protected. Section 4.9 describes the impacts on paleontological resources associated with the project. All four alternatives would conform to the guidelines. All of the alternatives would protect cultural and paleontological resources as established by the CDCA Plan as amended by the DRECP.

6. Electrical Generation Facilities: Geothermal generation may be allowed pursuant to licenses issued under 43 CFR Part 3250, et. seq. and after NEPA requirements are met. The analysis contained in the EIS, comprise the NEPA compliance required for this guideline. All action alternatives would require licenses consistent with 43 CFR Part 3250, et. seq. All alternatives are in conformance with the CDCA Plan, as amended, by the DRECP LUPA for generation facilities.

7. Transmission Facilities: DRECP LUPA land allocations within the HGLA allow electric transmission to occur in designated ROW corridors, and potentially allow them (subject to a plan amendment) to occur subject to individual assessment on a case-by-case basis. The HGLA is partially located in a corridor. A transmission line for each power generation facility is part of the three action alternatives. Establishment of ROWs would require a plan amendment to the CDCA if they are located outside of existing utility corridors in any allocation area other than a DFA. Utility corridors proposed in DFA would not require a plan amendment. Alternatives B, C and D are in conformance with the CDCA Plan because they would not likely require any new transmission lines through an ACEC/CDNCL or SRMA. Alternative A could potentially not be in conformance with the CDCA Plan as amended by the DRECP LUPA because if a geothermal facility was located within an ACEC/CDNCL or SRMA, then a transmission line interconnection through these land allocation areas would be required.

8. Communication Sites: None of the alternatives would require the installation of communications sites.

9. Fire Management: Fire suppression measures as identified in the CDCA Plan will be taken in accordance with specific fire management plans, subject to such conditions as the authorized officer deems necessary.

The project area is within the area covered by the California Desert District Fire Management Plan, March 2010. That Plan addresses management and suppression of wildfires, and does not address incidents on specific facilities such as power plants. Should a fire occur in the area that is not specific to the facility, it would be addressed by BLM, not by the applicant, and it would be addressed in conformance with the Fire Management Plan.

10. Vegetation: The CDCA Plan as amended by the DRECP LUPA includes a variety of goals and objectives associated with vegetation as described in Section 3.7.1. These are addressed in the EIS as follows:

    Native Plants - Removal of native plants in the ACECs/CDNCLs, SRMAs and DFAs is only allowed by permit after NEPA requirements are met, and after development of necessary stipulations. Approval of the ROW grant for the any of the action alternatives would constitute the permit for such removal. The mitigation measures in the EIS and conditions of approval to be required in the Record of Decision would constitute the stipulations to avoid or minimize impacts from the removal.

    Harvesting of plants by mechanical means - Harvesting by mechanical means is also allowed by permit only. The guidelines for vegetation harvesting include encouragement of such harvesting in areas where the vegetation would be destroyed by other actions, which would be the case with the action alternatives.

    Therefore, implementation of the alternatives would be in conformance with the guidelines contained within the CDCA as amended by the DRECP LUPA.

    Rare, Threatened, and Endangered Species, State and Federal - In all land allocation areas, all state and federally listed species will be fully protected. In addition, actions which may jeopardize the continued existence of federally listed species will require consultation with the USFWS. This is fully evaluated in Section 4.7.

    Sensitive Plant Species - Identified sensitive plant species would be given protection in management decisions consistent with BLM's policy for sensitive species management, BLM Manual 6840. The objective of this policy is to conserve and/or recover listed species, and to initiate conservation measures to reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing. Further information on sensitive plant species may be found in Section 4.7, including mitigation measures to reduce the potential impact of the action alternatives. Because these measures are intended to reduce threats to this species to minimize the likelihood of listing, implementation of the alternatives would be in conformance with the guidelines contained within the CDCA as amended by the DRECP LUPA.

    Unusual Plant Assemblages - No Unusual Plant Assemblages have been identified on the site of the proposed HGLA.

    Vegetation Manipulation - Manipulation of vegetation in ACECs/CDNCLs, SRMAs and DFAs by mechanical control or aerial broadcasting is not permitted. Vegetation manipulation is defined in the CDCA Plan as removing noxious or poisonous plants from rangelands; increasing forage production; creating open areas within dense brush communities to favor certain wildlife species; or eliminating introduced plant species. None of these actions would be conducted as part of the action alternatives. Noxious weed eradication is allowed after site-specific planning. Types and uses of pesticides, in particular herbicides, must conform to federal, State, and local regulations. The action alternatives would require the applicant follow required regulations. Therefore, each alternative would conform to the guidelines.

11. Land Tenure Adjustment: None of the alternatives would involve the change of ownership of land.

12. Livestock Grazing: BLM lands within the CDCA Planning Area are managed to allow grazing and support facilities with the protection of sensitive resources. Manipulation of vegetation by chemical or mechanical means is not allowed except for site-specific needs. No alternatives involve the addition of livestock or livestock support facilities. However, depending upon the potential future siting of a geothermal facility,

the animal management units in an existing grazing allotment may be reduced. No alternative involves changing the allowance of grazing, installation of support facilities or the manipulation of vegetation. All alternatives are in conformance with the plan.

13. Minerals: No alternatives involve the development of non-fluid minerals on ACEC/CDNCL lands.

14. Motorized Vehicle Access/Transportation: New roads may be developed under ROW grants or pursuant to regulations or approved plans of operations. In areas designated as limited use area for OHV use, such as the site locations under consideration in this Final EIS, changes to the transportation network (new routes, re-routes, or closures) in "limited" areas may be made through activity-level planning or with site-specific NEPA analysis (IM 2008-014). Some roads would be developed if Alternatives A, B, or C are selected. The specific roads would require a later site-specific NEPA analysis. The access needs for the two geothermal facilities do not substantially differ among the various alternatives presented in the EIS. The alternatives are compliant with the CDCA LUPA guideline.

15. Recreation: The action alternative would not involve the use of the proposed project for recreational uses.

16. Waste Disposal: No alternatives would involve the development of waste disposal sites.

17. Wildlife Species and Habitat: The CDCA Plan as amended by the DRECP LUPA includes a variety of goals and objectives associated with vegetation as described in Section 3.7.1. These are addressed in the EIS as follows:

    Rare, Threatened, and Endangered Species, State and Federal - In all land allocation areas, all state and federally listed species will be fully protected. In addition, actions which may jeopardize the continued existence of federally listed species will require consultation with the USFWS. As discussed in Section 4.7, the desert tortoise, which is listed as federally, and state threatened, would be affected by the action alternatives. However, the action alternatives would cause only minor affects to potential habitat. The BLM has initiated formal consultation with the USFWS in accordance with Section 7 of the Endangered Species Act. BMPs in Appendix A and CMAs identified in the DRECP LUPA provide protection and compensation measures for the desert tortoise, which include stringent avoidance measures, the full level of compensation required by USFWS, and enhancement and protection measures in other areas. Therefore, the proposed project and its alternatives would comply with the guideline to provide full protection to the species.

    Sensitive Species - Identified species would be given protection in management decisions consistent with BLM's policy for sensitive species management, BLM Manual 6840. The objective of this policy is to conserve and/or recover listed species, and to initiate conservation measures to reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing. BLM sensitive wildlife species are discussed in Section 3.7 and the effects of the Alternatives is analyzed in Section 4.7.

    The action alternatives including the mitigation measures associated with these actions, could involve habitat manipulation to improve habitat (such as restoration work). Habitat manipulation to improve wildlife habitat is allowed in all land allocation areas subject to NEPA environmental review requirements, which will be completed separately. Therefore, the alternatives would be in conformance with these guidelines.

    Although allowed by the CDCA Plan, the action alternatives do not involve the introduction or reintroduction of any species, so all alternatives are in conformance with this part of the plan.

18. Wetland/Riparian Areas: Wetland/riparian areas will be considered in all proposed land use actions. These issues were considered in the analysis of the HGLA for the all alternatives. All alternatives are in compliance with this part of the Plan.

19. Wild Horses and Burros: Under the CDCA Plan guidelines, populations of wild and free-roaming horses and burros will be maintained in healthy, stable herds, but will be subject to controls to protect sensitive resources. No alternative changes this Plan element.

20. Corridor Analysis: The HGLA contains two utility corridors. Depending on the actual location of a geothermal facility, which would be determined in a future NEPA decision, the development could impact the use of the corridor for future transmission needs. There appears to be adequate capacity within the corridors for some use of the corridors for geothermal development. In the actual siting of a facility, it will be important to conduct a detailed corridor analysis to determine the impact to the corridor for the specific project. All alternatives should allow the continued function of the corridor to meet future needs.

Chapter 5 Consultation and Coordination

5.1 INTRODUCTION

The scoping process as described in Chapter 5 of the DEIS/PA is summarized here. Discussion of public comments and BLM responses to comments on the DEIS/PA and the DSEIS/PA are also included in Section 5.6.

5.2 SCOPING

Scoping is an "early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). The public, affected agencies, Native American Tribes, and other interested parties are invited to participate in the environmental review process. In addition to the purpose of informing the public about the HGLA, the scoping process is also meant to achieve the following: (1) identify potentially significant environmental impacts for consideration in the EIS; (2) identify possible mitigation measures; (3) identify alternatives to the proposal; and (4) compile a notification list of public agencies and individuals interested in future meetings and notices.

5.2.1 Public Scoping Meeting

The BLM conducted four public scoping meetings between October 13 and October 20, 2009, in Lone Pine, Bishop, Ridgecrest and Death Valley, California. These meetings were attended by a total of 32 attendees. Table 5-1 lists the dates, and locations for each of the meetings. The scoping meetings provided an opportunity for the BLM to: (1) share information regarding the HGLA; (2) discuss the proposed CDCA Plan Amendment, the decision-making processes regarding amending a plan, and consideration of whether to grant or deny pending geothermal leases; and (3) listen to the public, agency, and Native American views on the range of issues and alternatives to be considered during the preparation of the EIS and proposed CDCA Plan Amendment.

Table 5-1 Scoping Dates and Locations

Date	Location
Tuesday, October 13, 2009 5:30 – 9:00 p.m.	Boulder Creek RV Resort 2550 S. Hwy 395 Lone Pine, CA
Wednesday, October 14, 2009 5:30 - 9:30 p.m.	Eastern Sierra Fairgrounds Home Economics Bldg. Sierra Street & Fair Drive Bishop, CA
Thursday, October 15, 2009 5:30 - 9 p.m.	Kerr-McGee Center 100 W. California Ave Ridgecrest, CA
Tuesday, October 20, 2009 10:00 a.m. to 1:30 p.m.	Timbisha Shoshone Tribal Office 900 Indian Village Rd Death Valley, CA

5.3 CONSULTATION AND COORDINATION

5.3.1 Notice of Intent

On September 11, 2009, the BLM published a Notice of Intent (NOI) in the Federal Register, Volume 74, Number 175. Entitled "Notice of Intent To Prepare an Environmental Impact Statement for the Proposed Leasing of National System of Public Lands for Geothermal Resource Development in the Haiwee Geothermal Leasing Area Located in Inyo County, CA and To Amend the California Desert Conservation Area Plan of 1980", the NOI described the BLM Ridgecrest Field Office's intent to prepare an EIS to analyze the proposed leasing of 22,460 acres of BLM-managed public lands for geothermal exploration, development, and utilization in the HGLA.

The September 11, 2009, NOI also served to announce that the leasing of public lands will require an amendment to the CDCA Plan of 1980, as amended.

The NOI initiated the public scoping period for the Haiwee EIS and proposed CDCA Plan Amendment. The NOI provided the background and need for the proposed action, and described the locations of public lands being considered for geothermal leasing in the HGLA. It discussed the alternatives identified for evaluation in the EIS, aspects of the environmental review process, as well as the preliminary issues to be addressed in the EIS. The NOI provided the BLM contact information and served as an invitation for other federal agencies to provide comments on the scope and content of the EIS/PA, and requested that all comments be received by October 13, 2009.

5.3.2 News Releases

On September 11, 2009, the BLM issued a news release announcing the times and locations of the public scoping meetings in Lone Pine, Bishop and Ridgecrest, California. The news release also listed issues to be analyzed in the EIS, and contact information. A second news release was issued on October 10, 2009, announcing the addition of the Death Valley scoping meeting date, time, and location.

On July 28, 2011, the BLM issued a news release announcing that decisions will be made regarding the authorization or denial of the three pending lease applications. This analysis and decision making process is consistent with the presentation at each of the Scoping Meetings.

5.3.3 Agencies

Federal, State, and local agencies were invited to participate in the HGLA scoping meetings via two news releases issued by the BLM. The news releases also identified preliminary issues and concerns for the project, as well as contact information. Follow up emails, letters, and telephone calls were made to the agencies to solicit issues and concerns, and coordinate with permitting agencies.

5.3.4 Elected Officials

BLM sent the Inyo County Supervisors scoping letters inviting them to participate in the scoping process for an EIS and proposed CDCA Plan amendment for geothermal exploration, development, and utilization in the HGLA. The letters described the proposed action, NEPA process, scoping, preliminary resource management issues and concerns, and schedule (See Appendix H).

Table 5-2 Inyo County Supervisors and Representative Districts

Inyo County Board of Supervisors	Representative District
Linda Arcularius	District 1
Susan Cash	District 2
Beverly Brown	District 3
Marty Fortney	District 4
Richard Cervantes	District 5

5.3.5 Naval Air Weapons Station, China Lake

On September 24, 2010, the BLM conducted a briefing with the NAWS, China Lake. The BLM took this opportunity to inform NAWS about the HGLA; to go over the purpose and need for geothermal leasing on BLM-managed lands; to review the alternatives; as well as to solicit comments.

5.4 Section 106 Consultation.

The NHPA is the principal federal law in the United States protecting historic properties. Historic properties are those properties that are eligible for, or listed on, the NRHP. Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings on historic properties and to provide the ACHP an opportunity to comment. The ACHP has promulgated regulations implementing section 106 of the NHPA at 36 CFR Part 800. In carrying out its responsibilities under Section 106 of this Act, a federal agency shall identify all consulting parties with a demonstrated interest in the undertaking, and typically include the SHPO, Indian tribes, Applicants, local governments, and the public. The agency shall consult with these parties to identify historic properties, assess effects to historic properties, and resolve any adverse effects identified.

The BLM has consulted with SHPO, Indian tribes, local organizations and the public regarding the HGLA. The BLM formally notified the ACHP of the undertaking and the BLM's finding of No Adverse Effects to Historic Properties via a letter dated February 20, 2018. The ACHP responded on March 4, 2018 indicating that they do not participate in consultation for undertakings unless there are adverse effects identified. Consultation with Indian tribes is ongoing and is conducted in a Government-to-Government manner. Tribal concerns raised during this consultation have been given due consideration. The BLM has coordinated the NEPA commenting process to partially satisfy the public involvement process for Section 106 of the NHPA (16 U.S.C. 470f) as provided for in 36 CFR 800.2(d)(3). Federal, state, and local agencies, along with tribes and other stakeholders that were interested or affected by the BLM's decision on this project, were invited to participate in the scoping process and, if eligible, could request or be requested by the BLM to participate as a cooperating agency pursuant to NEPA, and/or a consulting party pursuant to NHPA.

5.4.1 SHPO Consultation

The BLM Ridgecrest Field Office initiated formal consultation with the SHPO by letter on January 11, 2011. In this letter the BLM notified the SHPO of the proposed planning effort and requested concurrence with the BLM-proposed approach to meeting its Section 106 compliance requirements of through implementation of the alternative procedures within the Supplemental Procedures For Fluid Minerals Leasing of the California Statewide Protocol Agreement between the BLM and SHPO (Protocol). The SHPO responded with a return letter on April 19, 2011 and requested to be involved in the ongoing consultation associated with the proposed plan amendment.

Between May and September 2011, the BLM held several teleconference and in-person meetings with SHPO staff. BLM provided additional project information and hosted a site visit with SHPO staff. As a result of these ongoing consultation efforts SHPO staff indicated that the Supplemental Procedures For Fluid Minerals Leasing would be an acceptable process to comply with the Section 106 requirements for this proposed Plan Amendment.

The BLM consultation with SHPO continued with another formal letter dated February 20, 2014. The BLM proposed continuing consultation under the 36 CFR 800 regulations, consistent with the Threshold Conditions of the new Protocol (Stipulations 1.2 and 8.1) and recent BLM guidance, provided an update of the identification and consultation efforts, and provided the Agency's Finding of No Adverse Effects to Historic Properties. The SHPO concurred with the BLM Finding in a response letter dated June 6, 2014.

BLM notified SHPO of the changes to the proposed HGLA due to the DRECP LUPA. BLM formally notified SHPO by letter dated April 25, 2019 that the Agency review of the changes indicate that there is no change to the APE, the previous identification and evaluation efforts adequately address the changes to the proposed HGLA, and that BLM reaffirmed its previous finding of no historic properties adversely affected.

5.5 Government-to-Government Consultation with Indian Tribes

5.5.1 Laws, Regulations, and Policies

There are numerous federal laws, regulations, and policies directing agencies to consult with federally recognized Indian tribes in a Government-to-Government manner. Information and guidelines can be found in the BLM 1780 Tribal Relations Manual and the BLM 1780 Tribal Relations Handbook. BLM Handbook H-8120-1.

5.5.1.1 National Environmental Policy Act (NEPA) Implementing Regulations 40 CFR Part 1500

NEPA requires the preparation of an environmental assessment (EA) or EIS for any proposed major federal action that may significantly affect the quality of the human environment. While the statutory language of NEPA does not mention Indian tribes, the CEQ regulations and guidance do require agencies to contact Indian tribes and provide them with opportunities to participate at various stages in the preparation of an EA or EIS. CEQ has issued a Memorandum for Tribal Leaders encouraging tribes to participate as cooperating agencies with federal agencies in NEPA reviews. Section 40 CFR 1501.2(d)(2) requires that Federal agencies consult with Indian tribes early in the NEPA process. Other sections also refer to interacting with Indian tribes while implementing the NEPA process.

5.5.1.2 National Historic Preservation Act (NHPA), as amended (16 USC 470f)

The NHPA requires that, in carrying out the Section 106 review process, federal agency must consult with any Indian tribe that attaches religious and cultural significance to historic properties that may be affected by the agency's undertakings. The Section 106 regulations include both general direction regarding tribal consultation and specific requirements at each stage of the review process. See Section 5.3.6 above.

5.5.1.3 The Archeological Resources Protection Act of 1979 (16 U.S.C. 470aa-mm)

Directs federal agencies to consult with tribal authorities before permitting archeological excavations on tribal lands (16 U.S.C. 470cc(c)). Consultation is specifically required where issuance of a permit for the excavation of an archaeological resource poses a threat to sites of religious or cultural importance. It also provides for the confidentially of information concerning the nature and location of archeological resources, including tribal archeological resources.

5.5.1.4 Native American Graves Protection and Repatriation Act (25 U.S.C. 3001, et. seq.)

Requires consultation with Indian tribes, traditional religious leaders and lineal descendants of Native Americans regarding the treatment and disposition of specific kinds of human remains, funerary objects, sacred objects and other items.

5.5.1.5 American Indian Religious Freedom Act of 1978 (AIRFA) (Title 42, U.S. Code, Section 1996)

Establishes policy of respect and protection of Native American religious practices. It seeks to correct federal policies and practices that could (a) deny access to sacred sites required in traditional religions, (b) prohibit use and possession of sacred objects necessary for religious ceremonies, and (c) intrude upon or interfere with religious ceremonies. The BLM complies with AIRFA by obtaining and considering the views of traditional religious practitioners as part of the NEPA compliance process.

5.5.1.6 Executive Memorandum of April 29, 1994 (Presidential Memorandum for the Heads of Executive Departments and Agencies Regarding Government-to-Government Relations with Native American Tribal Governments)

Directs each federal agency to operate within a government-to-government relationship with federally recognized tribal governments; consult with tribal governments; assess the impact of plans, projects, programs, and activities on tribal trust resources; and assure that tribal rights are taken into account during consideration of such plans, projects and activities.

5.5.1.7 Executive Order. 13175 (Consultation and Coordination with Indian Tribal Governments), issued November 6, 2000

Directs federal agencies to establish regular and meaningful consultation and collaboration with Tribal officials in the development of federal policies that have Tribal implications, to strengthen the United States government-to-government relationships with Indian tribes as described in the Executive Memorandum of April 29, 1994, and to reduce the imposition of unfunded mandates upon Indian tribes.

5.5.1.8 Executive Order 13007

Directs federal agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners. It requires federal agencies to avoid adversely affecting the physical integrity of sacred sites to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions. EO 13007 reinforces the purposes expressed in AIRFA. The BLM complies with EO 13007 by consulting with tribal governments and Indian religious practitioners as part of the NEPA compliance process.

5.5.1.9 DOI Consultation Policy

In December 2016, the Department of the Interior issued the Policy on Consultation with Indian Tribes. This policy clarifies and provides guidance into the application of various laws and regulations that pertain to tribal consultation. BLM guidance for tribal consultation is also provided in 2016a (Manual) and 2016b (Handbook) as discussed above.

The Native American Element of the CDCA Plan identifies three goals related to Native American concerns:

- Identify Native American values through regular contact and consultation with tribal entities and/or individuals, consistent with policy.
- Give full consideration to Native American values in land-use planning and management decisions, consistent with statute, regulation and policy.
- Manage and protect Native American values wherever prudent and feasible.
- The Native American Element of the DRECP LUPA produced two new broad areas of concern related to Native American thematic topics:
- Process Concerns.
    - Consultation. Consultation should be conducted early, often, and in an ongoing manner that is respectful of tribal sovereignty, heritage values, and that strives for meaningful dialogue.
    - Ethnography. Tribes feel that their heritage values are not fully considered by cultural resources analysis that weighs heavily on archaeological expertise and methods.
    - Document Review. Tribes want access to cultural resources and other data sets to determine for themselves to what extent tribally valued resources are present, absent, or being considered during the planning process.
    - Confidentiality. Tribes want a high level of assurance that protocols for keeping sensitive cultural resources and heritage value information out of the public purview.
    - Monitoring. Tribal Monitoring is viewed by tribes as a last-ditch effort to protect cultural resources that could otherwise be damaged by construction. Tribes want assurances that tribal monitoring is routinely required for approved projects and that monitoring protocols provide Native American monitors sufficient authority to adequately protect cultural resources of tribal value.
    - Repatriation. Tribes want avoidance of archaeological materials to be the primary method for mitigating these cultural resources. If avoidance cannot be achieved, then some tribes may prefer repatriation instead of long-term curation.
    - Access. Tribal traditional practitioners want to maintain access, to the extent feasible, to sacred places to conduct cultural and religious practices.
    - Environmental Justice. Tribes affiliated with project areas through ancestral or traditional use claim they are EJ populations because tribal people maintain longstanding ancestral and traditional-use practices and concepts connected to the environment and to their identities as Indian people, unlike other populations that do not have territories linked to their collective identities. Tribes are requesting that EJ studies be conducted to link tribal resources with tribal cultural practices and their need to perpetuate traditional cultures that rely upon intact landscapes.

- Physical World Concerns
    - Archaeological objects and sites. Some of the archaeological resources identified in the LUPA Decision Area and the DRECP area that are associated with Native Americans include, but are not limited to: habitation sites, camps, human remains, lithic reduction features (quarries), thermal features, trail segments, pot drops, cairns, cleared circles, rock rings, quartz shatter concentrations, rock art, and earth figures.
    - Traditional Cultural Properties. Examples of TCPs for Native American communities may include natural landscape features, trail systems, places used for ceremonies and worship, places where plants are gathered for use in traditional medicines and ceremonies, places where artisan materials are found, and places and features of traditional subsistence systems, such as hunting areas. Given the nature of these resources, they may not necessarily be identified during conventional archeological, historical, or architectural surveys. As a result, the existence or significance of such locations often requires ethnographic input from the tribes viewing them as significant.

- o Traditional Cultural Properties. Examples of TCPs for Native American communities may include natural landscape features, trail systems, places used for ceremonies and worship, places where plants are gathered for use in traditional medicines and ceremonies, places where artisan materials are found, and places and features of traditional subsistence systems, such as hunting areas. Given the nature of these resources, they may not necessarily be identified during conventional archeological, historical, or architectural surveys. As a result, the existence or significance of such locations often requires ethnographic input from the tribes viewing them as significant.
- o Natural Resources. Some natural resources of interest to Native Americans include but are not limited to: plants, animals, minerals, water, and natural settings. Natural resources can be used for food, medicine, totem, aesthetic or spiritual purposes. Ensuring the spiritual efficacy of plant, animal, or mineral products requires adherence to proper traditional techniques critical to the perpetuation of indigenous cultures

5.5.2 Summary of Government-to-Government Tribal Consultation

The BLM has identified and invited five federally-recognized Indian tribes to consult in a government-to-government manner on the HGLA, including the Big Pine Paiute Tribe, the Bishop Paiute Tribe, the Fort Independence Paiute Tribe, the Lone Pine Paiute-Shoshone Tribe, and the Timbisha Shoshone Tribe. In addition, four non-federally recognized tribes and tribal communities have also been invited to consult regarding this undertaking, including the Kern Valley Indian Council, Tubatulabals Tribe of the Kern Valley, Monache Intertribal Council, and the Paiute River Indian Council-Nuui Cunni Interpretative Center. None of those Indian tribes have treaties with the United States Government, and no trust assets managed by the BLM are within the HGLA. The BLM notified tribes and requested government-to-government consultation by letter on October 7, 2009, at the earliest stages of review for the HGLA. Additional consultation letters were sent on July 13, 2011 and May 23, 2012. All letters included a request that the Tribes identify any areas to which they attach cultural or religious significance so that these sites may be considered in the environmental review for the HGLA. The BLM also engaged in formal government-to-government consultation including three formal letters and 13 face-to-face meetings and nine staff level coordination meetings regarding the HGLA. Copies of BLM letters to Indian tribes are included in Appendix F.

Indian tribes participating in the Scoping Process requested an opportunity for additional involvement, particularly through the Section 106 consultation process. They are concerned about extraction of resources from the land; the benefit to the tribes from the proposed action; impacts on spiritually important sites; impacts to Coso Hot Springs; the effects of the proposed action on the water table; the need for new transmission lines; and whether the new facilities could prohibit access to traditional lands. They also stated that geothermal development in the leasing area could conflict with their traditional values and that impacts on Native American values are not amenable to mitigation. Also expressed was the desire to have tribal monitors present in the event of any surface disturbing activities.

The BLM has received formal written responses from two Indian tribes – the Big Pine Paiute Tribe on November 20, 2009 and the Bishop Paiute Tribe on January 21, 2010. Big Pine Paiute Tribe comments included:
Need for timely tribal notification of projects by the BLM;

- Relationship of the HGLA to the Coso Known Geothermal Resource Area;
- Long-term viability of geothermal energy;
- Denial of access to the land in the leasing area;
- Overuse of water to the extent that plant and animal species and habitats would be harmed; and
- The need for the EIS to address impacts to wetlands, regional hydrology, vegetation, wildlife, rare plant and animal species, geology, aesthetics and scenic values, recreation, dust generation, as well as cumulative impacts.

Comments and recommendations in the January 21, 2010, response letter from the Bishop Paiute Tribe included:

- Information on the project boundaries and design;

- Results of cultural resource records searches and cultural resource surveys;
  - The need for a visit to the HGLA area;
  - Recommended that qualified archaeologists perform future surveys prior to any development;
  - Recommended that cultural resource monitors be used during surveys and ground disturbance; and
  - Copies of all cultural resource documentation.

The BLM provided field briefings and site tours to tribes on July 21, 2011 and August 16, 2011. Representatives from Timbisha Shoshone (Vice Chairman), the Big Pine Paiute Tribe (Tribal Council), Lone Pine Paiute-Shoshone Tribe (Tribal Historic Preservation Officer and the Tribal Environmental Coordinator), the Bishop Paiute Tribe (Tribal Environmental Coordinator, the Tribal Historic Preservation Officer, and a Tribal Cultural Committee Member), and two members of the Kern Indian Community. BLM notified tribes of the Agency's Finding of No Adverse Effects to Historic Properties by letters dated April 25, 2019. BLM received no responses to this notification.

As a result of the consultation identified above, no specific TCPs, archaeological sites, traditional hunting and gathering areas, or resources with cultural or religious significance were identified within the HGLA. In contrast, the idea that the entire landscape is sacred, was expressed. The BLM recognizes that the area is strongly rooted in Tribal histories, is important for maintaining the continuing cultural identity of the communities, and that the resources within the HGLA may hold a particular significance to Indian tribes. No specific resources would be affected by the proposed HGLA, but future actions within the HGLA may have the potential to affect these resources.

Comments received from the Tribes are discussed in Section 5.4. Government-to-Government consultation for this EIS is ongoing as BLM is currently conducting additional consultation regarding changes to the prosed HGLA due to the DRECP LUPA. The BLM will continue to consult with interested tribes and will continue to keep all tribal entities informed about the NEPA and NHPA status.

5.6 SUMMARY OF SCOPING COMMENTS RECEIVED

During the scoping process, the BLM received 14 comment letters and numerous verbal comments during the scoping meetings. Below is a summary of the issues and concerns that were used to determine the scope and significant issues to be analyzed in the EIS. A detailed summary of the public scoping effort, and document issues and concerns expressed during scoping may be found in the Scoping Report (Appendix H).

5.6.1 Purpose and Need

A number of commenters were concerned about the impacts of potential geothermal exploration, development, and utilization. They requested identification of suitable and non-suitable locations for geothermal resources. The public inquired about the anticipated amount of generation, the power plant type and lifespan, and cooling methods. Many commenters requested that the quantity of water needed, and its source, be identified.

A discussion of the Plan Amendment to the CDCA Plan in regards to the Geothermal Programmatic EIS and HGLA was requested. Some scoping meeting attendees were interested in the relationship of the HGLA to the Deep Rose Geothermal Exploration Project and the three pending lease applications, as well as the connection to Coso Geothermal Fields.

5.6.2 Alternatives

It was recommended that a reasonable range of alternatives, including the no action alternative, be analyzed. The following alternatives were suggested by the public and agencies: smaller leasing areas, alternative geothermal facility designs, and alternative water sources. There was also concern regarding the lack of a competitive bidding process for leasing of government lands for other renewable energy development, such as solar and wind, and multiple uses of the land.

5.6.3 Air Quality

Consideration of potential impacts caused by windborne dust and pollution, carbon dioxide emissions, and impacts to air quality in Rose Valley was recommended. It was also suggested that any program-related emission contributions to non-attainment areas be addressed, and that greenhouse gases and global warming be addressed.

5.6.4 Biological Resources

Concern was expressed for the potential loss of water resources in Rose Valley, and for the potential impacts it may cause to habitat and vegetation. A member of the public requested a surface water baseline study to analyze the potential impacts of surface water withdrawal to the local ecosystem. Analysis of riparian habitats, sensitive natural communities, natural springs, and artesian wells throughout the Rose Valley was also suggested.

Concern was also expressed over the loss of habitat for the Mohave ground squirrel and desert tortoise. The NAWS, China Lake expressed concerned about the WEMO Plan's compensation ratios for the Mohave ground squirrel. They were also concerned with the potential to exceed the disturbance threshold. A member of the public also requested that impacts to vegetation, animals, and insects be addressed. Coordination with the CDFW was requested.

5.6.5 Geothermal Resources

An organization requested the identification of the size and composition of existing geothermal resources. It was requested by the organization that the amount of electrical production from geothermal resources be based upon the size and extent of the underground geothermal reservoir. It was also requested that preservation of the geothermal reservoirs and long-term management be addressed. Attendees were concerned about the seismic activity in the area, and depletion of underground water basins. There was concern regarding potential impacts to the Coso Geothermal Power Plant and operations, as well as to the Coso Hot Springs. Attendees were interested in the cumulative impacts of a number of geothermal projects (existing and future) in close proximity to the HGLA.

5.6.6 Hazards and Hazardous Materials

There was concern regarding the potential for hazardous substance generation by future development in the HGLA, and treatment and disposal of hazardous substances. An analysis of wastewater and emission hazards to the public, and potential impacts from heat emissions, was requested.

5.6.7 Land Use / Agriculture / Recreation

Some scoping meeting attendees are concerned about the relationship of a number of desert management plans such as the CDCA Plan, the Northern and Eastern Mojave Plan, and the WEMO Plan with the proposed activities in the HGLA, and with potential land use conflicts. The HGLA contains roads utilized by recreational off-highway vehicles, and the public is concerned about decreased access and potential impacts to recreation. There is also concern regarding agricultural operations in the Rose Valley, and regarding the potential impacts to water well owners. The NAWS, China Lake is concerned about development and operations activity conflicts with flight paths and military special use areas.

5.6.8 Noise and Electromagnetic Fields (EMF)

An organization requested evaluation of noise generation and projected noise levels from development in the HGLA, and evaluation of potential impacts to workers and wildlife.

5.6.9 Public Health & Safety

The public is concerned about potential impacts to human health and safety and requested that the potential for wastewater and emission hazards to the public be analyzed.

5.6.10 Socioeconomics

Inyo County inquired about the potential for creation of jobs and revenue generation for the County. The County requested consideration of the potential impacts to the population and housing, and potential for socioeconomic impacts or adverse impacts to the Coso Geothermal Power Plant.

5.6.11 Traffic and Transportation

Caltrans was concerned about potential highway transportation issues on US 395, such as highway access points for future facilities and transport of construction materials and workforce.

5.6.12 Utilities & Public Services

Scoping meeting attendees questioned whether adequate electrical transmission was available to transfer the geothermal energy to the load centers, and inquired about plans to upgrade the existing transmission lines or need to construct a new substation.

5.6.13 Visual Resources

The Rose Valley supports a number of recreational uses and there is concern regarding visual impacts from the construction of structures and geothermal facilities.

5.6.14 Water Resources

Attendees were concerned about the increasing scarcity of water in California, especially in Rose Valley. Most of the comments received inquired about the water needs for geothermal energy development and production and questioned the source and amount of water appropriations. Rose Valley residents were very concerned about any potential reductions to water resources and the protection of watersheds, water rights, and nearby public lands. The public inquired about the presence of a connection between the GeoReservoir (Coso geothermal source aquifer) and the water basins in the HGLA, and requested evaluation of potential impacts from the use and consumption of the GeoReservoirs (Coso or HGLA geothermal source aquifer) on local water basins. The Native American Tribes were also concerned about the close proximity of the Coso Hot Springs to the HGLA and potential impacts to the hot springs. There was concern for the short and long-term impacts of water extractions.

5.6.15 Cumulative Effects

Many commenters were concerned about the cumulative impacts from existing and proposed geothermal projects such as the Deep Rose and Coso Geothermal Fields. There was also concern regarding large-scale, non-geothermal operations in the vicinity of the HGLA, such as LADWP operations, Owens Lake Dust mitigation, water utilization by Coso's Hay Ranch Water Extraction and Delivery System, and livestock grazing. They were especially concerned about the increasing scarcity of water in California and the needs for groundwater extraction by these projects. The public was concerned that the reasonable foreseeable development scenario was estimated to be too conservative, and may underestimate potential cumulative impacts and future projects and development. Cumulative effects should include an inventory and analysis of the following resources: wetlands (all springs and seeps), regional hydrology, vegetation, wildlife, rare plant and animal species, geology, aesthetic/scenic values, recreation, and dust generation. In addition to geothermal energy development, an evaluation of potential cumulative impacts with future solar and wind energy developments was requested.

5.6.16 Other Comments

The Native American Tribes, Inyo County planners, and local agencies requested additional coordination with and notification by the BLM. A comment was received that questioned a lease applicant's experience and knowledge of geothermal resource exploration and development, and financial capability. Consideration of previous studies, reports, evidence, and comments prepared for projects, such as the Coso Project, was suggested. An organization also requested production of public records in connection with the HGLA.

5.7 PUBLIC COMMENTS ON DEIS AND DSEIS

5.7.1 Introduction

In accordance with the CEQ Regulations (40 CFR, Part 1503), the BLM has received and evaluated public comments on the DEIS/PA and DSEIS/PA for the HGLA and has prepared written responses to these comments. Responses to substantive comments on the DEIS/PA and DSEIS/PA are provided in Appendix Z of this FEIS/PA in Section Z2.0 and within Tables Z-1 and Z-2. Appendix Z also contains copies of the comment letters received during the public review process. These letters include notation of each substantive comment as described in Section 5.6.3 below.

The BLM distributed the DEIS/PA for the HGLA for public and agency review and comment between May 4 and August 3, 2012. The BLM announced public meetings in Lone Pine and Ridgecrest to assist the public in preparing comments on the DEIS/PA. Public meetings were held on June 13, in Lone Pine, California, and June 14, in Ridgecrest, California. The BLM received 15 comment letters from agencies, organizations, and individuals/businesses during the comment period. As a result of some of those comments, the BLM developed the DSEIS/PA as described in Section 1.1 of this FEIS/PA.

The BLM subsequently distributed the DSEIS/PA for the HGLA for public and agency review and comment between May 3 and August 1, 2019. The BLM received 15 comment letters from agencies, organizations, and individuals/businesses during the comment period.

5.7.2 Format of Response to Comments

The comments received on the DEIS/PA and DSEIS/PA are organized by agency, organization, business, or member of the general public. Each comment letter/e-mail is assigned a unique number. Individual comments/issues within each comment letter/email are numbered individually along the right-hand margins. Comments, so delineated, are provided in Appendix Z, Section Z3.0.

5.7.3 Index of Comments Received

Tables 5-2 and 5-3 list all individuals, businesses, agencies and organizations that provided written comments on the DEIS/PA and DSEIS/PA. As described above, each comment letter, upon receipt, was assigned a unique letter with each comment individually numbered as well. For example, comment A-01 is the first substantive comment in Comment Letter A. "A" represents the individual/agency/organization commenter; the "01" refers to the first substantive comment in that letter. Letters A through O are assigned to DEIS/PA public comments, and Letters AA though GG are assigned to DSEIS/PA public comments.

Table 5-2 Comment Letters Received on the HGLA Draft EIS

Letter	Commenter	Correspondence Date	Comment Type
A	California Unions for Reliable Energy	August 2, 2012	Organization
B	Defenders of Wildlife/Sierra Club/Kerncrest Audubon Society	August 2, 2012	Organization
C	Defenders of Wildlife/ Friends of the Panamints/Center for Biological Diversity	July 16, 2012	Organization
D	Native American Heritage Commission	June 4, 2012	Agency
E	County of Inyo Board of Supervisors	July 10, 2012	Agency
F	Big Pine Paiute Tribe	July 23, 2012	Agency/Tribe
G	California Department of Transportation – District 9	May 24, 2012	Agency
H	Department of Navy – China Lake Naval Air Weapons Station	July 27, 2012	Agency
I	Los Angeles Power and Water Department	August 1, 2012	Organization
J	Environmental Protection Agency	July 30, 2012	Agency

Letter	Commenter	Correspondence Date	Comment Type
K	Rose Valley Properties, LLC	No Date	Business
L	Little Lake Ranch	July 23, 2012	Business
M	Tom Budlong	July 26, 2012	Individual
N	Sophia Merk	July 20, 2012	Individual
O	Center for Biological Diversity	August 9, 2012	Organization

Table 5-3 Comment Letters Received on the HGLA Draft Supplemental EIS

Letter	Commenter	Correspondence Date	Comment Type
AA	County of Inyo-Board of Supervisors	July 9, 2019	Agency
BB	Lahontan Regional Water Quality Control Board	July 23, 2019	Agency
CC	Environmental Protection Agency	July 31, 2019	Agency
DD	Big Pine Paiute Tribe	July 31, 2019	Agency/Tribe
EE	Amargosa Conservancy, et.al	July 31, 2019	Organization
FF	Center for Biological Diversity	August 1, 2019	Organization
GG	Basin and Range Watch	July 30, 2019	Organization

Chapter 6 List of Preparers

6.1 BUREAU OF LAND MANAGEMENT

Carl Symons	Ridgecrest Field Manager
Greg Miller	Project Manager/Assistant District Manager-Resources
Melissa Harris	Planning and Environmental Coordinator
Carly Summers	Planning and Environmental Coordinator, State Office
Mark Chatterton	Geology, Branch Chief Energy and Minerals
Jim Scrivner	Deputy State Director, Energy & Minerals
Dan Munger	Geologist, State Office
Matthew Wokosin	Petroleum Engineering Technician (Geothermal), Ridgecrest Field Office
Caroline Woods	Biologist, Ridgecrest Field Office
Mark Massar	Biologist, California Desert District Office
Tiffany Arend	Archaeologist, California Desert District Office

6.2 POWER ENGINEERS, INC.

Linda Erdmann	Project Manager
Darrin Gilbert	Project Coordinator/Visual/Lands/Special Designations
Heidi Horner	Technical Editor
Ben Bainbridge	Biological Resources
Ken McDonald	Biological Resources
Michael Dice	Cultural/Paleontological Resources & Native American Concerns
Wendy Hosman	Water Resources/Recreation
Charles Hutchinson	Grazing/Traffic/Socioeconomics
Tim Hazekamp	GIS Specialist

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APPENDIX A

BEST MANAGEMENT PRACTICES AND RECLAMATION PERFORMANCE STANDARDS

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APPENDIX A

BEST MANAGEMENT PRACTICES, MITIGATION MEASURES, AND RECLAMATION PERFORMANCE STANDARDS

A 1.0 Overview of Best Management Practices (BMPs)

Geothermal resource leases are subject to the standard stipulations and lease terms. The current lease terms, dated September 2008 and subject to changes, are found on Form 3200-24a (included at the end of Appendix K). The right to explore, develop and utilize leased geothermal resources is inherent in the lease, subject to stipulations, legal requirements, and terms and conditions on permits. Specific conditions of approval and other mitigation measures would be required during subsequent authorizations. These include timing and location of activities during the development phase (see Section 2.4 and Appendix B of this Final Environmental Impact Statement (FSEIS), Reasonably Foreseeable Development scenario). In addition, the Bureau of Land Management (BLM) and other governmental agencies may require specific permits.

In addition to the standard stipulations and lease terms, the BLM may require a number of best management practices (BMPs) and mitigation measures as conditions of any lease under the action alternatives. BMPs and mitigation measures are generally applied or applied on a site-specific basis to avoid, minimize, reduce, rectify, or compensate for adverse environmental or social impacts. They are applied to management actions to aid in achieving desired outcomes for safe, environmentally responsible resource development, by preventing, minimizing, or mitigating adverse impacts and reducing conflicts.

This section provides a list of sample BMPs that have been collected from various BLM, and other applicable agency documents addressing geothermal and fluid mineral leasing and development, including resource management plans, forest plans, and environmental reports for geothermal leasing and development. The purpose of this section is to provide a list of potential BMPs that could be incorporated as appropriate into the permit application by the lessee or could be included in the approved use authorization by the BLM as conditions of approval. When implementing new BMPs, the BLM will work with an affected lessee early in the process, to explain how BMPs may fit into their development proposals and how BMPs can be implemented in a cost effective and design appropriate manner. The BLM will discuss potential resource impacts with the lessee and seek the operator's recommended solutions. The BLM would encourage the lessee to incorporate necessary and effective BMPs into their project proposal. BMPs not incorporated into the permit application by the lessee may be considered and evaluated through the environmental review process and incorporated into the use authorization as conditions of approval or rights-of-way stipulations.

The Renewable Energy Action Team (REAT) agencies (California Energy Commission (CEC), California Department of Fish and Wildlife (CDFW), BLM, and United States Fish and Wildlife Service (USFWS)) jointly prepared the *Best Management Practices and Guidance Manual: Desert Renewable Energy Projects*, September 2010. The manual fulfills agency commitments in the State of California's Executive Order (EO) S-14-08, Secretary of the Interior Secretarial Order (SO) No. 3285, and related memoranda between California and the United States Department of Interior (DOI), and between the REAT agencies (signed in 2008 and 2009). The mitigation measures and BMPs proposed in the manual have been adopted for this EIS. Best Management Standards and Reclamation Performance Standards that are relevant to the Haiwee Geothermal Leasing Area (HGLA), and may apply to all action alternatives that authorize geothermal leasing, are listed in this Appendix.

The BLM has published environmental BMPs on its website and in *The Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development* (BLM 2007; commonly referred to as the Gold Book). Although these references were published as guidance and standards for the oil and gas industry, the mitigation measures for roads, transmission lines, pipelines, buildings, and screening are applicable guidance for developing and implementing BMPs for geothermal resource power plants. This document has been adopted for this FSEIS and will be applied to geothermal exploration and development within the HGLA.

The CEC approved the Salton Sea Unit #6 Power Project (CEC Publication No. 800-03-021, 2003) with conditions of certification and published a geothermal resources permitting guide (Blaydes & Associates 2007). Both documents provide examples of and explain in detail the requirements for developing geothermal wells and power plants in California. This document has been adopted for this SDEIS.

BMPs for geothermal energy are also incorporated into this SDEIS as detailed below from the Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (PEIS). The Record of Decision for the Geothermal PEIS was signed on December 17, 2008. Where the BMPs identified in the PEIS are inconsistent or incompatible with those developed under the HGLA Final EIS, the staff will determine the appropriate practices during the site-specific environmental review. Only those individual mitigation measures reasonably necessary to ensure environmentally responsible geothermal development should be selected. BMPs and mitigation measures should be dependent on factors such as the project size, location, site-specific characteristics, and potential resource impacts. Prior to inclusion into a permit, the measures may be further modified to meet site-specific situations and agency requirements.

The BMPs also include those identified in the Environmental, Health and Safety Guidelines for Geothermal Power Development (International Finance Corporation 2007), recommended controls on hydrogen sulfide gas (H_2S) emissions (Nagl n.d.), examples of waste discharge requirements (Regional Water Quality Control Board [RWQCB], Colorado River Basin Region 2007), and injection well guidance (USEPA 1999).

The BLM will incorporate BMPs as detailed in this appendix into proposed use authorizations after appropriate review. Final BMPs are most suitable for consideration by an administrative unit on a case-by-case basis, (1) depending on their effectiveness, (2) the balancing of increased operating costs vs. the benefit to the public and resource values, (3) the availability of less restrictive mitigation alternatives that accomplish the same objective, and (4) other site specific factors.

Guidelines for applying and selecting project-specific requirements include determining whether the measure would: 1) ensure compliance with relevant statutory or administrative requirements, 2) minimize local impacts associated with siting and design decisions, 3) promote post construction stabilization of impacts, 4) maximize restoration of previous habitat conditions, 5) minimize cumulative impacts, or 6) promote economically feasible development of geothermal energy on BLM-administered lands.

Geothermal project developers are advised to incorporate the general BMPs applicable to their project and project site into their Plan(s) of Development or Plan(s) of Operation submitted to the BLM, which are required for surface-disturbing activities. The BMPs provide guidance for lessees on how to meet Section 6 of the standard lease terms for this project area. Depending on site-specific conditions and individual development plans, the following BMPs and mitigation measures may be required. Others could be identified during site-specific analyses.

The BMPs, mitigation measures, lease stipulations, conditions of approval, and the construction, operation, maintenance, and reclamation of the geothermal developments, will be monitored to ensure their continued effectiveness and compliance through all phases of the project. When compliance is determined to be ineffective, the BLM will take steps to determine the cause and require the operator to take corrective action which may include stopping operations until compliance is restored as determined by the Authorized Officer.

A 2.0 General BMPs

These BMPs would help reduce or eliminate impacts to multiple elements of the human and natural environment. Many BMPs would also minimize operator costs. The following BMP’s are applicable across multiple resources, project components, and project phases:

1) Prior to geothermal exploration and development, a focused geotechnical survey should be conducted on potential areas of disturbance such as roads, drill pads, and power plant locations so they will be sited to avoid any hazards from subsidence or liquefaction (i.e., the changing of a saturated soil from a relatively stable solid state to a liquid during earthquakes or nearby blasting). Structures and facilities will be designed and constructed in accordance with seismic safety standards. Initial exploration (geophysics) does not disturb any land subsurface. The survey will evaluate and identify potential geologic hazards and would provide remedial grading recommendations, foundation and slab design criteria, and soil parameters for the design of geothermal power infrastructure. Prior to the initiation of geotechnical surveys (i.e., subsurface work as well as off-road travel), all areas of potential ground disturbance will be submitted to the appropriate environmental compliance activities (e.g., cultural resource survey, biological investigations) as determined by the BLM.
2) The operator will collect available information describing the environmental and socio-cultural conditions in the vicinity of the proposed project and will provide the information to the agency.
3) A monitoring program will be developed by the operator to ensure that environmental conditions are monitored during the exploration and well drilling, testing, construction, and utilization and reclamation phases. The monitoring program requirements, including adaptive management strategies, will be established at the project level to ensure that potential adverse impacts of geothermal development are mitigated. The monitoring program will identify the monitoring requirements for each major environmental resource present at the site, establish metrics against which monitoring observations can be measured, identify potential mitigation measures, and establish protocols for incorporating monitoring observations and additional mitigation measures into ongoing activities. The operator will provide results of the monitoring program to the agency in an annual report.
4) Prior to commencing work, project boundaries (including access routes and staging/parking areas) will be staked or flagged, as necessary, to identify the limits of the work area.
5) No work will occur outside defined project limits.
6) Work area footprints will be restricted to existing disturbed areas to the extent feasible.
7) Exploration, construction and operations related traffic would be restricted to routes approved by the agency(ies). Construction of new access roads or cross-country vehicle travel would not be permitted unless prior written approval is given by the authorized officer. Authorized roads used by the proposed action will be rehabilitated when construction activities are complete. The agency(ies) would work with the proponent to develop site-specific standards for route reconstruction. Use of other unimproved roads will be restricted to emergency situations.
8) Neither roads, drilling pads, nor other constructions should divert nor focus rain runoff within the sub-watersheds.

A 3.0 Resource Specific BMPs

A 3.1 Air Quality

The following air quality BMPs include recommendations to reduce emissions of criteria or hazardous air pollutants, CO_2 and H_2S. The United States Environmental Protection Agency (USEPA) does not classify H_2S as either a criteria air pollutant or a hazardous air pollutant. The state of California, however, adopted an Ambient Air Quality Standard for H_2S to protect public health and decrease odor annoyance. Air pollution control/management districts may have short-term, maximum (for example, hourly) and annual average standards for stationary sources of H_2S, including geothermal power plants. The Great Basin Unified Air Pollution Control District (GBUAPCD) has adopted rules that all operator shall adhere to (GBUAPCD 2006). The US Supreme Court has upheld in Massachusetts v. Environmental Protection Agency (2007) that the EPA is to regulate carbon dioxide and other greenhouse gases (GHGs) as pollutants. The State of California through legislation has set targets to reduce CO_2-equivalents of GHG emissions that the Air Resources Board implements.

1) The operator will coordinate with the GBUAPCD to develop and implement an air quality monitoring plan.
2) Drilling, well testing and geothermal production will comply with appropriate GBUAPCD hydrogen sulfide emission limits.
3) The operator shall adhere to GBUAPCD Rules regarding control of fugitive dust and emissions of particulate matter, carbon dioxide, oxides of nitrogen, sulfur compounds, and adhere to geothermal emission standards.
4) Develop an emissions inventory, a list of both long-term (annual) and short-term (generally 1-hour or 8-hour) emission rates for each relevant pollutant from each emission point source (such as well venting, drill rig diesel engines, fugitive dust, plant silencers, sulfur plant exhaust, cooling towers).
5) Organize emissions inventory by project phase: exploration; well-field development (estimate number of wells to be drilled, vented each year); plant operations (estimate number of replacement wells to be drilled each year, and forced and planned outage rates).
6) Quantify the pollutants contained in the geothermal fluids and steam by testing well venting.
7) Collect fluid and gas samples for every well using independent laboratory and air quality specialist for at least one round of sample collection and chemical analysis.
8) Own both the geothermal production and injection wells as well as the geothermal power plant, so that responsibility for H_2S emission control is not lost between the steam producer and electricity generator.
9) As an integral part of an odor control program, implement an ambient monitoring program for H_2S and meteorology. Continue to operate the meteorological station used to collect baseline data. Use an USEPA reference sulfur dioxide monitor with an in-line sulfur dioxide (SO_2) scrubber and H_2S to SO_2 oxidizer for real-time collection of less than 1.0 part per billion H_2S. Record hourly H_2S and wind data for retrieval whenever odor issues arise.
10) When H_2S is detected in ambient air in amounts equal to or greater than 0.03 parts per million (ppm) per hour (standard established by the ARB), the H_2S must be oxidized by current technological methods. H_2S is exempt from regulation where measured H_2S in the Non-Compressible Gas (NCG) component of geothermal fluid is not exposed to the atmosphere and there are no detectable H_2S, locations around the same plant, and/or locations in the same well field t.
11) Remove H_2S when the maximum ambient air concentration exceeds the standard established by the California Air Resources Board (CARB) (i.e., 0.03 parts per million (ppm) per hour). Utilize a “Stretford”-type process or by chemical oxidation if the concentration in the NCG stream is low enough for these processes to be effective. This standard applies to any flash type geothermal plant, but not to a binary (Organic Rankin Cycle) plant. H_2S is required to be monitored at both types of plants.
12) The operator will prepare and submit to the agency an Equipment Emissions Mitigation Plan for managing diesel exhaust, an Equipment Emissions Mitigation Plan will identify actions to reduce diesel particulate, carbon monoxide, hydrocarbons, and nitrogen oxides associated with construction and drilling activities. The Equipment Emissions Mitigation Plan will require that all drilling/construction-related engines:
    a. Are tuned to the engine manufacturer’s specification in accordance with an appropriate time frame.
    b. Do not idle for more than five minutes (unless, in the case of certain drilling engines, it is necessary for the operating scope).
    c. Are not tampered with in order to increase engine horsepower.

d. Include particulate traps, oxidation catalysts, and other suitable control devices on all drilling/construction equipment used at the project site.

e. Use diesel fuel having a sulfur content of 15 ppm or less, or other suitable alternative diesel fuel as defined by CARB.

f. Include control devices to reduce air emissions. The determination of which equipment is suitable for control devices should be made by an independent Licensed Mechanical Engineer. Equipment suitable for control devices may include drilling equipment, work over and service rigs, mud pumps, generators, compressors, graders, bulldozers, and dump trucks.

13) H_2S emissions would be abated during well testing (e.g., above 2.5 kilograms per hour per well (kg/hr/well) of H_2S per GBUAPCD Rule 424), for example, through the injection of hydrogen peroxide and sodium hydroxide into the test line.

A.3.1.1 Construction Best Management Practices for Air Quality

General

1) Limit speed of vehicles in construction areas to 10 miles per hour (mph) or less.

2) Water unpaved roads and disturbed areas at least twice per day. Increase watering frequency when wind speeds exceed 15 mph.

Fugitive Dust Suppression Program (Construction)

1) Prior to soil disturbance, install windbreaks at the windward sides of construction areas. The windbreaks shall remain in place until the soil is either stabilized or permanently covered.

2) Immediately cover excavated and stockpiled soil upon completion of work.

3) Cover all trucks hauling dirt, sand, soil or other loose materials and maintain at least six inches freeboard between the top of the load and the top of the trailer.

4) Maintain cargo compartments so that no spillage or loss of material can occur.

5) Clean cargo compartments for all haul trucks at the delivery site, after removal of materials.

6) Prior to entering a public roadway, employ tire cleaning and gravel ramps to limit accumulated mud and dirt deposited on the roads.

7) Clean up spillage and material tracked out or carried out into a paved road surface within 8 hours.

Well Drilling Emissions and Testing Issues (Construction)

1) Contractors will be hired by the lessee to conduct well drilling activities. These contractors will be required to have Statewide Portable Equipment Registrations (SPER) issued by CARB or be permitted by GBUAPCD for their diesel fueled engines. Typical SPER requirements for these types of engines include:

a. The opacity shall be limited to 20 percent or less aggregating for more than three minutes in any one hour.

b. PM_{10} emissions shall be limited to less than 0.1 grain per dry standard cubic feet (DSCF) corrected to 12 percent carbon monoxide (CO).

2) The well flow testing shall be completed as expeditiously as possible.

3) Well drilling activities shall use engines that meet or exceed the following USEPA off-road engine emission standards: Tier 3 engines (at a minimum) from 2018 to 2020; and Tier 4 engines after 2020.

4) The brine from a flow test is routed to a well test unit designed to minimize the release of entrained brine, which contributes to the particulate matter and metals release.

5) Brine flow rates shall be limited to 800,000 pounds per hour (lbs/hr) for both production wells and injection wells (CEOE 2003b, Response #3a).

6) Flow tests shall last less than 96 hours after the completion of the drilling.

7) Use hydrogen peroxide, sodium hydroxide (or another non-pollutant, non-toxic oxidizing agent) to control the H_2S emissions during well flow tests and initial commissioning.

Heavy Duty Diesel Equipment (Construction)

1) Perform regular maintenance to prevent emission increases due to engine problems.
2) Use ultra-low-sulfur fuel meeting CARB standards (15 ppm) for motor vehicle diesel fuel.
3) All large construction diesel engines which have a rating of 100 horsepower (hp) or more shall be equipped with catalyzed diesel particulate filters (soot filters), unless certified by engine manufacturers or the on-site air quality control mitigation monitor (AQCMM) that the use of such devices is not practical for specific engine types. For purposes of this BMP, the use of such devices is not practical for the following reasons:
    a. There is no available retrofit control device that has been verified by either CARB or the USEPA to control the engine in question to the highest level of available control;
    b. The construction equipment is intended to be on-site for five days or less; or
    c. If the AQCMM can demonstrate a good faith effort to comply with this requirement and that compliance is not possible.
4) Paving of all major access/egress routes to the project site and requiring construction workers and deliveries to take paved routes to and from the project site.
5) Suspension of activities causing fugitive dust under windy (i.e., sustained winds >25 mph) conditions.

A.3.1.2 Operational Best Management Practices for Air Quality

Fugitive Dust Suppression Program (Operations)

1) Pave all access and internal power plant roads.

2) Direct load haul trucks with recently dewatered filter cake.

3) Use wind break shields or structures at all exposed operation areas as feasible.

4) Designate a person to oversee the implementation of the fugitive dust control program.

5) Employ electric motors for operations and maintenance equipment when feasible.

Cooling Tower Mitigation Measures (Operations)

1) Control H_2S using a LO-CAT System with a control efficiency of 99.5 percent (CEOE 2002a, Appendix G.3).

2) In addition to the LO-CAT System for H_2S abatement, the project will include a polishing system using a solid bed H_2S removal scavenger system.

3) Assess the necessity of removing ammonia with control technology.

4) Control benzene using carbon absorbers with a control efficiency of 95 percent (CEOE 2002a, Appendix G.3).

5) Minimize off-gassing of H_2S by using oxidizers designed to oxidize at least 90 percent of the H_2S in the condensate (CEOE 2003b, Response #3d).

6) Design and build cooling tower with a drift eliminator, such that the drift rate does not exceed 0.0005 percent (CEOE 2002b, DR#5).

7) Hexavalent chromium containing compounds will not be used in the circulating water.

8) Control mercury emissions through the utilization of sulfurized activated carbon filters, selenium ceramic mass, or other abatement technologies.

Filter Cake[1] Handling Mitigation Measures

1) Direct load filter cake into trucks, trailers or bins as it is generated.

2) Secure a tarp over trailers and bins immediately after loading.

3) Use sulfate scale inhibitors to minimize radioactivity from radium (Ra226 and Ra228) and radon from the silica filter cake.

4) Minimize releases of filter cake into the environment by enclosing filter cake bays with doors or replace filter cake bays with containers or trailers capable of holding the waste material.

5) Prevent filter cake from being released or disposed of into the environment during the transfer to, from, or while stored at the filter cake bays or in end-dump trailers.

A.3.2 Noise

BLM regulations seek to “minimize noise,” but set no measurable standard. BLM relies on noise criteria published in 1975 by the USGS in “Geothermal Resources Operational Order No. 4.” The order is applicable to people occupying nearby homes, hospitals, schools, and libraries and wildlife, according to the 2008 PEIS and states that federal land lessees may:

> *“not exceed a noise level of 65 dB(A) for all geothermal-related activity including but not limited to, exploration, development, or production operations as measured at the lease boundary line or 0.8 km (one-half mile) from the source, whichever is greater, using the A-weighted network of a standard Sound Level Meter. However, the permissible noise level of 65 dB(A) may be exceeded under emergency conditions or with [regulatory] approval if written permission is first obtained by the lessee from all residents within 0.8 km (one-half mile).”*

[1] Filter cake is a by-product of drilling mud. Liquid wastes (including spent brine, steam condensate, and cooling tower blowdown) from geothermal power plants are reinjected underground, but the precipitated solids must be diverted to a filtering and dewatering process and then formed into “filter cakes.”

Geothermal resource exploration/testing involves well drilling and less invasive approaches such as geophysical remote sensing. Remote sensing can refine well targeting and reduce the number of wells drilled. The exploration/testing approach is generally identified in a reservoir management plan which includes, but is not limited to, the following measures:

1) Use as few drill sites as is feasible so that fewer people are noise-impacted.
2) Locate the sites as far from residences as possible. In addition, use terrain, such as ridges, and plan the drill site so that noise is projected away from residences, to shield noise impacts to the greatest extent possible.
3) To dampen drilling rig noise, install acoustical windows in structures occupied by affected parties.
4) Install adequate noise abatement equipment during construction and operation and maintain it in good condition to reduce noise from any drilling or producing geothermal well located within 1,500 feet of a habitation. Examples of such equipment include temporary noise shields, cyclone silencers, rock wall mufflers, and sound insulation in pipes. Silencers slow the velocity of steam in the steam processing facility.
5) The operator will take measurements to assess the existing background noise levels at a given site and compare them with the anticipated noise levels associated with the proposed project.
6) All equipment will have sound-control devices no less effective than those provided on the original equipment. All construction equipment used will be adequately muffled and maintained.
7) All stationary construction equipment (i.e., compressors and generators) will be located as far as practicable from nearby residences.
8) If blasting or other noisy activities are required during the construction period, nearby residents will be notified by the operator at least one hour in advance.
9) Explosives will be used only within specified times and at specified distances from sensitive wildlife or streams and lakes, as established by the federal and state agencies.

A 5.3 Soils

1) Do not use geothermal fluids or exploratory well drilling muds for dust control under any circumstances.
2) Erosive soils (defined as having severe or very severe erosion potential by the Natural Resources Conservation Service) and soils on slopes greater than 30 percent should be protected to minimize the potential for adverse impacts as detailed in Section 5.4 such as hay, small-grain straw, wood fiber, live mulch, cotton, jute, or synthetic netting.
3) Adequate drainage control devices and measures will be incorporated into road and well pad design at sufficient intervals and intensities to adequately control and direct surface runoff above, below, and within the road and well pad environments to avoid erosive concentrated flows.
4) The amount of vegetation cleared will be kept to the minimum necessary to accommodate all necessary project components.
5) Hydraulic mulch or Bonded Fiber Matrix (BFM) will be applied to disturbed areas and windrowed topsoil during construction to reduce the impacts to soil from wind erosion until final reclamation occurs (see Section 5.0 for Reclamation BMPs).
6) During initial construction, and prior to completion of construction, reclamation stormwater management actions will be taken to ensure disturbed areas are quickly stabilized to control surface water flow and to protect both the disturbed and adjacent areas from erosion and siltation. This may involve construction and maintenance of temporary silt ponds, silt fences, berms, ditches, and mulching.
7) Where possible, access roads should be located to follow natural contours and minimize side hill cuts and fills.

8) Excessive grades (e.g., over 15 percent) on roads, road embankments, ditches, and drainages should be avoided, especially in areas with erodible soils.
9) Roads should be designed so that changes to surface water runoff are minimized and new erosion is not initiated with water regulations.
10) Access roads and onsite roads should be surfaced with aggregate materials where necessary to provide a stable road surface, support anticipated traffic, reduce fugitive dust, and prevent erosion. Culvert outlets should be rip-rapped to dissipate water energy at the outlet and reduce erosion.
11) Road use should be restricted during the wet season if road surfacing is not adequate to prevent soil displacement, rutting, etc., and resultant stream sedimentation.

A 5.4 Water Resources, Brine Injection and Water Supply

Properly designed and sited geothermal power plants address water supply and well injection issues. Flash geothermal power plants can satisfy up to 95 percent of their water supply needs, including cooling tower make-up water, by recycling steam condensed from produced geothermal brine (CE Obsidian Energy LLC 2009). Water-cooled binary power plants return 100 percent of the geothermal fluid to the reservoir, but often require an external source of cooling water because the brine remains within a closed-loop system until injected and is not used for cooling. The brine may include concentrated amounts of contaminants which would present problems to the cooling system and the environment. Use of dry cooling or non-potable or degraded surface or groundwater would protect potable water supplies. Dry cooling can reduce the efficiency of electrical energy output of the power plant by as much as 50 percent in hot weather and that is why some binary geothermal power plants include a supplemental solar installation to make up for lost binary plant efficiency in high temperature summer environments as an alternative to using outside water for cooling.

The quality of underground sources of drinking water can be protected through careful well and casing design. Contamination of groundwater aquifers could be caused by upflow through a fault or by leakage of the injected fluid behind the casing due to a poor cement bond or through a casing damaged by corrosion or mechanical causes.

Hydraulic fracturing, or “fracking,” is a well stimulation process that promotes subsurface fracture systems to facilitate the movement of the underground energy source—in this case geothermal fluid—from rock pores to production wells. Hydraulic fluids, typically consisting of cold water or water with chemical additives, are pumped into geological formation at high pressures. Once pressure is sufficient, the hydraulic fluid, or flowback fluid, will rise to the surface back through the wellbore.

Potential impacts associated with hydraulic fracturing include the use of high volumes of water, potentially degrading local water resources, and the discharge of hydraulic fluid containing chemical additives that may result in contamination of groundwater and surface waters. Flowback water is either discharged to surface waters, regulated under the National Pollutant Discharge Elimination System (NPDES) program, or injected into the ground as regulated by the EPA or state Underground Injection Control (UIC) program. The USEPA has completed a study to evaluate the potential impacts of hydraulic fracturing on drinking water and public health. (USEPA 2016). Mitigation measures as identified in the study include groundwater level and quality monitoring, as well as obtaining and complying with criterion set forth in applicable permits.

Geothermal operations may result in water loss through evaporation. Evaporative losses may vary from 5 to 33 percent (Clark 2010). Binary cycle geothermal power plants typically have lower evaporative losses (five percent). To mitigate impacts associated with evaporative water losses, appropriate technologies, such as binary cycle, may be implemented.

Water/Brine Injection Well Best Management Practices

1) Begin planning for injection early in the field development stage. Prepare a preliminary injection strategy as soon as the first few exploration and production wells have been drilled and tested.

2) Use tracer testing and numerical modeling of the reservoir to develop an optimum injection strategy (poorly functioning production wells should not necessarily be converted to injection wells).
3) Prevent injection pressure buildup with proper chemical treatment and/or filtering of the injection fluid to prevent scaling and/or plugging of injection wells.
4) Increase the spacing between injection wells, or the number of injection wells, to redistribute the total amount of injection fluid over a larger area and thereby correct for ground heaving.
5) Avoid locating injection wells near known active faults and do not allow injection pressure to exceed original pore pressure to avert induced seismicity.
6) Design wells with casing that run from the surface to the depth below the underground source of drinking water. A well should have two casing strings; each sealed its entire length. Test casings, cements, and other materials before selecting them for use in construction at the specific well site.
7) At shallow depths, include multiple casing strings in geothermal wells.
8) If injecting under pressure, monitor injection pressures to avoid excessive pressure and minimize likelihood of injection-induced seismic activity from increased subsurface pressure and the stresses on the injection well equipment.
9) Inject at a rate that will not cause a pressure build-up in the formation or result in reduced fluid temperature at production wells. Monitor injection rates along with pressure monitoring to assess and ensure casing integrity.
10) Design and construct cellars around the casing wellhead. Keep these cellars dry or well drained to prevent corrosion of the casing at the soil-air-water interface.
11) Monitor well integrity through mechanical testing using industry standard well test and measurement practices (spinner, temperature, and pressure tests and tracer surveys) to prevent unintended release from within the well to the surrounding formations and inter-zonal migration of fluids between the casing and the formation.
12) Inspect surface conditions daily for casing leaks.
13) If an injection well penetrates an underground source of drinking water, perform mechanical integrity testing periodically to detect actual and potential leaks, casing failures, and cementing problems. Perform these tests prior to initial injection, after well workovers and repairs, and on a routine schedule during normal operations.

Water Supplies Best Management Practices

The use of surface or groundwater for cooling a geothermal facility must be thoroughly evaluated and impacts mitigated. This assessment may result in lengthy delays of permitting timeframes.

1) For flash-steam cycle plants, minimize the use of fresh water by using geothermal fluid as the major source of cooling water. Use high-efficiency fills in cooling towers to enhance air-to-water contact.
2) For binary geothermal plants, use air-cooled condensers only, during fall, winter and spring (October through April). During the summer season (May through September), plant electrical efficiency can be improved by using one of the following pre-cooling strategies:
    a. Direct deluge cooling of the air-cooled condenser tubes. Add a purified water rinse to wash away new forming scale when the deluge system is shut down for the winter.
    b. Spray-cooling enhancement (that is, pre-cooling with spray nozzles capable of creating micron-sized water droplets).

c. Honeycomb, porous evaporative-cooling media (for example, Munters media). Use degraded or reclaimed water sources for geothermal-source water supplies as much as possible. Minimize use of fresh or potable water supplies.

Sufficient water supply (for construction, cooling, geothermal makeup water, etc.) must be guaranteed by an applicant before the lease can be approved. The Applicant may need a Conditional Use Permit (CUP) approved by Inyo County to present to BLM before any lease would be granted. Water consumption and use would be evaluated during the NEPA process at the project level.

A.3.3

1) Validate compliance of proposed actions with water regulations in all of phases of geothermal exploration, development, operation, and reclamation with the Lahontan Regional Water Quality Control Board and Department of Water Resources staffs.
2) In coordination with State regulatory agencies the operator will comply with all state and federal surface and ground water rules and regulations for all phases of geothermal exploration, development, operation and reclamation.
3) Operators will have a clear understanding of the local hydrogeology.
4) Identify areas of groundwater discharge and recharge and their potential relationships with surface water bodies.
5) Operators will avoid creating hydrologic conduits between naturally discrete aquifers during drilling, foundation excavation and other activities.
6) Freshwater-bearing and other usable water aquifers (less than 10,000 ppm total dissolved solids [TDS], USEPA standard) will be protected from contamination by assuring that all well casing (excluding the liner) is required to be cemented from the casing shoe to the surface.
7) Periodic testing and monitoring via observation wells will be conducted in a manner to assure maximum protection of quality and quantity of water resources from groundwater extraction, geothermal fluids or alterations in reservoir pressure.
8) Water use will be minimized and water required for exploration and development will be obtained in a manner to assure maximum protection of water resources.
9) The discharge of fill or dredged materials into waters of the United States, including wetlands, would be avoided to the greatest extent possible. Playa lakes and other wetlands provide important groundwater recharge functions in the Rose Valley.
10) Avoid development of impervious geothermal facilities and access roads on the alluvial fans draining the Sierra Nevada and Coso Range and recharging the Rose Valley Groundwater Basin. To the extent possible, span or avoid development in the flood zones of intermittent and ephemeral drainages.
11) Construct roads perpendicular to stream crossings and avoid paralleling streams.
12) To the extent possible, avoid development of geothermal facilities and access roads in the 100-year floodplain and playa lakes in Rose Valley.
13) Proposed geothermal exploration and development would comply with the Clean Water Act as implemented by the State Water Resources Control Board's NPDES General Permit No. CAS000002, a general permit for construction activities, and the associated Order No. 92-08-DWQ, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction Activity. Projects of one acre or more are subject to this general construction permit process.
14) Developers would be required to eliminate or reduce non-stormwater discharges to stormwater systems, develop a Stormwater Pollution Prevention Plan (SWPPP) prior to beginning construction, inspect all stormwater control structures, and implement other pollution prevention measures, such as applicable BMPs and conservation measures during construction.

a. The SWPPP would include the specific measures and techniques for implementation to protect the project sites and adjacent areas from erosion and deposition during site grading, construction, and post-construction stabilization of sediment on the site.

b. The contractor would provide a copy of the SWPPP for the various crews performing work on the construction site, and a copy would be kept on-site during the project to satisfy the requirements of the NPDES permit. A draft of this SWPPP would be forwarded to the BLM for review prior to its finalization.

A 5.5 Vegetation

1) The construction crews and contractors shall be responsible for working around all shrubs and trees within the construction zone to the extent feasible. Particular avoidance shall be applied to riparian trees (i.e., cottonwoods and willows). Shrubs and trees shall be flagged by a qualified botanist to indicate top priority for avoidance.

2) Operators will develop a plan for control of noxious weeds and invasive species, which could occur as a result of new surface disturbance activities at the site. The most recent recommendations at the state and local level should be incorporated into any operating plan for the geothermal exploration and development. The plan will address monitoring, education of personnel on weed identification, the manner in which weeds spread, and methods for treating infestations. If trucks and construction equipment are arriving from locations with known invasive vegetation problems, a controlled inspection and cleaning area will be established to visually inspect construction equipment arriving at the project area and to remove and collect seeds that may be adhering to tires and other equipment surfaces.

3) Certified, weed-free mulch designed by the BLM to meet reclamation standards will be required when stabilizing areas of disturbed soil.

4) All vehicles and equipment associated with ground disturbance must be washed upon entry and exit of all project sites. Washing shall include wheels, undercarriages, bumpers, and all exposed surface parts of the vehicle capable of transporting seed. All tools such as chainsaws, hand clippers, pruners, etc., must also be cleaned before and after entering all project sites. When vehicles and equipment are washed, a daily log must record the following: 1) Location; 2) Date and time; 3) Methods used; 4) Staff present; 5) Equipment washed; and 6) Signature of responsible crew member. The written logs will be turned in to the BLM botanist upon completion of the project. Interim reports must be provided if requested or if the project extends beyond the planned period.

5) Fill materials and road surfacing materials that originate from areas with known invasive vegetation problems will not be used.

6) Herbicides shall be applied in accordance with state and federal law. No herbicides shall be used where Threatened or Endangered species occur. No herbicides shall be sprayed when wind velocities are above five miles per hour. No herbicides shall be used on native vegetation unless specifically authorized, in writing, by the BLM. A BLM Pesticide Use Plan must be completed by the developer and approved by the BLM. Only BLM-approved herbicides may be applied to BLM lands.

7) Revegetation, habitat restoration and weed control activities will be initiated as soon as possible after construction or exploration activities are completed. See Section 5.0 of this Appendix for Reclamation Performance Standards.

A 5.6 Fish and Wildlife

1) The operator will prepare a habitat restoration plan to avoid (if possible), minimize, or mitigate negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. The plan will identify revegetation, soil stabilization, and erosion reduction measures that will be implemented to ensure that all temporary use areas are restored. The plan will require that restoration occur as soon as possible after completion of activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats. The Restoration and Revegetation Plan shall be submitted to the

lead agencies for prior approval (see Section 5.0 of this Appendix). All project activities must comply with the approved Restoration and Revegetation Plan.

2) If work during the breeding/nesting season (February 15 through August 15) cannot be avoided, then prior to construction activities, a qualified biologist shall survey all breeding/nesting habitat. If vegetation is removed during March 15 through September 15, then pre-disturbance surveys will be conducted to determine whether active nests are present within the disturbance area. Nest surveys shall be conducted no more than three days prior to the start of construction activities. Documentation of findings, including a negative finding must be submitted to the CDFW prior to construction activities for review and concurrence. If no breeding/nesting birds are observed and concurrence has been received from CDFW, site preparation and activities may begin. If an active nest is discovered or breeding activities are located and concurrence has been received from the CDFW, the breeding habitat/nest site shall be fenced a minimum of 200 feet (500 feet for raptors, 0.5-mile for eagles) in all directions, and this area shall not be disturbed until the nest becomes inactive, the young have fledged, the young are no longer being fed by the parents, the young have left the area, and the young will no longer be impacted by the project. This buffer may be adjusted due to environmental factors or species-specific requirements upon consultation with the CDFW, BLM and/or the USFWS.

3) Prior to any construction activities and tree removal during the raptor nesting season, January 31st to September 1st, a qualified biologist shall conduct a single site survey for active nests no more than one week prior to any scheduled development. If an active nest is located, then no work shall be conducted within a 500 foot radius from the nest until the young have fledged and are independent of the adults. If an inactive raptor nest is observed within the vegetation at any construction sites proposed for vegetation removal, the CDFW shall be contacted to discuss mitigation measures should the nest become active during the project term.

4) The operator shall hire qualified biologists to survey for plant and animal species that are listed or proposed for listing as threatened or endangered and their habitats in areas proposed for development where these species could potentially occur; following accepted protocols and in consultation with the USFWS and the CDFW as appropriate. Particular care should be taken to avoid disturbing listed species during surveys. The operator will monitor activities and their effects on ESA-listed species throughout the duration of the project.

5) The operator shall hire qualified biologists to identify important, sensitive, or unique habitat and biota in the project vicinity and site and should design the project to avoid (if possible), minimize, or mitigate potential impacts on these resources. The design and siting of the facilities will follow appropriate guidance and requirements from the BLM, and other resource agencies, as available and applicable.

6) If pesticides are used on the site, an integrated pest management plan will be developed to ensure that applications would be conducted within the framework of all federal, State, and local laws and regulations and entail only the use of USEPA-registered pesticides.

7) The operator will ensure that employees, contractors, and site visitors avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. In addition, pets will be controlled or excluded to avoid harassment and disturbance of wildlife.

8) Ponds, tanks and impoundments (including but not limited to drill pits) containing liquids can present hazards to wildlife. Any liquids contaminated by substances which may be harmful due to toxicity, or fouling of the fur or feathers (salts, detergents, oils, etc.), should be excluded from wildlife access by fencing, netting or covering at all times when not in active use. Liquids at excessive temperature should likewise be excluded. If exclusion is not feasible, such as a large pond, a hazing program based on radar or visual detection, in conjunction with formal monitoring, should be implemented. Clean water impoundments can also present a trapping hazard if they are steep-sided or lined with smooth material. All pits, ponds and tanks should have escape ramps functional at any reasonably anticipated water level, down to almost empty. Escape ramps can take various forms depending on the configuration of the impoundment.

Earthen pits may be constructed with one side sloped 3:1 or greater lined ponds can use textured material; straight-sided tanks can be fitted with expanded metal escape ladders.

9) In order to minimize risks of direct drainage into riparian areas or other sensitive habitats, equipment storage, fueling, and staging areas shall be located at upland areas at sufficient distance and in such a manner as to prevent runoff from entering sensitive habitat. Project related spills shall be reported to BLM/CDFW/USFWS or other appropriate agency, cleaned up immediately, and contaminated soils removed to approved disposal areas.

10) If excavations are to be left open and unattended, an escape ramp will be constructed to the bottom of the pit with less than a 3 to 1 slope to provide a means of escape for wildlife. Prior to commencement of work activity each day, staff will check any excavated pits for wildlife. All excavations to be backfilled must be inspected for wildlife immediately prior to backfilling.

11) Project personnel will be restricted to the approved project limits. The project will not allow pets or hunting, killing, or harassment of native wildlife. The project will shield lighting and restrict dusk to dawn work activity that could affect diurnal and nocturnal foraging by native wildlife. Construction area and disturbance to soil and vegetation will be restricted to the minimum area possible to avoid unnecessary adverse impacts to wildlife habitat and native vegetation.

12) Biological monitors will be present during project construction activities if sensitive biological resources within the area of potential impact would be adversely impacted. The monitors will be responsible for ensuring that impacts to special-status species, native vegetation, wildlife habitat, or unique resources will be avoided to the fullest extent possible. Where appropriate, monitors will flag the boundaries of areas where activities need to be restricted in order to protect native plants and wildlife or special-status species. Those restricted areas will be monitored to ensure their protection during construction.

13) Construction crews will avoid impacting streambeds and banks of streams along the route to the extent possible. If necessary, a Streambed Alteration Agreement (SAA) will be secured from CDFW. Impacts will be mitigated based on the terms of the SAA.

14) All pipelines outside of a power plant site or other fenced areas would be elevated at least 12 inches (0.3 meter) above the ground surface to allow wildlife mobility and prevent interference with natural drainage.

A 5.7 Cultural Resources

1) Before any specific permits are issued for leases, the BLM will identify, and consider effects to historic properties in compliance with Section 106 of the National Historic Preservation Act and its implementing regulations at 36 CFR Part 800.

2) Proposed developments within approved leases will be subject to additional Section 106 review. Proposed developments will be reviewed consistent with the process identified in the DRECP PA. All contracted fieldwork conducted for Section 106 compliance for proposed leasing developments will be performed under the terms of a Cultural Resources Use Permit (CRUP) and a Fieldwork Authorization (FA) issued by the BLM. Section IV of the DRECP PA, which guides identification, evaluation, and assessment of effects, requires that a BLM Class I inventory, including records search and literature review, be undertaken prior to any field activities. The Class I inventory shall be utilized to develop a research design and work plan for all cultural resource studies. The work plan will include defining the Area of Potential Effects (APE) for direct and indirect effects for the proposed development inside the area to be leased. A new Class III inventory will be prepared after a FA is issued by BLM. BLM may also require the development of a geo-archaeological study of the entire direct effects APE, an indirect effects study of the indirect APE, and a separate historic-built environment study. Technical reports generated for the project will require a BLM-mandated peer review.

3) BLM will consult with tribal stakeholders to identify any resources that have cultural or religious significance to the Tribes or Tribal Organizations. The BLM may require the development of an

ethnographic assessment for the project, if the Tribes or Tribal Organizations indicate that they have additional information that should be considered in the Section 106 review.

4) Based on the results of the identification efforts described above, and the results of the peer review, BLM will determine if any of the cultural resources identified within the APE, including resources with cultural or religious significance to a Tribe, meets one or more of the NRHP eligibility criteria specified in 36 C.F.R. § 60.4 and possesses integrity. Resources that meet one or more criteria and possess integrity shall be considered historic properties. Once eligibility determinations have been made, BLM will submit the agency proposed determinations of eligibility to the project-specific consulting parties for review and comment and will concurrently request SHPO review and concurrence on the agency proposed determinations of eligibility and findings of effect.

5) Avoidance of impacts through project design will be given priority over mitigation as the preferred treatment measure associated with any potential adverse effects identified. Avoidance measures include moving project elements away from site locations, or into areas bearing previous development impacts, or restricting travel to existing roads.

6) If adverse effects to historic properties from any proposed development within the HGLA are identified, the BLM will execute a project-specific MOA pursuant to 36 C.F.R. § 800.6 to fulfill the intent of the DRECP PA. Historic properties will be treated and managed in accordance with the process identified in Section V.A.1 of the DRECP PA. All mitigation measures for historic properties that will be adversely affected by a specific leasing development will be identified in an Historic Properties Treatment Plan (HPTP) that will be included as an appendix to the MOA. The Applicant is responsible for implementing all of the terms of the MOA, with BLM oversight.

7) The BLM, in consultation with the SHPO, the ACHP (if participating), Indian tribes, and project-specific consulting parties, will develop a comprehensive plan to manage post-review discoveries and unanticipated effects during project construction. The plan will be attached to any project-specific MOA or PA as an appendix, and implemented by the Applicant, with BLM oversight. If an area exhibits a high potential for containing subsurface cultural resources, but no resources were observed during a Class III inventory, monitoring by a qualified archaeologist could be required during all excavation and earthmoving in the high-potential area.

8) Should any post-review discoveries or unanticipated effects occur prior to the development of a monitoring plan, or where an MOA or PA for a specific project has not been executed, the BLM shall follow the process at 36 C.F.R. § 800.13(b).

9) The BLM shall ensure that any Native American human remains, funerary objects, sacred objects, or objects of cultural matrimony discovered on federal lands shall be treated in accordance with the provisions of NAGPRA and its implementing regulations at 43 CFR Part 10. In consultation with the Tribes and Tribal Organizations for any specific undertaking, the BLM shall seek to develop a written plan of action pursuant to 43 C.F.R. 10.5(e) to manage the inadvertent discovery or intentional excavation of human remains, funerary objects, sacred objects, or objects of cultural patrimony. Finally, The BLM shall ensure that the Native American Heritage Commission is notified so that Native American human remains and/or funerary objects discovered on non-federal lands are treated in accordance with the applicable requirements of the California Public Resources Code at Sections 5097.98 and 5097.991, and of the California Health and Human Safety Code at Section 7050.5(c).

10) The BLM shall ensure that a Historic Properties Management Plan (HPMP) will be developed for all projects where historic properties require long term management. The HPMP will be developed in consultation with the SHPO, the ACHP (if participating), and project-specific consulting parties. The HPMP will identify how historic properties will be managed through project Operations and Maintenance, and Decommissioning. The Applicant is responsible for implementing the terms of the HPMP, with BLM oversight.

A 5.8 Paleontological Resources

1) Any proposed development of a lease area must undergo a project-specific Potential Fossil Yield Classification (PFYC) analysis of geologic units on BLM-administered lands in the lease area. The PFYC analysis must, at minimum, include the general distribution of known fossil localities and the fossil-yield potential of the geologic units underlying the project site; the location, extent, and depth of construction-related land disturbances at the project site; and how public access may increase following the construction of access roads and transmission infrastructure, which could encourage unauthorized collection activities, theft, or vandalism.

2) Certain processes associated with project development are unlikely to impact paleontological resources: The PFYC will guide paleontological field surveys. Field surveys will be focused on areas of the proposed lease development that have the potential to impact geologic units with a PFYC rating of 3, 4, 5, or Unknown. For those areas of a project that will be excavated during construction but where no rock exposures exist, certain procedures such as geotechnical exploration shall be used in conjunction with the PFYC classification system to allow the professional paleontologist to determine, with BLM concurrence, whether paleontological monitoring is required in order to retrieve unique paleontologic data that would otherwise be lost.

3) If during the analysis for a proposed lease development project, the paleontologist determines that there is a moderate to high potential for impacts to paleontologic resources, BLM will require the development of a paleontological mitigation-monitoring plan and subsequent active construction-related monitoring. The plan must include a formal monitoring and collection program; identify measures to prevent potential looting/vandalism or erosion impacts during and after construction is completed; and address the education of workers and the public to make them aware of the consequences of unauthorized collection of fossils on public lands. The Plan must also include a curation agreement with an appropriate museum facility.

4) Unexpected discovery of paleontological resources during construction will be brought to the attention of the responsible BLM authorized officer immediately. Work will be halted in the vicinity of the find to avoid further disturbance to the resources while they are being evaluated and appropriate mitigation measures are being developed.

A 5.9 Visual

1) The operator will incorporate visual design considerations into the planning and design of the project to minimize potential visual impacts of the proposal and to meet the Visual Resource Management objectives of the area and the agency.

2) “Dulled” or galvanized metal finish towers or poles shall be used for transmission lines to reduce visual contrast.

3) Non-specular (non-reflective) conductors shall be used for transmission lines to reduce visual contrast.

4) Construct low-profile structures whenever possible to reduce structure visibility.

5) Select and design materials and surface treatments to repeat or blend with landscape elements.

6) Site projects outside of the viewsheds of publicly accessible vantage points, or if this cannot be avoided, as far away as possible.

7) Site projects to take advantage of both topography and vegetation as screening devices to restrict views of projects from visually sensitive areas.

8) Site facilities away from and not adjacent to prominent landscape features (e.g., foothills or mountains, and water features).

9) Avoid placing facilities on ridgelines, summits, or other locations such that they will be silhouetted against the sky from visually sensitive areas.

10) Collocate facilities to the extent possible to use existing and shared rights-of-way, existing and shared access and maintenance roads, and other infrastructure to reduce visual contrast.

11) Site linear features (above-ground pipelines, rights-of-way, and roads) to follow natural land contours rather than straight lines (particularly up slopes) when possible. Fall-line cuts should be avoided.
12) Design and construction of all new roads to a safe and appropriate standard, "no higher than necessary" to accommodate their intended use.
13) Site linear features to cross other linear features (e.g., trails, roads) at right angles whenever possible to minimize viewing area and duration.
14) Site and design structures and roads to minimize and balance cuts and fills and to preserve existing rocks, vegetation, and drainage patterns to the maximum extent possible.
15) Use appropriately colored materials for structures or appropriate stains and coatings to blend with the project's backdrop. Refer to the Standard Environmental Colors chart available from the BLM.
16) Use non-reflective or low-reflectivity materials, coatings, or paints whenever possible.
17) Site pipelines adjacent to roadways to reduce surface disturbance and minimize visual contrast.
18) No paint or permanent discoloring agents shall be applied to rocks or vegetation to indicate survey or construction activity limits.
19) Paint grouped structures the same color to reduce visual complexity and color contrast.
20) Design and install efficient facility lighting so that the minimum amount of lighting required for safety and security is provided but not exceeded and so that upward light scattering (light pollution) is minimized. This may include, for example, installing shrouds to minimize light from straying off-site, properly directing light to only illuminate necessary areas, and installing motion sensors to only illuminate areas when necessary to reduce offsite visual contrast during nighttime hours.
21) Site construction staging areas and laydown areas outside of the viewsheds of publicly accessible vantage points and visually sensitive areas, where possible, including siting in swales, around bends, and behind ridges and vegetative screens.
22) Discuss visual impact mitigation objectives and activities with equipment operators prior to commencement of construction activities.
23) Avoid installing gravel and pavement where possible to reduce color and texture contrasts with existing landscape.
24) Use excess fill to fill uphill-side swales resulting from road construction in order to reduce unnatural-appearing slope interruption and to reduce fill piles.
25) Prevent downslope wasting of excess fill material.
26) Round road-cut slopes, vary cut and fill pitch to reduce contrasts in form and line, and vary slope to preserve specimen trees and nonhazardous rock outcroppings.
27) Provide benches in rock cuts to accent natural strata.
28) Use split-face rock blasting to minimize unnatural form and texture resulting from blasting.
29) Segregate topsoil from cut and fill activities and spread it on freshly disturbed areas to reduce color contrast and to aid revegetation.
30) Bury utility cables in or adjacent to the road where feasible.
31) Undertake interim restoration during the operating life of the project as soon as possible after disturbances. During road maintenance activities, avoid blading existing forbs and grasses in ditches and along roads.
32) Randomly scarify perpendicular to the angle of cut slopes to reduce texture contrast with existing landscape and to aid in revegetation.
33) Cover disturbed areas with stockpiled topsoil or mulch and revegetate with a mix of native species establishing a composition to reduce contrast with the surrounding undisturbed landscape.

34) Restore rocks, brush, and natural debris whenever possible to approximate preexisting visual conditions.

A 5.10 Health, Safety Pesticides and Waste Management

1) Increase the pH of spent geothermal brine to keep silica in solution prior to reinjection.
2) Return spent geothermal brines, steam condensate, and cooling system blowdown to the geothermal resource via reinjection wells.
3) Assure that hazardous substances and wastes removed from surface impoundments are not leaked, spilled, or otherwise improperly released outside the surface impoundments and into the environment.
4) Remediate any contamination near and around surface impoundments, including the tops of berms and areas downwind from the impoundments, filter cake bay storage areas, hydroblast pads and adjacent areas, pipes containing hazardous waste scale and areas adjacent, and other areas where hazardous waste releases or disposals have occurred.
5) Ensure that all employees and contractors staff operating at any facility receive appropriate hazardous waste management and high pressure high temperature (HPHT) training prior to conducting any work involving hazardous waste, including hazardous waste treatment, storage, and disposal at the facility, or HPHT environments, including well site, pipeline, and power plant operations.
6) Conduct annual environmental audits to identify all hazardous waste streams and determine compliance with all applicable statutory and regulatory provisions of California's Hazardous Waste Control Law and the Unified Hazardous Waste and Hazardous Materials Management Regulatory Program.
7) Maintain a minimum freeboard of two feet at all times within the geothermal brine surface impoundment. Ensure the fluids and brine precipitates discharged to and contained in the surface impoundment never overflow.
8) Install a leak detection system beneath the membrane liner of the geothermal brine surface impoundment. Inspect the system quarterly to ensure brine is not collecting due a membrane-liner breach.
9) Monitor groundwater wells to determine whether the geothermal brine surface impoundment is releasing hazardous waste into groundwater.
10) Clean conveyance systems regularly to prevent buildup of silica scale and the potential for release of solid materials from conveyance systems.
11) Perform pipe maintenance and descaling only in areas designated for these activities.
12) Construct hydro blasting areas so that the base is impermeable and no wastewater can spray or run onto adjacent soil. For example, the hydro blasting area should have 12-foot-high walls on three sides. Convey wastewater from the hydro blasting process to the brine surface impoundment for reinjection to the geothermal resource.
13) Containerize and control drilling mud and cuttings by placing muds and cuttings in containers such as Baker tanks or other by other means to prevent discharging such wastes to land.
14) Hazardous and non-hazardous materials and management of used oil and underground storage tanks shall be treated in accordance with Resource Conservation and Recovery Act (RCRA) as detailed in Title 40 Code of Federal Regulations parts 239-259, parts 260-273, and parts 279-280. Remediation costs of spills shall be the sole responsibility of the leaseholder.
15) Operators will develop a hazardous materials management plan addressing storage, use, transportation, and disposal of each hazardous material anticipated to be used at the site. The plan will identify all hazardous materials that would be used, stored, or transported at the site. It will establish inspection procedures, storage requirements, storage quantity limits, inventory control, nonhazardous product substitutes, and

disposition of excess materials. The plan will also identify requirements for notices to federal and local emergency response authorities and include emergency response plans.

16) Operators will develop a waste management plan identifying the waste streams that are expected to be generated at the site and addressing hazardous waste determination procedures, waste storage locations, waste-specific management and disposal requirements, inspection procedures, and waste minimization procedures. This plan will address all solid and liquid wastes that may be generated at the site.

17) Operators will develop a spill prevention and response plan identifying where hazardous materials and wastes are stored on site, spill prevention measures to be implemented, training requirements, appropriate spill response actions for each material or waste, the locations of spill response kits on site, a procedure for ensuring that the spill response kits are adequately stocked at all times, and procedures for making timely notifications to authorities.

18) A safety assessment will be conducted to describe potential safety issues and the means that would be taken to mitigate them, including issues such as site access, construction, safe work practices, security, heavy equipment transportation, traffic management, emergency procedures, and fire control.

19) A health and safety program will be developed to protect both workers and the general public during construction and operation of geothermal projects.

20) Regarding occupational health and safety, the program will identify all applicable federal and state occupational safety standards; establish safe work practices for each task (e.g., requirements for personal protective equipment and safety harnesses; Occupational Safety and Health Administration standard practices for safe use of explosives and blasting agents; and measures for reducing occupational electric and magnetic fields exposures); establish fire safety evacuation procedures; and define safety performance standards (e.g., electrical system standards and lightning protection standards). The program will include a training program to identify hazard training requirements for workers for each task and establish procedures for providing required training to all workers. Documentation of training and a mechanism for reporting serious accidents to appropriate agencies will be established.

21) Regarding public health and safety, the health and safety program will establish a safety zone or setback for generators from residences and occupied buildings, roads, rights-of-way, and other public access areas that is sufficient to prevent accidents resulting from the operation of generators. It will identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or rehabilitation activities. It will also identify measures to be taken during the operation phase to limit public access to hazardous facilities (e.g., permanent fencing would be installed only around electrical substations, and facility access doors would be locked).

22) Operators will consult with local planning authorities regarding increased traffic during the construction phase, including an assessment of the number of vehicles per day, their size, and type. Specific issues of concern (e.g., location of school bus routes and stops) will be identified and addressed in the traffic management plan.

23) Operators will develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.

24) Underground utilities will be installed to minimize the amount of open trenches at any given time, keeping trenching and backfilling crews close together. Avoid leaving trenches open overnight. Where trenches cannot be backfilled immediately, escape ramps should be constructed at least every 100 feet.

25) All refueling will occur in a designated fueling area that includes a temporary berm to limit the spread of any spill.

26) Drip pans will be used during refueling to contain accidental releases.

27) Drip pans will be used under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.

28) Any containers used to collect liquids will be enclosed or screened to prevent access to contaminants by wildlife, livestock, and migratory birds.

29) Spills will be immediately addressed per the spill management plan, and soil cleanup and removal initiated as soon as feasible.

A 5.11 Wild Horses and Burros

1) The operator will ensure employees, contractors, and site visitors avoid harassment and disturbance of wild horses and burros, especially during reproductive (e.g., breeding and birthing) seasons. In addition, any pets will be controlled to avoid harassment and disturbance of wild horses and burros.

2) Observations of potential problems regarding wild horses or burros, including animal mortality, will be immediately reported to the agency.

A 5.12 Livestock Grazing

1) The operator will coordinate with livestock operators to minimize impacts to livestock operations.

A 5.13 Recreation

1) Any necessary temporary route closures for construction would be coordinated with BLM and before beginning construction.

2) Signs directing vehicles to alternative park access and parking would be posted in the event construction temporarily obstructs parking areas near trailheads.

3) Signs and/or flagging that advise recreational users of construction activities would be posted in coordination with BLM. Whenever active work is being performed, the area should be posted with "Construction Ahead" signs on any adjacent access roads or trails that might be affected.

4) Whenever possible, construction activities would be avoided during high recreation use periods.

A 5.14 Scenic and Historic Trails

1) When any right-of-way application includes remnants of a historic trail, is located within the viewshed of an historic trail's designated centerline, or includes or is within the viewshed of a trail eligible for listing on the NRHP or designated scenic trail, the operator will evaluate the potential visual impacts to the trail associated with the proposed project and identify appropriate mitigation measures for inclusion in the operation plan.

A 5.15 Transportation/Roads/Pads

1) Operators will consult with local planning authorities regarding increased traffic prior to the construction phase, including an assessment of the number of vehicles per day, their size, and type. Specific issues of concern (e.g., location of school bus routes and stops) will be identified and addressed in the traffic management plan.

2) Signs will be placed along roads to identify speed limits, travel restrictions, and other standard traffic control information. Signs directing vehicles to alternative park access and parking will be posted in the event construction temporarily obstructs recreational parking areas near trailheads. Whenever active work is being performed, the area will be posted with "construction ahead" signs on any adjacent access roads or trails that might be affected.

3) Project personnel and contractors will be instructed and required to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions, to ensure safe and efficient traffic flow and to reduce wildlife collisions and disturbance and fugitive dust.
4) When practical, construction activities will be avoided during high recreational use periods.
5) To plan for efficient use of the land, necessary infrastructure will be consolidated wherever possible.
6) Existing roads and pad sites will be used to the maximum extent feasible, but only if located in a safe and environmentally sound location. No new roads and pad sites will be constructed without agency authorization. If new roads and pad sites have been authorized, they will be designed and constructed by the operator to the appropriate agency standard, no higher than necessary to accommodate their intended function. Roads and pad sites will be routinely maintained by the operator to assure public safety and to minimize impacts to the environment such as erosion, sedimentation, fugitive dust, and loss of vegetation.
7) An access road siting and management plan will be prepared incorporating existing Agency standards regarding road design, construction, and maintenance such as those described in the BLM 9113 Manual and the Surface Operating Standards for Oil and Gas Exploration and Development (i.e., the Gold Book, 4th Edition, 2007).
8) A traffic management plan will be prepared for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan will incorporate measures such as informational signs, flaggers when equipment may result in blocked throughways, and traffic cones to identify any necessary changes in temporary lane configuration.
9) Access roads will be located to minimize stream crossings.
10) All structures crossing streams will be located and constructed so that they do not decrease channel stability or increase water velocity.
11) Operators will obtain all applicable federal and state water crossing permits.
12) Roads will be designed so that changes to the natural pattern of surface water runoff are minimized and new erosion is not initiated.
13) Access roads will be located to minimize stream crossings. All structures crossing streams will be located and constructed so that they do not decrease channel stability or increase water velocity.
14) The operator will obtain agency authorization prior to borrowing soil or rock material from agency lands.
15) Dust abatement techniques will be used before and during surface clearing, excavation, or blasting activities. Dust abatement techniques (such as those detailed GBUAPCD Rules regarding control of Fugitive Dust and as identified in Air Quality BMPs and Fugitive Dust Suppression Program detailed above) will be used on unpaved, unvegetated surfaces to minimize fugitive dust. Speed limits (e.g., 10 mph) will be posted and enforced to reduce fugitive dust. Construction materials and stockpiled soils will be covered if they are a source of fugitive dust.
16) Culvert outlets will be rip-rapped to dissipate water energy at the outlet and reduce erosion. Catch basins, roadway ditches, and culverts will be cleaned and maintained regularly.

A 4.0 BMPs For Pipelines

1) Pipelines constructed above ground due to thermal gradient induced expansion and contraction will rest on cradles above ground level, allowing small animals to pass underneath.
2) Projects should be analyzed to ensure adequate passage for all wildlife species. The pipeline will be raised higher to allow wildlife passage where needed.
3) Because pipeline corridors through certain habitat types can alter local predator-prey dynamics by providing predators with lines of sight and travel corridors, large projects should be analyzed to ensure there will be no significant changes to predator-prey balance.

A 5.0 Reclamation Performance Standards

The following reclamation performance standards shall be met:

A 5.1 Interim Reclamation

Interim reclamation of well locations and access roads shall occur soon after the well is put into production. Interim reclamation will include those disturbed areas that may be re-disturbed during operations and will be re-disturbed at final reclamation to achieve restoration of the original landform and a natural vegetative community.

Disturbed areas not needed for active, long-term production operations or vehicle travel have been re-contoured, protected from erosion, and revegetated with a self-sustaining, vigorous, diverse, native (or as otherwise approved) plant community sufficient to minimize visual impacts, provide forage, stabilize soils, and impede the invasion of noxious, invasive, and non-native weeds.

A 5.2 Final Reclamation

Final Reclamation includes those disturbed areas that will not be re-disturbed where the original landform and a natural vegetative community shall be restored.

- The original landform shall be restored for all disturbed areas including well pads, production facilities, roads, pipelines, and utility corridors.

- General: A self-sustaining, vigorous, diverse, native (or otherwise approved) plant community shall be established on the site, with a density sufficient to control erosion and invasion by non-native plants and to reestablish wildlife habitat or forage production. At a minimum, the established plant community will consist of species included in the seed mix and/or desirable species occurring in the surrounding natural vegetation.

- Specific: No single species will account for more than 30 percent total vegetative composition unless it is evident at higher levels in the adjacent landscape. Permanent vegetative cover will be determined successful when the basal cover of desirable perennial species is at least 80 percent of the basal cover on adjacent or nearby undisturbed areas where vegetation is in a healthy condition; or 80 percent of the potential basal cover as defined in the National Resource Conservation Service Ecological Site(s) for the area. Plants must be resilient as evidenced by well-developed root systems and flowers. [Shrubs, will be well established and in a "young" age class at a minimum (therefore, not comprised mainly of seedlings that may not survive until the following year).]

- Erosion features shall be equal to or less than surrounding area and erosion control is sufficient so that water naturally infiltrates into the soil and gullying, headcutting, slumping, and deep or excessive rills (greater than three inches) are not observed.

- The site shall be free of State- or county-listed noxious weeds, oil field debris and equipment, and contaminated soil. Invasive and non-native weeds are controlled.

A 5.3 Reclamation Actions

- During initial well pad, production facility, road, pipeline, and utility corridor construction and prior to completion of the final well on the well pad, pre-interim reclamation stormwater management actions will be taken to ensure disturbed areas are quickly stabilized to control surface water flow and to protect both the disturbed and adjacent areas from erosion and siltation. This may involve construction and maintenance of temporary silt ponds, silt fences, berms, ditches, and mulching.

- When the last well on the pad has been completed, some portions of the well location will undergo interim reclamation and some portions of the well pad will usually undergo final reclamation. Most well locations will have limited areas of bare ground, such as a small area around production facilities or the surface of a rocked road. Other areas will have interim reclamation where workover rigs and fracturing tanks may need a level area to set up in the future. Some areas will undergo final reclamation where portions of the well pad will no longer be needed for production operations and can be re-contoured to restore the original landform.

- The following minimum reclamation actions will be taken to ensure that the reclamation objectives and standards are met. It may be necessary to take additional reclamation actions beyond the minimum in order to achieve the Reclamation Standards.

A 5.4 Reclamation - General

Procedure:

- The agency will be notified 24 hours prior to commencement of any reclamation operations.

Site Maintenance and Hygiene:

- Immediately upon well completion, the well location and surrounding areas(s) will be cleared of, and maintained free of, all debris, materials, trash, and equipment not required for production.

- No hazardous substances, trash, or litter will be buried or placed in pits.

- All trash generated from this project will be collected and disposed of off BLM administered lands at an disposal site approved by the California Department of Toxic Substance Control . The project site shall be kept clean of debris and microtrash to avoid attracting wildlife. All food-related trash items shall be enclosed in sealed containers and regularly removed from the site.

Vegetation Clearing:

- Vegetation removal and the degree of surface disturbance will be minimized wherever possible.

- Temporary impacts shall be returned to pre-existing contours and revegetated with a BLM approved native plant species mix. Special Status vegetation will be flagged and voided when necessary.

- During site-specific review of projects, each area proposed for geothermal development will be assessed for site-specific requirements. [Example of site-specific requirement: During vegetation clearing activities, trees and woody vegetation removed from the well pad and access road will be moved aside prior to any soil disturbing activities. Care will be taken to avoid mixing soil with the trees and woody vegetation. Trees left for wood gathering will be cut [twelve inches or less from the ground], delimbed, and the trunks, six inches or more in diameter will be removed and placed either by the uphill side of the access road, or moved to the end of the road, or to a road junction for easy access for wood gatherers and to reduce vehicle traffic on the well pad. Trees with a trunk diameter less than six inches and woody vegetation will be used to trap sediment, slow runoff, or scattered on reclaimed areas to stabilize slopes, control erosion, and improve visual resources.]

Topsoil Management:

- Operations will disturb the minimum amount of surface area necessary to conduct safe and efficient operations. When possible, equipment will be stored and operated on top of ungraded or grubbed ground to minimize surface disturbance.

- In areas to be heavily disturbed, the top eight inches of soil material will be stripped and stockpiled around the perimeter of the well location to control run-on and run-off, and to make redistribution of topsoil more efficient during interim reclamation. Stockpiled topsoil may include vegetative material. Topsoil will be clearly segregated and stored separately from subsoils. Several layers of soil may occur within the top eight inches of material. If more than one subsoil layer is observed during excavation, those subsoil layers will also be segregated and stored separately from one another. All layers will be returned back onto the site in the reverse order that they were removed.

- Earthwork for interim and final reclamation will be completed within six months of well completion or plugging unless a delay is approved in writing by the BLM authorized officer.

- Salvaging and spreading topsoil will not be performed when the ground or topsoil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of four inches deep, the soil will be deemed too wet.

- No major depressions will be left that would trap water and cause ponding.

- Water pipelines should be inspected daily to eliminate the potential for soil erosion caused by leaking or broken pipes.

Seeding:

- Seedbed Preparation. Initial seedbed preparation will consist of re-contouring to the appropriate interim or final reclamation standard. All compacted areas to be seeded will be ripped to a minimum depth of 18 inches with a minimum furrow spacing of two feet, followed by re-contouring the surface and then evenly spreading the stockpiled topsoil. Prior to seeding, the seedbed will be scarified and left with a rough surface.

  If broadcast seeding is to be used and is delayed, final seedbed preparation will consist of contour cultivating to a depth of 4 to 6 inches within 24 hours prior to seeding, dozer tracking, or other imprinting to loosen up the soil and create seed germination micro-sites.

- Seed Application. Seeding will be conducted no more than 24 hours following completion of final seedbed preparation.

  No seeding will occur from [May 15 to September 15]. Fall seeding is preferred and will be conducted after [September 15] and prior to ground freezing. [Shrub species will be seeded separately and will be seeded during the winter.] Spring seeding will be conducted after the frost leaves the ground and no later than [May 15].

Erosion Control and Mulching:

- Mulch, silt fencing, wattles, hay bales, and other erosion control devices will be used on areas at risk of soil movement from wind and water erosion.

- Mulch will be used if necessary to control erosion, create vegetation micro-sites, and retain soil moisture and may include hay, small-grain straw, wood fiber, live mulch, cotton, jute, or synthetic netting. Mulch will be free from mold, fungi, and certified free of noxious or invasive weed seeds.

- If straw mulch is used, it will contain fibers long enough to facilitate crimping and provide the greatest cover.

Pit Closure:

- Reserve pits will be closed and backfilled within 60 days of release of the rig. All reserve pits remaining open after 60 days will require written authorization of the authorized officer. Immediately upon well completion, any trash in the pit will be removed. Pits will be allowed to dry, be pumped dry or solidified in-situ prior to backfilling.

- Following completion activities, pit liners will be completely removed or removed down to the solids level and disposed of at an approved landfill, or treated to prevent their reemergence to the surface and interference with long-term successful revegetation. If it was necessary to line the pit with a synthetic liner, the pit will not be trenched (cut) or filled (squeezed) while containing fluids. When dry, the pit will be backfilled with a minimum of five feet of soil material. In relatively flat areas the pit area will be slightly mounded above the surrounding grade to allow for settling and to promote surface drainage away from the backfilled pit.

Management of Invasive, Noxious, and Non-Native Species:

- All reclamation equipment will be cleaned prior to use to reduce the potential for introduction of noxious weeds or other undesirable non-native species.

- An intensive weed monitoring and control program will be implemented prior to site preparation for planting and will continue until interim or final reclamation is approved by the authorized officer.

- Monitoring will be conducted at least annually during the growing season to determine the presence of any invasive, noxious, and non-native species. Invasive, noxious, and non-native species that have been identified during monitoring will be promptly treated and controlled. A Pesticide Use Proposal will be submitted to the BLM for approval prior to the use of herbicides.

A 5.5 Interim Reclamation Procedures – Additional

Recontouring:

- Interim reclamation actions will be completed as soon as is practicable when the final well on the location has been completed, weather permitting. The portions of the cleared well site not needed for active operational and safety purposes will be re-contoured to the original contour if feasible, or if not feasible, to an interim contour that blends with the surrounding topography as much as possible. Sufficient semi-level area will remain for setup of a workover rig and to park equipment. In some cases, rig anchors may need to be pulled and reset after re-contouring to allow for maximum interim reclamation.

- If the well is a producer, the interim cut and fill slopes prior to re-seeding will not be steeper than a 3:1 ratio, unless the adjacent native topography is steeper. Note: Constructed slopes may be much steeper during drilling, but will be re-contoured to the above ratios during interim reclamation.

- Roads and well production equipment will be placed on location so as to permit maximum interim reclamation of disturbed areas. If equipment is found to interfere with the proper interim reclamation of disturbed areas, the equipment will be moved so proper re-contouring and revegetation can occur.

Application of Topsoil and Revegetation:

- Topsoil will be evenly spread and revegetated over the entire disturbed area not needed for all-weather operations including road cuts and fills and to within a few feet of the production facilities, unless an all-weather, surfaced, access route or small "teardrop" turnaround is needed on the well pad.

- In order to inspect and operate the well or complete workover operations, it may be necessary to drive, park, and operate equipment on restored, interim vegetation within the previously disturbed area. Damage to soils and interim vegetation will be repaired and reclaimed following use.

Visual Resources Mitigation for Reclamation:

- Trees, if present, and vegetation will be left along the edges of the pads whenever feasible to provide screening.

- To help mitigate the contrast of re-contoured slopes, reclamation will include measures to feather cleared lines of vegetation and to save and redistribute cleared trees, debris, and rock over re-contoured cut and fill slopes.

- To reduce the view of production facilities from visibility corridors and private residences, facilities will not be placed in visually exposed locations (such as ridgelines and hilltops).

- Production facilities will be clustered and placed away from cut slopes and fill slopes to allow the maximum re-contouring of the cut and fill slopes.

- All long-term above ground structures will be painted [Dead Brown] (from the "Standard Environmental Colors" chart) to blend with the natural color of the late summer landscape background.

A 5.6 Final Reclamation Procedures - Additional

- Final reclamation actions will be completed within six months of well plugging, weather permitting.

- All disturbed areas, including roads, pipelines, pads, production facilities, and interim reclaimed areas will be re-contoured to the contour existing prior to initial construction or a contour that blends indistinguishably with the surrounding landscape. Salvaged topsoil will be spread evenly over the entire disturbed site to ensure successful revegetation. To help mitigate the contrast of re-contoured slopes, reclamation will include measures to feather cleared lines of vegetation and to save and redistribute cleared trees, woody debris, and large rocks over re-contoured cut and fill slopes.

- Water breaks and terracing will only be installed when absolutely necessary to prevent erosion of fill material. Water breaks and terracing are not permanent features and will be removed and reseeded when the rest of the site is successfully revegetated and stabilized.

- If necessary to ensure timely revegetation, the pad will be fenced to BLM standards to exclude livestock grazing for the first two growing seasons or until seeded species become firmly established, whichever comes later. Fencing will meet standards found on page 18 of the BLM/FS Gold Book, 4th Edition, or will be fenced with operational electric fencing.

- Final abandonment of pipelines and flowlines will involve flushing and properly disposing of any fluids in the lines. All surface lines and any lines that are buried close to the surface that may become exposed in the foreseeable future due to water or wind erosion, soil movement, or anticipated subsequent use, must be removed. Deeply buried lines may remain in place unless otherwise directed by the authorized officer.

A 5.7 Reclamation Monitoring and Final Abandonment Approval

- Reclaimed areas will be monitored annually. Actions will be taken to ensure that reclamation standards are met as quickly as reasonably practical.

- Reclamation monitoring will be documented in a reclamation report submitted to the authorized officer as determined on a site-by-site and project basis. The report will document compliance with all aspects of the reclamation objectives and standards, identify whether the reclamation objectives and standards are likely to be achieved in the near future without additional actions, and identify actions that have been or will be taken to meet the objectives and standards. The report will also include acreage figures for: Initial Disturbed Acres; Successful Interim Reclaimed Acres; and Successful Final Reclaimed Acres. Annual reports will not be submitted for sites approved by the authorized officer in writing as having met interim or final reclamation standards. Monitoring and reporting continues annually until interim or final reclamation is approved. Any time 30 percent or more of a reclaimed area is re-disturbed, monitoring will be reinitiated.

- The authorized officer will be informed when reclamation has been completed, appears to be successful, and the site is ready for final inspection.

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APPENDIX B

REASONABLE AND FORESEEABLE DEVELOPMENT SCENARIO

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APPENDIX B

REASONABLE AND FORESEEABLE DEVELOPMENT SCENARIO HAIWEE GEOTHERMAL LEASING AREA

B.1.0 INTRODUCTION AND BACKGROUND

Following guidance in BLM Handbook H-1624-1, *Planning for Fluid Mineral Resources*, a Reasonable Foreseeable Development (RFD) is project management activities and actions, including developments, which are likely to occur in the planning area over the life of the plan (i.e., generally 15 to 20 years or whatever has been determined to be the planning horizon or timeframe for the RMP) assuming continuation of existing management. The fluid minerals specialist focuses attention on projecting fluid minerals leasing, exploration, development, production and abandonment activities. The description of existing fluid minerals practices and information on existing leases and related exploration and development activities as well as the potential for development in the planning area provides the basis for projecting the RFD under existing management. The level of detail necessary for describing the reasonably foreseeably development scenario is basically a function of: the amount of geologic data available regarding fluid mineral potential; and the nature or level of resource conflicts or controversies, i.e., planning issues or management concerns involving fluid mineral leasing and development.

This Reasonable Foreseeable Development (RFD) scenario has been prepared as a basis for analyzing environmental impacts resulting from future leasing and development of federal geothermal resources within the Haiwee Geothermal Leasing Area (HGLA). As the name implies, the level and type of development anticipated in this RFD is a “best guess” of what may occur if these areas are leased. It is not intended to be a “maximum-development” scenario; however it is biased towards the higher end of expected development.

The foreseeable development described here could occur on any land within the HGLA (22,836 acres), regardless of surface or mineral ownership.

The anticipated total surface disturbance for the area as reflected by the assumptions described below is summarized as follows:

Planning Area	BLM Disturbance (acres)	Total Disturbance (acres)
Haiwee Geothermal Leasing Area	376 (initial) 257 (final)	404 (initial) 276 (final)

Twenty-four of the 38 sections in the HGLA boundaries are within the Coso Known Geothermal Resource Area (KGRA). This area was previously analyzed as having a moderate to high potential for the occurrence of geothermal resources. HGLA lands that are outside of the KGRA are adjacent to and similar in geology to lands within the KGRA. The HGLA lands also have similar mineralogy, lithology, and geologic structure to the Coso KGRA. Numerous technical papers and geologic analyses have documented the similarities in geologic setting between the two areas.[1] While no direct data is available to validate this RFD scenario, the proximity to the Coso geothermal operations and the KGRA suggests the possibility of a similar resource within the HGLA. The RFD analysis in this document is based on the proximity of the HGLA to the active Coso geothermal field and the ongoing operations that occur there.

The Coso geothermal field is located in an area of relatively recent volcanic activity which resulted from magma intruding to shallow depths along localized faults, thereby providing a heat source for the geothermal field. The

[1] Duffield, et al., 1980, Jackson & O’Donnell, 1980, Wohletz and Heiken, 1992, etc.

Coso geothermal field has produced as much as 273 megawatts (MW) of electricity from a total of nine 30 MW geothermal flash steam turbine power plants. The field currently produces significantly less than that rated capacity due to a decline in reservoir pressure resulting from geothermal production over more than three decades. The geothermal system is hot-water dominated, with a fluid temperature i.e., greater than 360 degrees Fahrenheit (oF) [182 degrees Celsius (oC)], high enough to support a “dual-flash” process.

Dual-flash uses changes in pressure to create steam vapor, which drive large turbines, and convert the heat energy into electricity. Since the geothermal resource fluid (geofluid) is used directly to turn the turbines in a flash plant, it can be cooled for reinjection only by means that result in large amounts of evaporation of the resource. The drawback to this type of production is that a significant proportion of the geothermal fluids are lost to evaporation and not re-injected into the geothermal reservoir. However, freshwater sources are not required for plant operations unless and until the resource reservoir is drawn down to the point where pressures begin to decline and production levels begin to suffer. In the latter years in the life of a flash plant (i.e., 27 years of continuous operation in the case of Coso), “makeup water” from an outside source, usually freshwater, can be injected into the reservoir to “recharge” the geothermal source reservoir. It is still not necessary for cooling, however.

Another type of flash plant technology is the direct use of dry steam to turn turbines. This type of a resource is found in only a few places in the world and is not expected to be identified within the HGLA. The choice of technology is largely controlled by the temperature of the produced water, although some geothermal companies have converted existing flash plants to binary systems with either wet or dry cooling technologies.

Binary systems represent a third type of commonly used geothermal development techniques, where power generation results from the geothermal fluid heating a secondary working fluid (with a lower boiling point than water) to turn the turbines for power generation. Because binary systems utilize a closed loop system where the geothermal fluid never touches the ambient atmosphere, there is no evaporation of the fluid, and so the geothermal reservoir does not become degraded over time, as in a flash plant. However, the produced fluid still needs to be condensed and cooled for reinjection to the source reservoir, and freshwater from outside sources have traditionally been used for cooling. Although the volumes of freshwater consumed for cooling a binary plant are far less in comparison to the direct evaporation of geothermal fluid that occurs in cooling a flash plant resource, such sources of water are in high demand for agriculture, domestic and recreational uses, and to recharge bodies of surface water. Binary geothermal technology is generally used where resource fluid temperatures are less than 360oF (182oC). Most existing binary plants are now turning to dry or air cooling technologies at least seasonally, because such cooling methods do not require any consumption of freshwater or geothermal resource fluid. In arid climates, however, plant efficiency and production levels decline seasonally in hotter months for plants utilizing dry cooling methods. The tradeoff is that binary plants with dry cooling will have virtually no impact on either freshwater aquifers or the geothermal reservoir once the plant is in operation. If the lands are leased, lessees will consider these factors in choosing a geothermal plant design and method of cooling.

No direct data currently exist on the presence of a geothermal resource within the HGLA. The assumption made in preparing this RFD scenario is that, if a potential geothermal resource were to be identified, factors including the temperature and thermodynamics of the geothermal reservoir and the local availability of water that may be necessary for geothermal energy production and plant operations will determine whether flash or binary technology is appropriate, as well as the method of cooling.

The Coso geothermal field is used as an example for what may be found in the HGLA. Unlike Coso, the HGLA has no surface features associated with geothermal activity such as hot springs and fumaroles. Based on this observation, it is assumed that any resource, should one be located, would be deeper than at Coso and less economically viable. The RFD scenario assumes that only two 30 MW power plants would be constructed, each with a useful life of 30 years, and that the most likely plant design would be dual-flash. For purposes of this RFD scenario, the foreseeable development described could occur on any land in the HGLA regardless of surface or mineral ownership.

Argonne National Laboratory (Clark et al. (2016)) evaluated a range of geothermal technologies to compare their relative water consumption rates, and concluded that for those temperatures where both hydrothermal binary and hydrothermal flash can operate, water consumption (from all sources including geothermal fluid) for the binary power plant (HB-1) was less than the flash power plant. The flash system relies on water from the geothermal reservoir for cooling, while the binary system requires another water source for cooling needs unless air cooling technology is used, which can impact plant efficiency seasonally, to the point of being uneconomic in some climates. However, over the course of a 30-year power plant lifetime, long-term water supply from the geothermal reservoir may require supplemental injection from another source in the latter years of a flash plant's operation.

Volumes of water that may be consumed are entirely dependent upon the overall design of the facility, its cooling systems and technical requirements. Wet, dry, or hybrid cooling systems can result in varying degrees of overall water use. Recycling technologies can also have an impact on water consumption. Ancillary systems may impact water consumption without regard to the geothermal technology being used.

Fluid Loss (usage) in California Wet-cooled Binary and Flash Geothermal Power Plants

	MW	% Loss	Acre-feet/year
Binary Powerplant			
Casa Diablo	40	4%	623
East Mesa	49.5	4%	2,518
Heber	92	6%	2,556
Multi-stage Flash			
Coso	273[2]	48%	13,540
Salton Sea	340	18%	10,807

Table from Shevenell, L., 2011 *Water Use in Geothermal Power Generation*; presentation to the National Water Resources Association annual meeting.

The following assumptions are made for this RFD scenario and the analysis of impacts:

1) The difference in disturbance footprint (acreage), between flash, dual-flash, and binary technology is negligible;
2) There will be adequate hydrothermal fluid in the geothermal reservoir for the life of each power plant, regardless of technology;
3) The geothermal reservoir is a confined aquifer and fluid production from that reservoir would not impact other aquifers; and
4) The difference in impacts between the flash, dual-flash and binary technologies is not significant.

There is a wide range of variability that may be expected from differing geothermal technologies in differing geological settings. While flash plants do not require freshwater from an external source for cooling, it is possible, as previously stated, that a dual flash system might eventually also require injection from an external water source to recharge the geothermal reservoir in the event that years of evaporation of the geothermal fluid during cooling results in significant drawdown of the resource reservoir.

As a result of public comments on the DEIS regarding water usage of binary system and flash system geothermal power plants, the BLM conducted additional data collection to better understand the potential water usage of flash and binary geothermal systems. Argonne National Laboratory (ANL) evaluated and estimated water usage for four geothermal power plant scenarios using a model developed by U.S. Department of Energy (Clark et. al 2016). The Geothermal Electricity Technology Evaluation Model (GETEM) was developed to estimate and summarize the performance and cost of various geothermal power system configurations with a wide variety of physical characteristics. Argonne uses this model for its life cycle analysis of geothermal energy, particularly to estimate

[2] The volumes of acre-feet consumed in evaporative cooling in these flash plant examples appears more drastic due to the larger plant sizes (e.g., 273 MW for Coso vs. 40 MW for Casa Diablo). While it is an oversimplification to correct for the MW difference alone (as temperature and pressure differences also affect volume), such a calculation would show that 40 of Coso's MW might consume 1,983 acre-feet of geofluid annually, as compared to the 623 acre-feet of freshwater consumed to produce 40 MW at Casa Diablo.

operational fresh water and geofluid consumption for hydrothermal flash and binary systems.

In comparison to other electricity generating technologies, geothermal flash and binary are of the same magnitude and among the lowest consumers of water per kilowatt-hour, and also utilize the smallest “footprint” in terms of surface acreage necessary. For flash or multi-flash systems, geothermal fluid loss rates are typically larger than binary systems, because the produced fluid is directly flashed to steam and subsequently used in the evaporative cooling process. Binary systems are “closed loop” systems with all of the produced water being directly re-injected back into the geothermal reservoir. Binary systems always require an external source of water in a system utilizing wet or hybrid cooling, but binary systems that utilize dry cooling methods full time do not involve consumption of either freshwater or geothermal resource fluid.

B.2.0 AVAILABLE DATA AND ASSUMPTIONS

The HGLA encompasses about 38 sections, or approximately 22,805 acres. Of this, nearly all the land is BLM surface and subsurface. Of the 22,805 acre leasing area, only 1,572 acres are non-federal, for a total federal area of 21,233 acres. Included in the 21,233 acres of BLM-managed land are three pending lease applications covering about 4,460 acres.

The RFD includes total anticipated development for the entire 22,805 acres.

The RFD uses a simple ratio of 93% by dividing the total number of BLM managed acres with the total number of acres within the HGLA, and multiplying by 100:

$$\mathbf{(21{,}233_{\text{acres BLM}} / 22{,}805_{\text{acres Total}}) \times 100 = 93\%}$$

This means that a maximum of 93% of the impacted acreage identified in the RFD scenario might be expected to occur on BLM-managed land that could be open to development under this RFD, only about 257 acres (93% of 276 acres), and 376 acres of total disturbance (93% of 404 acres) could occur on BLM-managed lands in the HGLA.

There are no direct data on which to base this RFD. There are no known temperature gradient wells in the immediate vicinity, nor have there been any deep exploration wells drilled in the area to date. Therefore, the basis of this RFD in terms of predicting likely plant design technology will be the proximity of the area to the Coso geothermal field, a field that currently produces approximately 100 MW to 200 MW (net) of electricity from a total of nine 30 megawatt (MW) geothermal turbine/generators.

The Coso field is located in an area of widespread ancient volcanic activity. This volcanic activity resulted from magma being intruded to unusually shallow depths, thereby providing a heat source for the geothermal field. The HGLA appears to be in the same general geologic regime.

The distance between the Coso geothermal field and the HGLA is about 10 to 15 miles. Proximity to a known producing geothermal field has little to do with the ultimate productivity of an area. However, from a geologic standpoint, there is a relatively high likelihood that some of the volcanic activity and fracturing in the Coso geothermal field may exist in the HGLA as well.

For the purpose of this RFD, it will be assumed that two 30 MW dual-flash power plants will be constructed and that the powerplants will have a useful life of 30 years. It will also be assumed that the productive areas will be less prolific than in the Coso geothermal field and will require more wells per MW than in the Coso geothermal field.

B.2.1 Exploration Activities

For exploration activities within an area open to geothermal leasing, an operator must file an exploration application with the BLM that identifies the areas to be explored and the method of exploration. The proposal identified in the application is initially reviewed to determine whether it is covered by regulations regarding “casual use” geothermal exploration or whether additional environmental and regulatory review is required. The BLM may, depending upon the results of the analysis undertaken during this review, approve, reject, or modify the project requested in the application.

Exploration may include geophysical exploration such as seismic reflection/refraction testing,2 and other forms of (low impact) surface geophysical testing. This RFD scenario anticipates that up to 20 temporary exploration or temperature gradient wells (TGW), could be drilled. Seismic testing can be either passive, to detect naturally-occurring events, or induced, which would use small charges to create seismic reflections. Seismic testing typically requires the drilling of very shallow holes (less than 100 feet) for the placement of explosives or seismic monitoring devices. Because there has not been any actual drilling in the leasing area, it will be assumed that some level of exploration will occur prior to full-field development. Exploration will include geophysical exploration such as seismic testing and the drilling of up to 20 temperature gradient wells. It is assumed that the total surface disturbance relating to seismic testing will be two acres.

Typical geophysical exploration is usually passive, measuring magnetic fields or electrical current, using receivers stationed at known locations. The size and intensity of the energy measured as it moves through the earth provides a clearer understanding of the subsurface. Geophysical testing is expected to create two acres of total surface disturbance in the RFD scenario.

TGWs are small diameter, relatively shallow boreholes that do not extend into a geothermal resource or reservoir. The purpose of these wells is to identify areas that have the greatest amount of heat flow. Once identified, these areas could be the targets for slim-hole resource confirmation wells on leased lands. It is assumed that the surface disturbance for each of the 20 exploration wells, or TGWs, is three acres. The three acres of disturbance includes a drilling site and an access road. It is likely that some of the drilling locations used for the TGWs may also be used for production well locations. For the purposes of the RFD scenario, however, it was assumed that these would remain separate disturbances.

The total temporary surface disturbance anticipated from exploration is 62 acres (20 TGWs x 3 acres each + 2 acres geophysics). It is assumed that this would be a temporary impact, because the exploration and TGWs will typically be plugged, abandoned, and these well sites, along with the two acres disturbed by geophysical testing, would be reclaimed. If a resource is identified, however, it is understood that some of the TGWs may be used for observation or monitoring for a period of time.

B.2.2 New Wells

Surface Disturbance- To support each of the two 30 MW power generation facilities, it is estimated that a total of 15 production wells and seven injection wells would need to be drilled over the course of the estimated 30-year useful life of each powerplant. This includes both wells drilled initially, estimated to be nine production wells and three injection wells, and makeup or replacement wells, estimated to be six production wells and four injection wells, that will need to be drilled over the 30-year period to maintain the 30 MW of net production. It is anticipated that one new well will be drilled every three years. The wells would be located on up to five new well pads, with each pad large enough to accommodate the drilling of up to five wells. All wells on BLM-managed land will be permitted by BLM using standard review methods that ensure: 1) protection of groundwater; 2) protection of public safety; and 3) that the environment is not unnecessarily or unduly damaged.

Each production or injection well has the potential to be from 6,000 feet to 15,000 feet deep. However, these depths should not be considered a limiting factor, since the potential environmental effects are not strongly correlated to the depth of a well, or to the number of wells on a well pad. For example, a 15,000-foot deep well could be drilled with only slightly more impacts than a 6,000 foot well. The RFD scenario considers the level of impacts associated with the deeper wells, providing a high-development bias, thus eliminating the need to analyze the shallower example. Surface impacts could be further minimized by requiring that multiple wells be drilled from existing single well pad locations. In the case of leases with NSO stipulations, wells would have to be directionally-drilled from adjacent lands located outside the NSO area to ensure that surface impacts do not occur.

Because the resource is expected to be relatively deep, directional drilling could be practical and result in drilling locations that could accommodate multiple wells. In this case, each well-pad would require approximately seven acres, including cut and fill. The extent of cut and fill could be important, as the topography is quite steep in parts of the HGLA. It is assumed that at least five wells could be drilled from each well location. The assumption of five wells per location should not be considered a limiting factor in this RFD because additional wells could be drilled from an existing location with few additional impacts.

Given the rugged topography, each well-pad is estimated to need three miles of 30-foot wide access road and one mile of pipeline. It is estimated that half the pipelines will follow the access roads in flatter areas, thereby adding 10 feet to the total width. It is estimated that the other half of the pipelines will be built in rugged areas and would go "cross country." These pipelines would require 30 feet of disturbance initially, but after construction, only a 15-foot access road will remain. Those disturbed acres not used for pipeline access road would be reclaimed to restore native vegetation.

Each production well is expected to take between 90 and 150 days to drill. During this time, greater than 95 dB noise could be generated by the diesel engines that power the drilling rigs and air compressors/mud pumps, as well as from the drawworks, drawworks brake, racking of pipe, and well testing. The racking of pipe and drawworks brake are higher-pitched noises that typically travel further than sources such as diesel engines. To limit the undesirable effects of noise on wildlife, drilling rigs may be required to implement best management practices (BMPs) that are commonly employed in more urban settings. All diesel engines will use mufflers, per standard industry practice. Well testing would also require that mufflers be used to reduce noise. Up to three drilling rigs could be in operation simultaneously and drilling is expected to take place 24 hours a day, seven days per week.

This estimate includes the acreage of surface disturbance for all new well pads, roads, and pipeline corridors associated with the well field needed to supply geothermal resources for one 30-MW power plant. If the maximum scenario envisioned in the RFD scenario (two 30-MW power plants) is realized, the expected disturbance would double: 212 acres of temporary disturbance (106 acres x 2 power plants) with 194 acres of disturbance (97 acres x 2 power plants) following initial reclamation.

Total foreseeable surface disturbance for new well pads, roads, and pipeline corridors associated with the wellfield for *each* 30 MW powerplant is summarized below.

Description	**Unit Surface Disturbance (acres)**	**Number**	**Total Surface Disturbance (acres)**
Well pads	7	5	35
Access roads	3.6 acres/mi	15 miles	54
Flat-land Pipelines	1.2 acres/mi	2.5 miles	3
Rugged-land Pipelines (initial)	3.6 acres/mi	2.5 miles	9
Rugged-land Pipelines (final)	1.8 acres/mi	2.5 miles	5
-			**106 acres (initial)** **97 acres (final)**

Considering the surface disturbance from two wellfields to supply geothermal resources to the two 30 MW powerplants, the initial ***total*** surface disturbance would be 212 acres (106 acres x 2) and then about 194 acres (97 acres x 2) after reclamation.

Potential Impacts

<u>Noise</u>- Each well is expected to take between 90 and 150 days to drill. During this time, greater than 95 dB of noise will be generated by the diesel engines that power the drilling rig and air compressors/mud pumps, as well as from the drawworks, drawworks brake, racking of pipe, and well testing. The racking of pipe and drawworks brake are higher pitched noises that typically travel further and are more difficult to mitigate than sources such

as diesel engines. All diesel engines will use mufflers per standard industry practice. All well testing will be done through mufflers to reduce noise. Up to three drilling rigs could be in operation simultaneously and drilling is expected to take place 24 hours a day, seven days per week.

Air Quality- Diesel engine exhaust, well testing, and dust are the primary impacts to air quality from the drilling of wells. Vented steam during a well test can contain dust, carbon dioxide, hydrogen sulfide, mercury, benzene, and ammonium and other non-condensable gases. Hydrogen sulfide emissions are abated through the injection of hydrogen peroxide and sodium hydroxide into the test line. Dust emissions from roads can be mitigated by periodic watering.

Groundwater- There may be Underground Sources of Drinking Water in the HGLA, and groundwater may be potable in some parts of the basin. However, given the geology, significant groundwater sources of drinking water are unlikely. If potential drinking water from groundwater does occur, geothermal wells include multiple casing strings at shallow depths where aquifers are most likely to exist. For a 9,000-foot well, surface casing is normally set between 300 and 1,000 feet, an intermediate string is set at 2,000 to 4,000 feet, and a production string is set to 4,000 to 6,000 feet. Casing is either cemented in place or slotted linear (uncemented) using standard industry practice. In addition, all injection wells may be required to be periodically tested for mechanical integrity. The testing protocol will depend on the nature of any aquifers and the type of resource encountered.

B.2.3 Powerplants

Potential Impacts

Based on the type of reservoir encountered at the Coso geothermal field, it is anticipated that two dual flash powerplant locations will be built to utilize the hot water and steam from the leases in the HGLA. Each powerplant will be capable of generating 30 MW (net) of electricity.

In a dual flash powerplant, hot water from the wells is first sent to a high pressure separator where the pressure is reduced, thereby causing some of the hot water to flash to steam. The steam is sent to a high pressure turbine. The hot water that is not flashed to steam is then sent to a low pressure separator where the pressure is once again reduced and some of the hot water flashes into low pressure steam. The low pressure steam is sent to a low pressure turbine. Whatever hot water is not flashed into steam is sent to an injection well. Typically, this process only flashes 20% to 30% of the hot water into steam, on a mass basis.

After leaving the turbine, both the high and low pressure steam are condensed into water and then sent to a cooling tower for further temperature reduction. The cool water is circulated through the condenser to increase plant efficiency. Water that is not evaporated in the cooling process or used in the condenser loop is also sent to an injection well.

Each plant location would require about 20 acres, which would be 25 acres of total surface disturbance including cut and fill. Each plant would also require three miles of access road and four miles of new transmission line to intertie with an existing transmission line that runs through the southwest portion of the HGLA. It is assumed that the access road will require 30 feet of surface disturbance, which includes cut and fill. Transmission intertie lines require 100 feet of initial surface disturbance; however, once the lines are constructed all but a 20-foot wide access road would be reclaimed with native vegetation.

The total surface disturbance for both powerplants is summarized in the following table:

Description	Unit Surface Disturbance (acres)	Number	Total Surface Disturbance (acres)
Powerplant location	25 acres/powerplant	2 powerplants	50
Access roads	3.6 ac/mi	6 miles	22
Transmission lines - initial	12.1 ac/mi	4 miles	48
Transmission lines - final	2.4 acres/mi	4 miles	10
Total Disturbed Acres - Powerplants	-	-	**130 (initial)** **82 (final)**

Potential Impacts

Noise- Powerplant noise usually entails a constant low-level hum primarily created by the cooling tower fans.

Air Quality- A dual flash plant will discharge any non-condensable gases that are produced with the steam including carbon dioxide, methane, ammonia, and hydrogen sulfide. However, local air quality districts typically have strict limits on hydrogen sulfide emissions. To mitigate hydrogen sulfide emissions, the hydrogen sulfide gases are scrubbed from the steam using a “Stretford”, iron chelate, or burner process.

Groundwater- Geothermal exploration and development will require water for well drilling, dust control during construction, and makeup water to compensate for evaporative loss during plant operation if the plant utilizes “wet” cooling towers. Water would be required during exploration and gradient well drilling activities occurring throughout the life of the project, as well. Makeup water necessary to maintain fluid pressures in the geothermal reservoir would also be necessary. Reinjection of less water than is produced from the geothermal reservoir would result in a gradual reduction in reservoir pressures and/or geothermal fluid yield and, as a consequence, result in a gradual reduction in the quantity of steam available to generate power.

Any additional groundwater extraction in the Rose Valley aquifer could cause localized or more wide-spread drawdowns in groundwater. Depending on groundwater extraction rates and proximity to sensitive features like Little Lake, water table drawdown could significantly impact the water available for residential use, irrigation, riparian and wetland habitat, and private wells. Increased groundwater extraction could also indirectly impact groundwater quality. Increased groundwater extraction could create upward groundwater gradients, causing an increase in Total Dissolved Solids (TDS) content, and could reduce suitability of groundwater for agricultural or drinking water uses. Increase of TDS could be great enough in some cases to render some groundwater no longer suitable as a drinking water source.

Overall, minor to no measurable short-term impacts would be expected from groundwater extraction needs for exploration, development, and dust control with the realized RDF. Higher impacts to existing groundwater users in Rose Valley are expected if continuous groundwater extraction would be conducted to augment the geothermal reservoir fluid. Long-term groundwater extraction from the local, near surface groundwater aquifer, to augment geothermal reservoir fluid levels could likely have significant long-term impacts on groundwater resources in Rose Valley, particularly, to Little Lake, if restrictions are not implemented.

Withdrawals could increase the depth to groundwater near existing water supply wells in the central portion and north end of Rose Valley leading to a drying of shallow wells, and long-term pumping could cause a reduction in groundwater flow towards Little Lake Ranch. Long-term reliance on water from the geothermal reservoir would likely require supplemental injection from another source.

Stipulations imposed by the BLM would require that groundwater extraction for consumptive use may be allowed, but may not exceed the safe yield or recharge rate to the Rose Valley Aquifer and may not cause a decline of 10 percent or more to the average annual flow of water of water flowing into the surface features at Little Lake. Therefore, impacts to the water resources are expected to be minor, and largely limited to local changes in groundwater recharge or runoff patterns.

Visual - Powerplants will be sited using terrain to obstruct visual impacts to the extent possible. All facilities will also be painted a color that blends into the natural setting. Steam plumes from the cooling towers, may rise several hundred feet above the cooling towers on cold, clear days, but may be absent on warm, dry days, especially in summer.

Seismic Impacts - Development at The Geysers geothermal field has resulted in the creation of micro-seismic events that seem to be tied to production and/or injection. This has been a cause for concern in the development of other geothermal fields as well. The Geysers is a unique dry-steam resource that is only found in two or three other places in the world. Induced seismicity is not typical to geothermal development. The induced seismicity experienced at The Geysers is less than magnitude 3.0 on the Richter scale. While larger earthquakes do occur within The Geysers, there is little evidence that these are tied to geothermal activity. More likely, the larger events are related to naturally-occurring movement along the many faults in the area.

Environmental analysis done at The Geysers has concluded that while micro-seismic events are a result of geothermal activity, these events are not large enough to cause structural damage to homes or other improvements. Therefore, this has not been considered a significant impact.

B.2.4 Decommissioning and Reclamation

Total disturbance from exploration, development, and operation of two 30 MW geothermal electrical generating facilities is projected to be 404 acres (see discussion above), with 368 of these acres (91 percent) expected to occur on BLM managed lands. Following initial exploration and development, 128 acres of disturbance are projected to be reclaimed to pre-project conditions. For the 30-year operational life of the facilities, the projected long-term disturbance is 276 acres. Of that, 251 acres (91 percent of 276 acres) are expected to occur on BLM managed lands.

The decommissioning of a facility typically occurs when the energy resource has been depleted. Close-out entails the removal of all hardware and infrastructure improvements that serviced the facility (i.e., roads, concrete pads, and structures) and the rehabilitation of the land in accordance with a reclamation plan approved by the BLM. The goal of the completed reclamation is to return the land to its pre-project condition.

APPENDIX C

ROSE VALLEY GROUDWATER CHEMISTRY

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APPENDIX C

ROSE VALLEY GROUNDWATER CHEMISTRY

C.1.0 Introduction

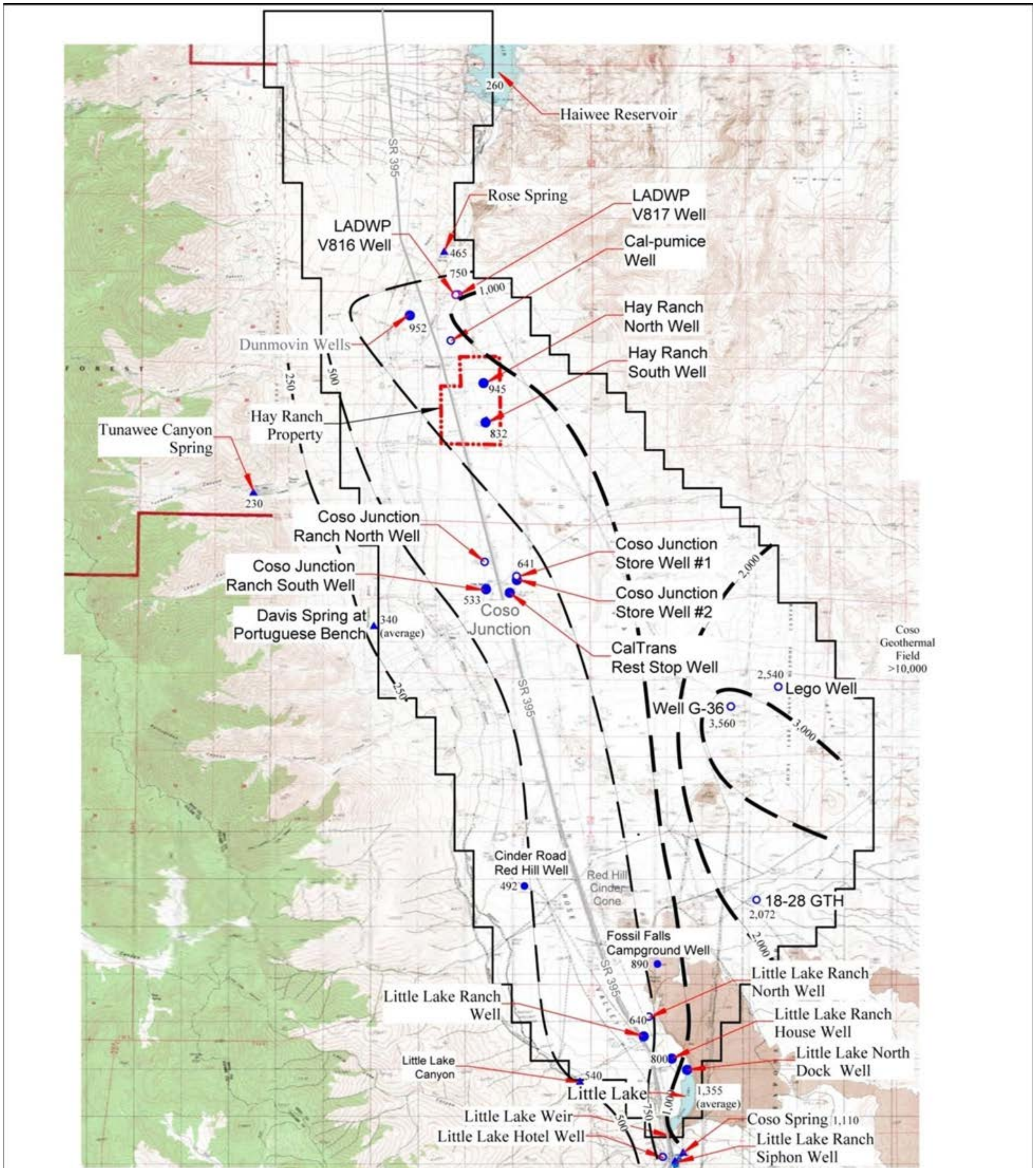
This section discusses the chemistry of the waters found in the vicinity of the Haiwee Geothermal Leasing Area (HGLA). Particular focus is given to identifying water types and distinguishing the sources of various waters as well as the relationship between a variety of waters identified in the area.

The chemistry of waters found in Rose Valley and the related watershed varies widely reflecting the multiple types of waters often found within hydrological systems of the semi-arid western United States with the addition of a hydrothermal system. Water chemistry in the Haiwee area is influenced by the interaction between groundwater and rock along the hydrological flow paths with the addition of a geothermal brine component. Recharge waters from drainage of the mountains surrounding Rose Valley have lower dissolved solids (TDS) than the valley's groundwater, which typically is higher in dissolved solids reflecting longer transit times and a greater degree of water-rock interaction. Surface water can be even higher in dissolved solids where it is impacted by evaporation (Güler 2002). Outflow of saline geothermal brines from the Coso geothermal system to the east may also provide a component of flow to the Rose Valley hydrological system.

Total dissolved solids (TDS) range from very low to a few hundred milligrams per liter (mg/L) in surface streams draining the Sierras to the west or in springs of the Coso-Argus Range to the east to several thousand mg/L in geothermal brines in the Coso Geothermal Reservoir and related geothermal surface manifestations to the east. Groundwater in the northern Rose Valley near Hay Ranch is characterized by TDS between 800 and 900 mg/L whereas groundwater in the southern Rose Valley is characterized by TDS from 500 to 700 mg/L. At Little Lake the water is slightly brackish with TDS from 1,500-2,500 mg/L. The TDS levels in the upper several hundred feet throughout the Rose Valley are shown in Figure C-1.

The Coso geothermal system was initially a liquid-dominated system containing sodium chloride brines with a small steam cap in the shallowest parts of the field. The fluids contain non-condensable gases which are primarily carbon dioxide. Where there is steam present, the gases partition into the steam phase. The steam cap has grown during the last 20 years of supplying power generation. Surface manifestations include both brine-fed and steam-fed features. The brine fed features are typically brine-groundwater mixtures while the steam-fed features are mud-pots and fumaroles affected by steam or steam condensate containing acidic gases mixing with surface waters or surface material. The chemistry of the geothermal system will be discussed further in the sections below. While the TDS of the geothermal fluids is distinctly higher than the rest of the area (10,000 mg/L), it is not included in the contours because the connection is not well defined.

Figure C-1 Distribution of Total Dissolved Solids in Rose Valley



Di

SOURCE: Geologica 2008

C.2.0 Hydrochemical Analyses and Water Types

Chemical analysis of water samples collected in the Rose Valley and vicinity indicates that there are several distinct water types. Sierran waters (and minor amounts of water from the Coso Range) recharge the area (Güler 2002, Williams 2004). There also appears to be or to have been a small inflow of subterranean discharge from the Coso Geothermal System which reaches as far as the LEGO well. The chemistry and isotopic signatures of the other types of water suggest that the Rose Valley hydrological system contains waters that have followed different and sometimes complex pathways from their mountain sources to points of discharge.

Güler (2002), and Williams (2004) compiled an extensive database of chemical analyses of waters within the area to evaluate and characterize water quality. They grouped the waters within the area into several water types:

- Sierran: springs and streams that drain the Sierras; calcium (Ca)- (sodium, Na)-bicarbonate (HCO3); average TDS≈200 mg/L
- Indian Wells Rose Valley: springs, streams and shallow groundwater in basins along the eastern side of the Sierra; Na-Ca-HCO3-(sulfate, SO4); average TDS≈700 mg/L
- Coso-Argus Group: surface and spring samples from the Coso and Argus Ranges; Ca-HCO3 - average TDS≈500 mg/L
- Little Lake Group: Samples from Little Lake and surrounding springs; Na-(Mg)-HCO3 -Cl; average TDS≈1,200 mg/L
- Geothermal Brine: from deep (500-3,000 m Coso geothermal reservoir); Na-Cl; TDS≈10,000 mg/L

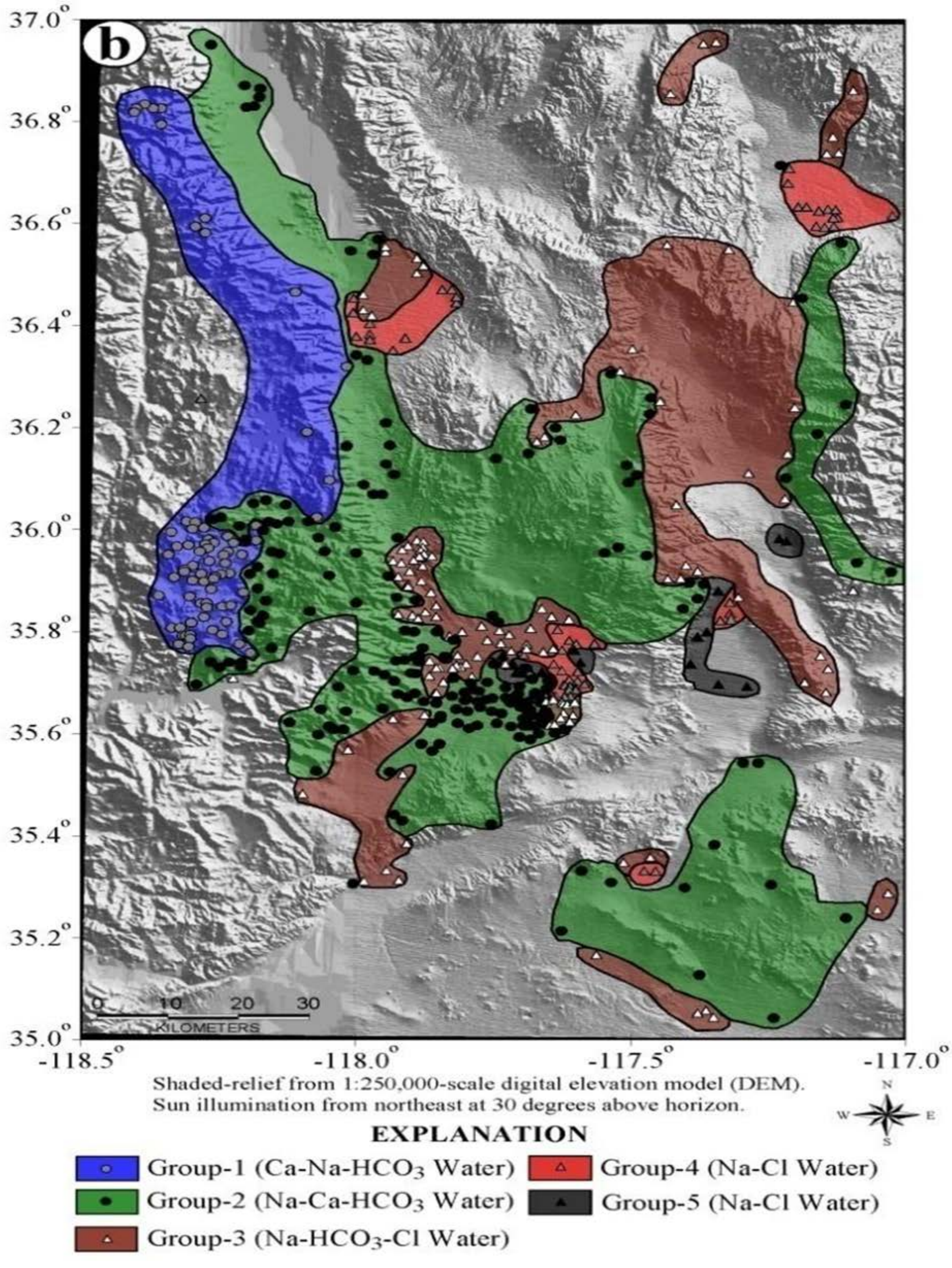
To these we add two types of waters found at Coso Hot Springs:

- Geothermal steam-fed surface fluid
- Geothermal brine-fed surface fluids

Waters in the vicinity of the program area have also been classified based on the relationship to the point of recharge; the chemistry of water in Basin and Range-type hydrological systems can be explained by increasing degrees of water-rock interaction and chemical evolution. High Sierra recharge waters (Group 1) are Ca-Na-HCO3 water with average TDS of 67 mg/l whereas low-elevation Sierra and Coso Range waters and basin fill groundwaters (Group 2) are slightly more evolved based on water-rock interaction and are typically Na-Ca-HCO3 water with average TDS of 356 mg/l. The waters in the program area are primarily Group 1 and 2 types, but within the area slightly to the north, there are more concentrated and evolved waters. Group 3 are transitional Na-HCO3-Cl waters typically found on basin floors with an average TDS of 1018 mg/l representing greater evolution. Group 4 are brackish Na-CL waters with average TDS of 5133 mg/l and Group 5 are brines with an average TDS of 94,000 mg/l.

Figure C-2 shows the distribution of these waters in the vicinity of the HGLA. Geothermal waters represent waters with higher degrees of water rock interaction partially influenced by higher temperatures, interaction with different minerals and the influence of magmatic influx. Although they are primarily NaCl brines, they are not included in this classification.

Figure C-2 Water Types in the Vicinity from Gruler (2002)



A review of chemical and isotopic analysis of water samples from Rose Valley and the adjacent mountains suggests that Sierran, Indian Wells-Rose Valley (IWRV), Little Lake (LL), and possibly a component of geothermal brine water types are present in Rose Valley groundwater. Within the IWRV type, Portuguese Bench, Coso Junction, and Hay Ranch waters are clearly distinguished from each other and from Little Lake and geothermal waters, particularly in the conservative element of chloride. Little Lake waters, represented by the LL Ranch House Well, LL (an average of surface waters), and the Coso Spring are clearly distinguished from other Rose Valley groundwaters by higher concentrations of all constituents except Ca and Mg according to Güler (2002), and Williams (2004). The only exception is the geothermal-influenced LEGO and 18-28 GTH wells. Williams (2004) suggests that elevated Na relative to Ca, Mg, and Cl, as well as boron (B) and lithium (Li) indicate a geothermal component in Little Lake waters. However, the elevated chloride in Little Lake waters may also be a result of evaporation (concentration) of waters from nearby Sierran recharge from the west (as represented by Little Lake Canyon Spring) combined with groundwater flow down the valley (represented by Little Lake north well water).

Hay Ranch groundwater appears to be a more concentrated version of Haiwee Reservoir water. The dominance of sulfate in waters in the northern part of Rose Valley (Hay Ranch and Dunmovin) distinguishes these waters from the rest of the valley. Although the Hay Ranch wells were drilled deeper than many of the other wells in the valley, the Dunmovin well is not, so depth alone probably does not produce the difference in water chemistry. Concentration of these waters by evaporation would not produce the chemistry of the Little Lake waters, suggesting that other waters must mix with the northern Rose Valley waters as they flow southward towards Little Lake prior to evaporation in the Lake which produces the distinct chemistry of Little Lake water.

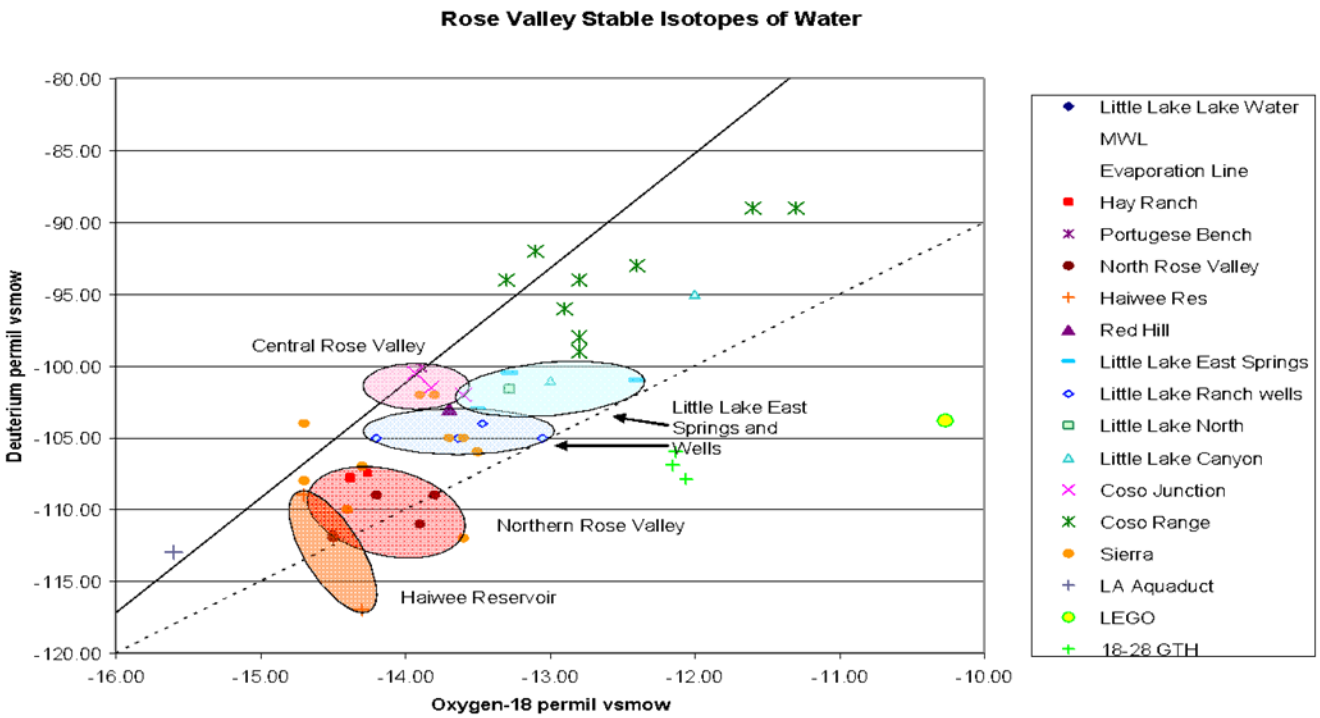
Despite the different chemistries of waters at discharge points within Rose Valley watershed most waters appear to generally have the same origin. Similar boron/chloride ratios (the ratio of two relatively conservative elements) support similar origins. Boron/chloride ratios within the Hay Ranch watershed are similar to water from the Sierras and to the Coso geothermal waters suggesting that although various processes change the absolute concentrations of these conservative elements, the source of the water is likely precipitation in the Sierra and Coso Ranges.

C.3.0 Isotope Data

Stable water isotope (oxygen-18 and deuterium) signatures are commonly used to evaluate the origins of waters. Isotope concentrations of waters from within the Rose Valley and its watershed reflect variable sources as well as evaporation. Stable isotopic data for Rose Valley waters was collected from numerous sources (MHA-RHT 2009) from analysis in many laboratories over many years. Within single data sets variation of oxygen-18 is around $\pm 0.2^{o}/_{oo}$ and deuterium is approximately $1^{o}/_{oo}$, the range of variability around the data presented below is probably greater that these numbers.

Evaporation enriches waters in the heavier stable isotopes making the waters less isotopically negative. At first glance, the stable isotopes of Little Lake waters appear different from all other waters. These differences can be explained by isotopic fractionation which occurs during the evaporation of these shallow lakes (Figure C-3).

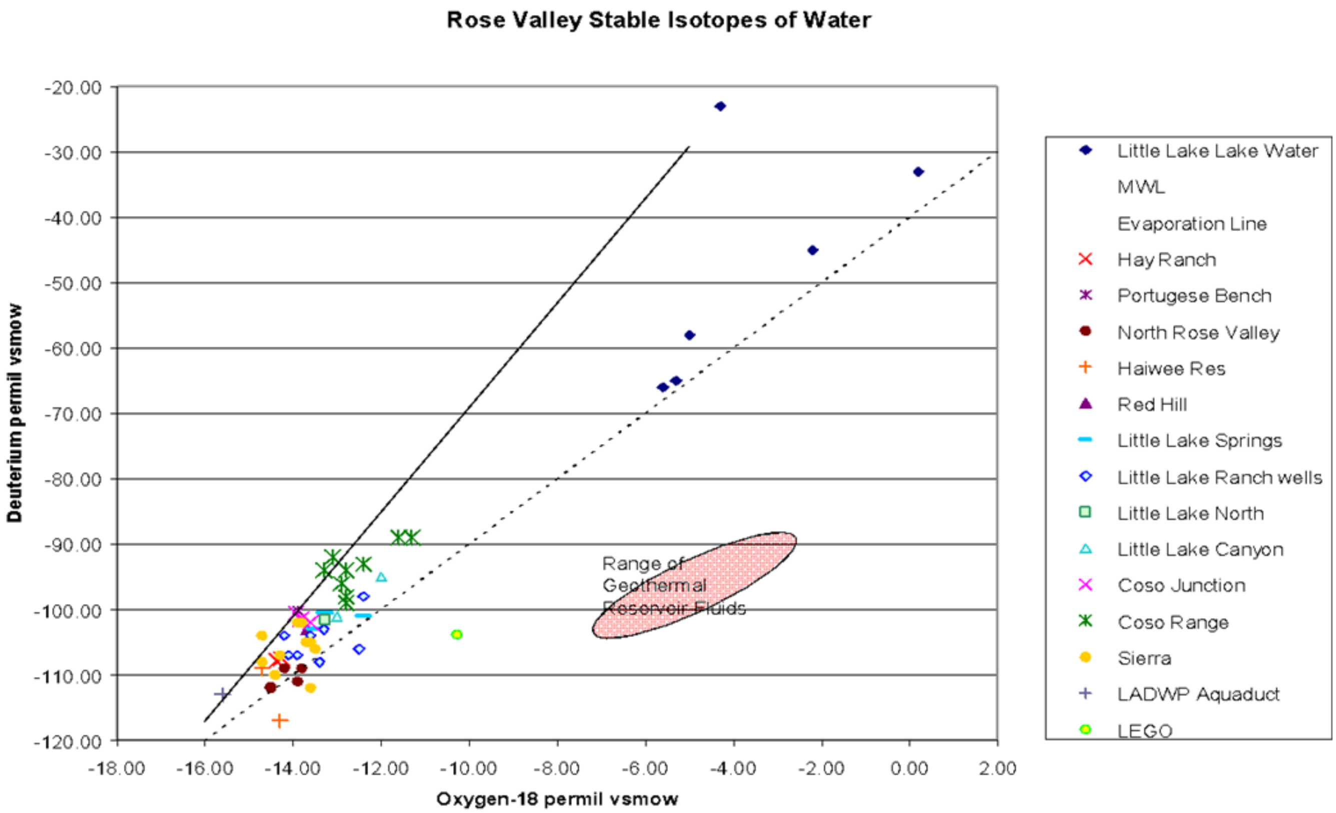
Figure C-3 Stable Isotopes of Rose Valley excluding the lake water from Little Lake



SOURCE: Fournier and Thompson (1980), Guler (2002), Geotrans, (2004), Coso Operating Company (2007), US Navy GPO (2007 and 2008).

Based on stable isotopic composition of groundwater represented by well and spring waters (minimizing the effect of evaporation), sources of groundwater from the northern to the southern end of the valley can be distinguished from each other. These differences may in part reflect differences in recharge from the Sierra, which is isotopically lighter (more negative) to the north as represented by the Los Angeles Department of Water and Power (LADWP) Aqueduct water and Haiwee Reservoir and isotopically heavier (less negative) in the south. The Haiwee reservoir sample may also be influenced by evaporation. The stable isotopic signature of the northern part of the Valley (including Hay Ranch waters) is similar to the Haiwee Reservoir and the highest or more northerly Sierras. Portuguese Bench and Coso Junction waters appear to be similar to each other and isotopically more like the Sierras farther south than Haiwee and more directly west of Rose Valley (Figure C-4). Thus, the isotopic signature of Rose Valley groundwaters suggest that there is recharge from the Sierras all along the north-south axis of the valley, with different isotopic signatures, in addition to some valley underflow from north to south.

Figure C-4 Stable Isotopes of Waters from Rose Valley and Vicinity



SOURCE: Fournier and Thompson (1980), Guler (2002), Geotrans, (2004), Coso Operating Company (2007).

The isotopic signature of groundwater in wells or springs down gradient from Little Lake (i.e., Little Lake East Spring, also known as Coso Spring, and Little Lake Ranch Wells) is probably affected by the isotopic shift related to evaporation of the lake water. Therefore, the Little Lake North Well probably represents un-evaporated recharge to the Lake from groundwater whereas Little Lake Canyon spring may indicate recharge to the Little Lake from the west. The source waters for Little Lake appear to be either:

1) From the Sierran source area similar to Portuguese Bench springs with a longer subsurface pathway (which increases oxygen-18 by water-rock interaction but not deuterium), or

2) Predominantly Portugese Bench type Sierra water and a small amount of geothermal water (or geothermal mixed water), or

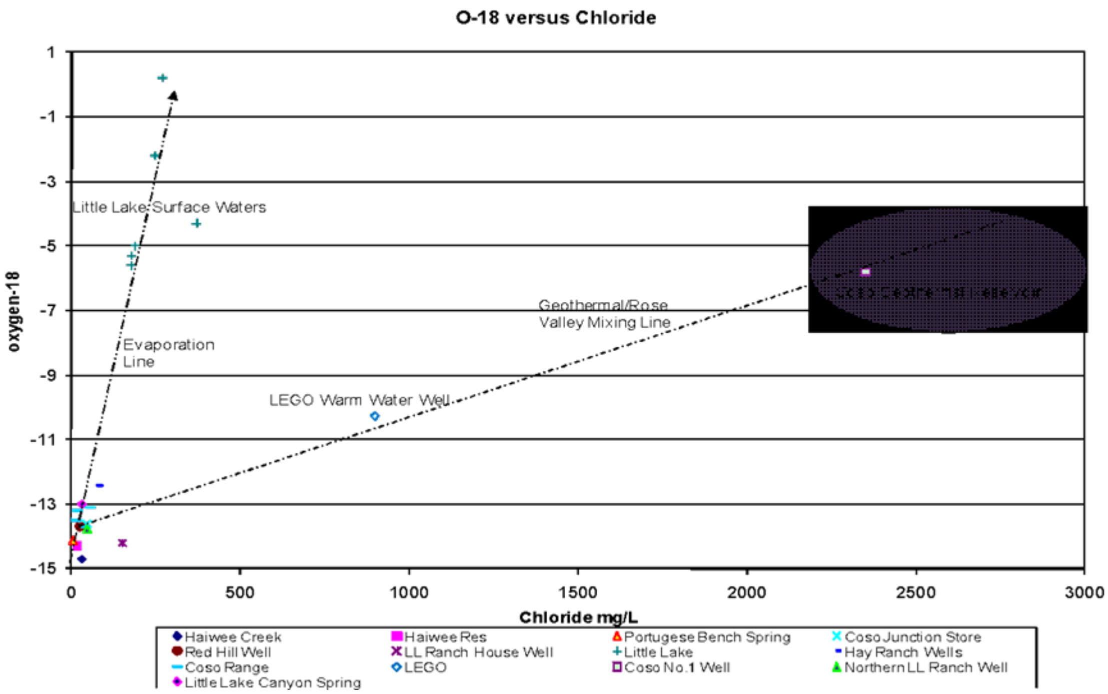
3) Predominantly Portuguese Bench type Sierra water and a small amount of Rose Valley underflow from the north.

If the major source of Little Lake water was directly from the Hay Ranch area via subsurface groundwater flow, significant evaporation would have to occur prior to arriving at Little Lake which is unlikely. In addition, groundwater flow within the Rose Valley would have a major diversion around Coso Junction.

While the chloride concentrations in Little Lake water could be produced by mixing a component of the geothermal water from the east, the combination of isotopic signature and chloride concentrations in Little Lake are most likely generated by evaporating water similar to that observed in the Little Lake North Well or in the Little Lake Canyon Spring to the west or a combination of the two (Figure C-5). In either case, water isotopes suggest the water sources for the Little Lake area are predominantly from the local Sierran watershed to the west and are distinct from the Northern Rose Valley water chemistries, potentially indicating more recharge to the Little Lake area from the west

than from the north. Slight displacement towards a lighter isotopic signature from the area around Portuguese Bench may reflect a slight influence of groundwater underflow from north to south through Rose Valley.

Figure C-5 Oxygen-18 versus Chloride Relationships in Waters around Rose Valley



Water Potability

Drinking water quality (potability) of waters within the Rose Valley ranges from excellent to marginal. Available data (MHA-RMT, 2009) indicate that Hay Ranch waters exceed primary drinking water standards (EPA, 2003) for arsenic, nitrate and nitrite. Secondary drinking water standards are primarily related to aesthetics and taste. Several waters exceed the secondary drinking water standard levels for TDS and sulfate. Recent analysis of water samples from the Hay Ranch wells indicates the water does not meet secondary drinking water standards for TDS, sulfate, iron and manganese.

APPENDIX D

Supplemental Biological Data and Protected/Sensitive Wildlife Species

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APPENDIX D

PROTECTED/SENSITIVE PLANT AND WILDLIFE SPECIES

This appendix provides supplemental tables discussed in Section 3.7 and Section 4.7 of this FSEIS that have changed from or supplement the DEIS (BLM 2012). Also refer to Section 3.19, Section 4.19 and Appendix D of the DEIS.

Table D-1 List of Special-status Plant Species Expected to Occur in the Haiwee Geothermal Leasing Area

Common name *Scientific name*[1]	**Listing Status**[2] **Federal**	**State**	**Conservation Status**[3] **BLM FO**	**CNPS**	**Flowering Period**[4]	**Habitat Preferences**[4]	**Potential for Occurrence**[5]
Ripley's aliciella *Aliciella ripleyi*	-	-	-	1B.3	May-Jul	Perennial herb. Mojavean desert scrub, on limestone and carbonate soils; rocky slopes, rock/cliff faces, and rock crevices. 300–1950 m	**Low.** Some potential suitable habitat in action area, but no recent observations.
Spanish Needle onion *Allium shevockii*	-	-	SS	1B.3	May-Jun	Bulbiferous herb. Pinyon and juniper woodlands and upper montane coniferous forest; metamorphic outcrops and talus. 850–2500 m	**Low.** Very little potential suitable habitat in action area and nearest known location is 17 mi away.
Darwin Mesa milk-vetch *Astragalus atratus* var. *mensanus*	-	-	SS	1B.1	Apr-Jul	Perennial herb. Great Basin scrub, Joshua tree woodland, and pinyon and juniper woodlands; volcanic clay soils and gravel. 1340-2315 m	**High.** Some potential suitable habitat in action area and nearest known location is 3 mi away.
Walker Pass milk-vetch *Astragalus ertterae*	-	-	SS	1B.3	Apr-May	Perennial herb. Pinyon and juniper woodlands; open areas with sandy, granitic soil, among pines, live oaks. 1705-1900 m.	**Low.** Very little potential suitable habitat in action area and nearest known location is 24 mi away.

Common name *Scientific name*[1]	Listing Status[2] Federal	State	Conservation Status[3] BLM FO	CNPS	Flowering Period[4]	Habitat Preferences[4]	Potential for Occurrence[5]
White pygmy-poppy *Canbya candida*	FS S	-	-	4.2	Mar-Jun	Annual herb. Joshua tree woodland, Mojavean desert scrub, and pinyon and juniper woodland; sandy places. 600-1460 m.	**High.** Some potential suitable habitat in action area and nearest known location is 4 mi away.
Muir's tarplant *Carlquistia muirii*	-	-	SS	1B.3	Jul-Aug	Rhizomatous herb. Chaparral, lower montane coniferous forest, and upper montane coniferous forest; dry, open sites on granitic soil. 1100-2500 m.	**Low.** Very little potential suitable habitat in action area and nearest known location is 20 mi away.
Jaeger's caulostramina *Caulostramina jaegeri*	-	-	SS	1B.2	May-Jul	Perennial herb. Great Basin scrub, limestone, pinyon and juniper woodlands, and subalpine coniferous forest; rock crevices and cliffs. 1800 – 2800 m.	**Moderate.** Some potential suitable habitat in action area, but nearest known location is 28 mi away.
Kern Canyon clarkia *Clarkia xantiana* ssp. *parviflora*	-	-	-	4.2	May-Jun	Annual herb. Chaparral, Cismontane woodland, Great Basin scrub, valley and foothill grassland; sandy, rocky soils on dry slopes and occasional roadsides. 700 -3620 m.	**Moderate.** Some potential suitable habitat in action area and nearest known location is 2 mi away.
Bristlecone cryptantha *Cryptantha roosiorum*	-	Rare	SS	1B.2	June-July	Perennial herb. Limestone and subalpine coniferous forest; carbonate, rocky soils and high ridges. 2440-3230 m.	**Low.** Very little potential suitable habitat in action area and nearest known location is >30 mi away.
Desert cymopterus *Cymopterus deserticola*	-	-	SS	1B.2	Mar-May	Perennial herb. Joshua tree and Mojavean desert scrub; sandy desert. 630-1500 m.	**Moderate.** Some potential suitable habitat in action area, but nearest known location is >30 mi away.

Common name *Scientific name*[1]	Listing Status[2] Federal	State	Conservation Status[3] BLM FO	CNPS	Flowering Period[4]	Habitat Preferences[4]	Potential for Occurrence[5]
Ripley's cymopterus *Cymopterus ripleyi* var. *saniculoides*	-	-	SS	1B.2	Apr-Jun	Perennial herb. Joshua tree woodland and Mojave desert scrub; sandy, gravelly carbonate soil. 1000-1660 m	**Moderate.** Some potential suitable habitat in action area, but nearest known location is >30 mi away.
July Gold *Dedeckera eurekensis*	-	Rare	SS	1B.3	May-Aug	Deciduous shrub. Desert wash, limestone, and Mojavean desert scrub; limestone outcrops and carbonate soils. 1220-2200 m.	**Moderate.** Some potential suitable habitat in action area, but nearest known location is >30 mi away.
Mojave tarplant *Deinandra mohavensis*		CE	SS	1B.3	June-Oct (Jan)	Annual herb. Chaparral, coastal scrub, and riparian scrub; mesic. 640-1600 m.	**Moderate.** Some potential suitable habitat in action area, but nearest known location is 22 mi away.
Panamint daisy *Enceliopsis covillei*	-	-	SS	1B.2	Mar-Jun	Perennial herb. Mojavean desert scrub; subalkaline, stony hillsides and canyons. 400-1830 m.	**Moderate.** Some potential suitable habitat in action area, but nearest known location is >30 mi away.
Hall's daisy *Erigeron aequifolius*	-	-	SS	1B.3	Jul-Aug	Rhizomatous herb. Broadleaved upland forest, lower montane coniferous forest, pinyon and juniper woodlands, and upper montane coniferous forest; rocky and granitic substrate, rock ledges and crevices. 1500-2440 m.	**Low.** Very little potential suitable habitat in action area and nearest known location is 20 mi away.
Kern buckwheat *Eriogonum kennedyi* var. *pinicola*	-	-	SS	1B.1	May-Jun	Perennial herb. Chaparral and pinyon and juniper woodlands; clayey substrate, dry ridges. 1340-1950 m.	**Low.** Very little potential suitable habitat in action area and nearest known location is >30 mi away.
Pinyon Mesa buckwheat *Eriogonum mensicola*	-	-	-	1B.3	Jul-Sep	Perennial herb. Great Basin scrub, pinyon and juniper woodlands, and upper montane coniferous forest; open, rocky or gravelly substrate. 1800-2805 m.	**Low.** Some potential suitable habitat in action area and nearest known location is 6 mi away.

Common name *Scientific name*[1]	**Listing Status[2] Federal**	**State**	**Conservation Status[3] BLM FO**	**CNPS**	**Flowering Period[4]**	**Habitat Preferences[4]**	**Potential for Occurrence[5]**
Panamint Mountains buckwheat *Eriogonum microthecum var. panamintense*	-	-	SS	1B.3	Jun-Oct	Deciduous shrub. Pinyon and juniper woodlands and subalpine coniferous forest; rocks. 1890-3250 m.	**Low.** Very little potential suitable habitat in action area and nearest known location is >30 mi away.
Barstow Woolly-Sunflower *Eriophyllum mohavense*	-	-	SS	1B.2	Apr-May	Annual herb. Alkali playa, chenopod scrub, and Mojavean desert scrub; creosote bush scrub. 500-960 m.	**Low.** Some potential suitable habitat in action area, but nearest known location is >30 mi away.
Red Rock poppy *Eschscholzia minutiflora* ssp. *twisselmannii*	-	-	SS	1B.2	Mar-May	Annual herb. Mojavean desert scrub; volcanic tuff; desert washes, flats, and slopes. 680-1230 m.	**Moderate.** Some potential suitable habitat in action area, but nearest known location is >30 mi away.
Jaeger's hesperidanthus *Hesperidanthus jaegeri*	-	-	SS	1B.2	May-Jul	Perennial herb. Great Basin scrub, limestone, pinyon and juniper woodlands, and subalpine coniferous forest; rock crevices and cliffs. 1800 – 2800 m.	**Low.** Some potential suitable habitat in action area, but nearest known location is 28 mi away.
Owens Peak lomatium *Lomatium shevockii*	-	-	SS	1B.3	Apr-May	Perennial herb. Lower montane coniferous forest and upper montane coniferous forest; rocky slopes and talus. 1770-2500 m.	**Low.** Very little potential suitable habitat in action area and nearest known location is >30 mi away.
Panamint Mountains lupine *Lupinus magnificus* ssp. *magnificus*	-	-	SS	1B.2	Apr-Jun	Perennial herb. Desert wash, Great Basin scrub, Mojavean desert scrub, and upper montane coniferous forest; desert slopes and washes. 1000-2500 m.	**Moderate.** Some potential suitable habitat in action area and nearest known location is 11 mi away.
Creamy blazing star *Mentzelia tridentata*	-	-	SS	1B.3	Mar-May	Annual herb. Mojavean desert scrub; creosote bush scrub; rocky, gravelly, or sandy substrate. 700-1160 m	**Moderate.** Some potential suitable habitat in action area and nearest known location is 6 mi away.

Common name *Scientific name*[1]	Listing Status[2] Federal	Listing Status[2] State	Conservation Status[3] BLM FO	Conservation Status[3] CNPS	Flowering Period[4]	Habitat Preferences[4]	Potential for Occurrence[5]
Kelso Creek monkeyflower *Mimulus shevockii*	-	-	SS	1B.2	Mar-May	Annual herb. Joshua tree woodland and pinyon and juniper woodland; alluvial fans, dry streamlets, generally granitic soils. 800-1340 m.	**Low.** Some potential suitable habitat in action area, but nearest known location is >30 mi away.
Sweet-smelling monardella *Monardella beneolens*	-	-	SS	1B.3	Jul-Sep	Rhizomatous herb. Alpine boulder and rock field, subalpine coniferous forest, and upper montane coniferous forest; granitic substrates. 2500-3500 m.	**Low.** No potential suitable habitat in action area and nearest known location is 13 mi away.
Amargosa beardtongue *Penstemon fruticiformis* var. *amargosae*	-	-	-	1B.3	Apr- Jul	Perennial herb. Desert wash and Mojavean desert scrub; creosote bush scrub. 850-1400 m	**Moderate.** Some potential suitable habitat in action area and nearest known location is 4 mi away.
Inyo rock daisy *Perityle inyoensis*	-	-	SS	1B.2	Jun-Aug	Perennial herb. Great Basin scrub and Pinyon and juniper woodland; dry, rocky slopes. 1800-2710 m.	**Low.** Some potential suitable habitat in action area, but nearest known location is 18 mi away.
Hanaupah rock daisy *Perityle villosa*	-	-	SS	1B.3	Jun-Sep	Perennial herb. Great Basin scrub and pinyon and juniper woodland; dry, rocky slopes. 1700-2600 m.	**Low.** Some potential suitable habitat in action area, but nearest known location is >30 mi away.
Death Valley sandpaper plant *Petalonyx thurberi* ssp. *gilmanii*	-	-	SS	1B.3	May-Nov	Evergreen shrub. Desert dunes, desert wash, and Mojavean desert scrub; sandy washes and dunes. 260-1445 m.	**Low.** Some potential suitable habitat in action area, but nearest known location is 18 mi away.
Charlotte's phacelia *Phacelia nashiana*	-	-	SS	1B.2	Mar-Jun	Annual herb. Joshua tree woodland, Mojave desert scrub, and pinyon and juniper woodland; sandy to rocky, granitic slopes. 600-2200 m	**High.** Some potential suitable habitat in action area and nearest known location is 3 mi away.

Common name *Scientific name*[1]	Listing Status[2] Federal	State	Conservation Status[3] BLM FO	CNPS	Flowering Period[4]	Habitat Preferences[4]	Potential for Occurrence[5]
Nine Mile Canyon phacelia *Phacelia novenmillensis*	-	-	SS	1B.2	(Feb) May-Jun	Annual herb. Broadleaved upland forest, Cismontane woodland, pinyon and juniper woodland, and upper montane coniferous forest; open, sandy to gravelly soils. 1645-2640 m.	**Moderate.** Some potential suitable habitat in action area, but nearest known location is 10 mi away.
Owens Valley checkerbloom *Sidalcea covillei*	-	SE	SS	1B.1	Apr-Jun	Perennial herb. Chenopod scrub, Great Basin scrub, limestone meadow and seep, and wetlands; mesic alkaline soils and alkaline flats. 1095-1415 m	**Moderate.** Some potential suitable habitat in action area and nearest known location is 4 mi away.

1. Scientific and common names from CNDDB RareFind database (2017).
2. Plant status definitions are as follows:
   Federal: U.S. Fish and Wildlife Service designations:
   FE Endangered: Any species that is in danger of extinction throughout all or a significant portion of its range.
   FT Threatened: Any species likely to become endangered within the foreseeable future.
   SC Species of concern: Other species of concern to the Service.
   SLC Species of local concern: Species of local or regional concern or conservation significance.
   State: California Department of Fish and Game designations:
   CE Endangered: Any species that is in danger of extinction throughout all or a significant portion of its range.
   CT Threatened: Any species likely to become endangered within the foreseeable future.
   United States Forest Service designations:
   FS S: Forest Service Sensitive species
3. Plant status definitions are as follows:
   BLM FO: BLM Ridgecrest Field Office
   SS Special status plant species
   CNPS: California Native Plant Society designations:
   1B Plants rare, threatened or endangered in California and elsewhere.
   2 Plants rare, threatened or endangered in California, but more common elsewhere.
   3 Plants for which more information is needed – a review list.
   Plants of limited distribution – a watch list.
   CNPS endangerment subcategories:
   .1 Seriously endangered in California.
   .2 Fairly endangered in California.
   .3 Not very endangered in California.
4. Flowering period and habitat preference information from CNDDB RareFind database (CDFG 2017), CNPS On-line Inventory (2017), BLM (2014), and Hickman (1993).
5. The following definitions for probability of occurrence are used:
   - **Present:** the species is known to occur.
   - **High:** historical records exist in the immediate vicinity or action area AND the habitat requirements strongly associated with the species occur in the action area.
   - **Moderate:** historical records exist in the immediate vicinity OR the habitat requirements strongly associated with the species occur in the action area.
   - **Low:** no recent historical records exist in the action area or immediate vicinity and/or the habitats needed to support the species are of poor quality.

Table D-2 Sensitive Wildlife Species with Potential to Occur within the Haiwee Action Area

Scientific Name	Species	Listing Status[1]			Habitat Requirements	Potential for Occurrence[2]
		FEDERAL	STATE	OTHER		
Birds						
Accipiter gentilis	Northern Goshawk	BLM Sensitive	-	DFG SC	Within, and in the vicinity of, coniferous forest. Uses old nests and maintains alternate sites. Usually nests on north slopes, near water; red fir, lodgepole pine, Jeffrey pine, and aspens are typical nest trees.	**Low.** Small area with potential habitat. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Aquila chrysaetos	Golden Eagle	-	-	DFG FG, USFWS BCC	Species occur in open habitats, especially in the mountains and hills, where it can spot prey from the air. They nest atop tall trees or high on rocky cliffs. Golden Eagles are uncommon year-round residents in Inyo County.	**High.** Small area with potential habitat. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Asio otus	Long-eared owl	-	-	DFG SSC	Long-eared Owls inhabit open woodlands, forest edges, riparian strips along rivers, hedgerows, juniper thickets, woodlots, and wooded ravines and gullies.. Roosting sites are usually in the heaviest forest cover available	**Low.** Small area with potential habitat. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Athene cunicularia	Burrowing Owl	BLM Sensitive	-	DFG SC	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas. Uses rodent burrows in sparse grassland, desert, and agricultural habitats.	**High.** Suitable open habitat is found sporadically throughout the action area, especially in the open disturbed areas and grasslands. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Buteo swainsonii	Swainson's Hawk	-	ST	-	Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, agricultural areas, and ranches. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	**Moderate.** Small area with potential habitat. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Falco peregrinus	Peregrine falcon	Delisted	SE	-	Near wetlands, lakes, rivers, or other water; on cliffs, banks, dunes, mounds, and man-made structures. Nest consists of a scrape on a depression or a ledge in an open site.	**Moderate.** Small patches of potential habitat found in western portion of the action area. It is determined that development in the action area may affect, but is not likely to adversely affect, this species,
Haliaeetus leucocephalus	Bald Eagle	Delisted	ST	-	Ocean shore, lake margins, and rivers for both nesting and wintering. Most nests are within one mile of water. Nests in large, old-growth or dominant live trees with open branches, especially Ponderosa pine. Roosts communally in winter.	**Low.** Insufficient open aquatic habitat within the action area. It is determined that development in the action area will not affect this species.
Lanius ludovicianus	Loggerhead Shrike	-	-	DFG SSC, USFWS BCC	The Loggerhead Shrike occupies open country with lookout perches, woodlands, open scrub, and the margins of dry grasslands. It is a fairly common year-round resident in Inyo County.	**High.** Loggerhead Shrikes are expected to occur and nest in low numbers throughout the action area, especially near the transmission line corridors, where they can perch high above the habitat to search for prey. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Toxostoma lecontei	Le Conte's Thrasher	BLM Sensitive	-	DFG SSC, USFWS BCC	Inhabit low, hot, barren deserts and valleys, usually in regions of scant vegetation where the bird's light color blends with the sandy gravel environment. In Inyo County Le Conte's Thrashers are uncommon, year-round residents.	**High**. They are expected to occur and nest infrequently and in low numbers throughout the action area.

Scientific Name	Species	Listing Status[1]			Habitat Requirements	Potential for Occurrence[2]
		FEDERAL	STATE	OTHER		
Mammals						
Antrozous pallidus	Pallid Bat	BLM Sensitive, FSC	-	DFG SSC, WBWG: H	Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. This species is very sensitive to disturbance of roosting sites.	**High**. Potential foraging habitat in action area, but very limited rocky roosting habitat.
Corynorhinus tonwsendii	Townsend's Big-Eared Bat	BLM Sensitive, FSC	-	DFG SSC, WBWG: H	Occurs throughout California in a variety of habitats, but most common in mesic sites. Roosts in the open, hanging from walls or ceilings. Very sensitive to human disturbance.	**High.** Known sightings in the vicinity of the action area. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Lasionycteris noctivagans	Silver-haired Bat	-	-	WBWG: H	Silver-haired bats are among the most common bats in forested areas of the United States. They are considered to be a solitary, tree-roosting species	**High.** Known sightings in the vicinity of the action area. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Lasiurus blossivillii	Western Red Bat	-	-	DFG SSC, WBWG: H	Roosts primarily in trees, 2 to 40 feet off the ground. Occurs from sea level up through mixed conifer forests. Prefers habitat edges and mosaics with trees that are protected from above and open below, with open areas for foraging.	**High.** Known sightings in the vicinity of the action area. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Spermophilus mohavensis	Mojave Ground Squirrel	-	ST	-	Open desert scrub, alkali scrub and Joshua tree woodland. Also feeds in annual grasslands, restricted to Mojave desert. Prefers sandy to gravelly soils, avoids rocky areas, uses burrows at base of shrubs for cover. Nests are in burrows.	**Present.** Known sightings in the vicinity of the action area. It is determined that development in the action area may adversely affect this species.
Taxidea taxus	American Badger	-	-	DFG SSC	It is most abundant in drier, open sites with friable soils in most shrub, forest, and herbaceous habitats. Badgers dig burrows for shelter and for natal dens.	**High.** Species is expected to occur and previous surveys have documented the species sign (i.e., dens, scat) within the action area. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Vulpes macrotis arsipus	Desert Kit Fox	-	-	Ca Fur-bearing Mammal		**High.** Species is expected to occur and previous surveys have documented the species sign (i.e., dens, scat) within the action area. Multiple habitats including desert scrub, saltbush, chaparral, and grassland.

Scientific Name	Species	Listing Status[1] FEDERAL	STATE	OTHER	Habitat Requirements	Potential for Occurrence[2]
Reptiles						
Gopherus agassizii	Desert Tortoise	FT	ST	-	Most common in desert scrub, desert wash and Joshua Tree habitats; occurs in almost every desert habitat. Requires friable soil for burrow and nest construction creosote bush habitat with annual wildflower blooms.	**Present.** Occurrence records exist for the species in the vicinity of the action area and suitable habitat exists. Additionally, known range of the desert tortoise includes Indian Wells Valley and Rose Valley (BLM 2005). Surveys conducted in 2009 found desert tortoises or their sign in low densities throughout these areas (Laberteaux 2009). It is determined that development in the action area may affect, but is not likely to adversely affect, this species.
Sceloporus graciosus gracisois	Northern Sagebrush Lizard	BLM Sensitive	-	DFG SSC	Occurs in the Great Basin and mountainous areas, inhabiting montane chaparral, hardwood and conifer habitats, eastside pine and juniper habitats, and Great Basin shrub habitats of the Sierra Nevada and the Cascades. Isolated populations occur at Sutter Buttes in the Sacramento Valley, in the Coast Range, and in the desert mountains of Inyo County.	**High.** Known sightings in the vicinity of the action area. It is determined that development in the action area may affect, but is not likely to adversely affect, this species.

[1] **Status Codes**
FE Federally listed as Endangered
FT Federally listed as Threatened
FPE Federally proposed for listing as Endangered
FPT Federally proposed for listing as Threatened
FPD Federally proposed for delisting
FC Federal candidate species (former Category 1 candidates)
FSC Species of Concern
SE State-listed as Endangered
ST State-listed as Threatened
SCE State candidate for listing as Endangered
SCT State candidate for listing as Threatened
SCD State candidate for delisting
BLM Sensitive
DFG SC: Department of Fish and Game Species of Concern
DFG FP: Department of Fish and Game Fully Protected Species
USFWS BCC: Fish and Wildlife Service Birds of Conservation Concern
WSBG:H The Western Bat Working Group Species designated as "High Priority

[2] **Potential for Occurrence (PFO)**
Absent from Site – Species is restricted to habitats that do not occur within the action area.
Low Potential for Occurrence – No historical records exits of the species occurring within the action area or its immediate vicinity, and/or the habitats needed to support the species on the site are of poor quality.
Moderate Potential for Occurrence –Either a historical record exists of the species within the immediate vicinity of the action area and/or the habitat requirements associated with the species occur within the action area
High Potential for Occurrence – Both a historical record exists of the species within the action area or its immediate vicinity and the habitat requirements strongly associated with the species occur within the action area.
Present – The species is known to occur.

Table D-3 Sensitive Wildlife Species with Potential to Occur within the Haiwee Action Area

SCIENTIFIC NAME	SPECIES	LISTING STATUS[1]			PROBABILITY OF OCCURRENCE[2]
		FEDERAL	STATE	OTHER	
Birds					
Accipiter gentilis	Northern Goshawk	BLM Sensitive	-	CDFG SC	Low
Aquila chrysaetos	Golden Eagle	BGEPA	-	CDFG FP, USFWS BCC	High
Asio otus	Long-eared owl	-	-	CDFG SSC	Low
Athene cunicularia	Burrowing Owl	BLM Sensitive	-	CDFG SC	Present
Buteo swainsonii	Swainson's Hawk	-	ST	-	Moderate
Falco peregrinus	Peregrine falcon	Delisted	SE	-	Moderate
Haliaeetus leucocephalus	Bald Eagle	Delisted	ST	-	Low
Lanius ludovicianus	Loggerhead Shrike	-	-	CDFG SSC, USFWS BCC	High
Toxostoma lecontei	Le Conte's Thrasher	BLM Sensitive	-	CDFG SSC, USFWS BCC	High
Reptiles					
Gopherus agassizii	Desert Tortoise	FT	ST	-	Present
Sceloporus graciosus gracisois	Northern sagebrush lizard	BLM Sensitive	-	CDFG SSC	High
Mammals					
Antrozous pallidus	Pallid Bat	BLM Sensitive,	-	CDFG SSC, WBWG:H	High
Corynorhinus tonwsendii	Townsend's Big-eared Bat	BLM Sensitive,	-	CDFG SSC, WBWG:H	High
Lasionycteris noctivagans	Silver-haired bat	-	-	WBWG:H	High
Lasiurus blossivillii	Western Red Bat	-	-	CDFG SSC, WBWG:H	High
Spermophilus mohavensis	Mojave Ground Squirrel	-	ST	-	Present
Taxidea taxus	American Badger	-	-	CDFG SSC	High

[1]**Status Codes**

FT Federally listed as Threatened
FSC Species of Concern
SE State-listed as Endangered

ST State-listed as Threatened
BLM Sensitive
CDFG SSC: Department of Fish and Game Species of Concern
CDFG FP: Department of Fish and Game Fully Protected Species
USFWS BCC: Fish and Wildlife Service Birds of Conservation Concern
WSBG:H The Western Bat Working Group Species designated as "High Priority"
BGEPA Bald and Golden Eagle Protection Act

[2]**Potential for Occurrence (PFO)**
Absent from Site – Species is restricted to habitats that do not occur within the action area.
Low Potential for Occurrence – No historical records exits of the species occurring within the action area or its immediate vicinity, and/or the habitats needed to support the species on the site are of poor quality.
Moderate Potential for Occurrence –Either a historical record exists of the species within the immediate vicinity of the action area and/or the habitat requirements associated with the species occur within the action area
High Potential for Occurrence – Both a historical record exists of the species within the action area or its immediate vicinity and the habitat requirements strongly associated with the species occur within the action area.
Present – The species is known to occur.

Table D-4 Impact Summary to Biological Resources

IMPACT TYPE	PROGRAM IMPACT	POTENTIAL IMPACT AND BIOLOGICAL RESOURCE EFFECTS	IMPACT LEVEL AND DURATION
Direct flora injury and/or mortality	Vehicle and human trampling during construction, operation and maintenance	Destruction, mortality, and injury to vegetation, reduction in habitat quantity and quality	**Moderate**. Long-term within the footprint from construction, access roads, and structures. Short-term in areas adjacent to drilling operations provided that restoration occurs.
Indirect plant injury and/or mortality	Soil compaction, spread of non-native species, deposition of dust and mud, soil erosion	Reduction in habitat quantity and quality, expansion of non-native species, reduction in plant vigor	**Low**. Short-term within the footprint from construction. Long-term for access roads.
Direct fauna injury and/or mortality	Vehicle and human trampling during construction, operation and maintenance	Destruction, mortality, and injury to wildlife species. Nest destruction. Fossorial species and species with limited mobility are most susceptible.	**Moderate**. Short-term within the footprint from construction, structures, and in areas adjacent to the geothermal plant. Long-term for access roads.
Indirect fauna injury and/or mortality	Vegetation removal, slope erosion, construction noise	Habitat quantity and quality reduction, habitat fragmentation, wildlife displacement	**Low**. Short-term within the footprint from construction. Long-term for access roads and/or vegetation maintenance.
Ground disturbance	Construction, well pads, geothermal plant, tower foundations, access roads	Habitat quantity and quality reduction, habitat fragmentation	**Moderate**. Short-term within the temporary footprint from construction. Long-term from access roads, well pads, pipeline and geothermal plant location.
Fugitive dust generation	Construction, maintenance, and repair activities	Reduced photosynthesis, impaired species respiration, reduction in habitat quality	**Low**. Short-term within the Program footprint from construction. Long-term from access roads and geothermal plant location.
Exposure to pollutants	Chemical spills from construction and maintenance	Reduce survival, population, and growth	**Low**. Short-term, localized to construction and maintenance sites.
Noise, human presence	Construction, maintenance, and repair activities	Displace wildlife, disrupt breeding, migration, and foraging	**Moderate**. Short-term within the footprint from construction. Long-term from access roads, well pads, and geothermal plant location.
Fire	Construction and maintenance equipment, human access	Habitat loss and reduction in habitat quality through the potential post-fire establishment of noxious weeds	**Low**. Short-term in the construction footprint for the transmission line provided that restoration occurs. Long-term for access roads, well pads, pipeline and geothermal plant location.

IMPACT TYPE	PROGRAM IMPACT	POTENTIAL IMPACT AND BIOLOGICAL RESOURCE EFFECTS	IMPACT LEVEL AND DURATION
Avian collisions	Conductors, shield wires, and guy-wires	Individual mortality; waterfowl and upland game birds would be most susceptible	**Moderate**. Long-term for transmission line ROW.
Increased predator habitat	Transmission towers	Raptors and corvids exploit perching opportunities, trash, and ponded water, resulting in increased predation on small mammal, tortoises and other bird species	**Moderate**. Long-term for transmission line ROW.

APPENDIX E

DEMOGRAPHICS

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APPENDIX E

This appendix provides supplemental tables and figures discussed in Section 3.19 and Section 4.19 of this FSEIS that have changed from the DEIS (BLM 2012). Also refer to Section 3.19, Section 4.19 and Appendix E of the DEIS.

Table E-1 Racial Composition of HGLA SSA Communities – Percent of Population

LOCATION	RACE[1]					
	WHITE	AFRICAN AMERICAN	ASIAN	HISPANIC	NATIVE AMERICAN[2]	NATIVE HAWAIIAN[3]
Inyo County	63.4	1.0	1.6	21.4	13.1	0.1
Independence	88.9	0.0	0.7	7.1	3.5	0.9
Lone Pine	79.6	0.1	0.8	23.7	7.4	0.0
Kern County	34.8	6.2	5.2	52.8	2.6	0.3
California City	68.2	12.8	3.7	17.0	1.6	0.3
Johannesburg	91.5	0.6	0.0	5.7	1.1	0.0
Mojave	67.5	5.6	2.0	28.3	1.3	0.1
Randsburg	85.7	0.0	0.0	5.2	5.2	0.0
Ridgecrest	82.0	3.5	3.9	12.0	1.1	0.6
San Bernardino County	29.3	9.5	7.4	52.8	2.0	0.5
Red Mountain Trona	87.0	1.5	0.6	14.1	2.3	0.4
California	37.7	6.5	14.8	38.9	1.7	0.5

[1]Totals may be greater than 100 percent, based on USCB rounding data.
[2]Includes American Indian and Alaska Native ethnicities.
[3]Includes Native Hawaiian and Other Pacific Islander ethnicities.
Sources: USCB 2018a, USCB 2018b.

Table E-2 Rental, Ownership, and Vacant Housing Units in HGLA SSA Communities

LOCATION	HOUSING TYPE				TOTAL HOUSING UNITS*
	FOR RENT	FOR SALE ONLY	FOR MIGRANT WORKERS	OTHER VACANT UNITS	
Inyo County	120	68	4	272	1,540
Independence	7	1	0	40	290
Lone Pine	34	14	0	85	425
Kern County	6,693	2,806	192	10,203	28,955
California City	251	106	0	570	956
Johannesburg	0	0	0	99	99
Mojave	101	48	0	88	288
Randsburg	0	0	0	0	0
Ridgecrest	502	327	0	319	1,510
San Bernardino County	15,163	7,831	97	17,802	89,520
Red Mountain	Data not available.				
Trona	0	0	0	0	5
California	232,391	89,797	2,967	296,299	1,104,350

Sources: USCB 2012-2016 American Community Survey.
*The total number of housing units includes the data presented in Table E-2 and housing units that are rented, but not occupied; housing units that are sold and not occupied; and housing units for seasonal, recreational, or occasional use.

Table E-3 Median Household Income and Per Capita Income for Communities in the HGLA SSA

LOCATION	MEDIAN HOUSEHOLD INCOME	PER CAPITA INCOME
Inyo County	$47,278	$28,678
Independence	$54,423	$27,815
Lone Pine	$38,661	$23,796
Kern County	$49,788	$21,094
California City	$48,776	$19,849
Johannesburg	Data not available.	$10,679
Mojave	$34,280	$17,195
Randsburg	$26,314	$23,015
Ridgecrest	$59,780	$28,095
San Bernardino County	$54,469	$21,857
Red Mountain	Data not available.	
Trona	Data not available.	
California	$63,783	$31,458

Sources: USCB 2018a, USCB 2018b.

Table E-4 Population Trends in the Counties in the HGLA SSA

COUNTY	2000[1]	2010[2]	2016[2]	PERCENT CHANGE 2000-2016
Inyo	17,945	18,546	18,144	1.1
Kern	661,645	839,627	884,788	33.7
San Bernardino	1,709,434	2,035,212	2,140,096	25.2

Source: [1]USCB 2000; [2]USCB 2018a, USCB 2018b.

Table E-5 Census 2010 Populations by Zip Code

ZIP CODE	AREA NAME	COUNTY	2010 POPULATION	PERSONS PER SQ. MILE
92328	Death Valley-Homewood Canyon-Valley Wells	Inyo	445	0.2
93513	Big Pine	Inyo	1,763	7.0
93522	Darwin	Inyo	48	1.2
93526	Independence	Inyo	719	12.7
93545	Lone Pine	Inyo	2,082	50.0
93549	Olancha	Inyo	344	1.1
	INYO COUNTY TOTAL		**5,401**	**2.0**
93255	Onyx	Kern	614	2.4
93283	Weldon	Kern	2,040	7.8
93501	Mojave	Kern	5,467	13.5
93505	California City	Kern	14,038	130.2
93527	Inyokern	Kern	2,387	2.3
93554	Randsburg	Kern	72	1.1
93555	Ridgecrest	Kern	32,560	126.3
	KERN COUNTY TOTAL		**57,178**	**23.8**
93562	Trona	San Bernardino	1,818	52.8
		TOTAL	**64,397**	**12.5**

Table E-6 Population Projections, HGLA SSA Counties, to 2050

-	2020	2030	2040	2050
Inyo County	18,825	19,219	19,360	19,176
Kern County	929,787	1,067,631	1,213,558	1,350,705
San Bernardino County	2,235,282	2,483,568	2,735,646	2,981,484
California	40,719,999	44,019,846	46,884,801	49,158,401

Source: California Department of Finance (2017).

Table E-7 Population Projections, by Zip Codes, in the Kern County Portion of the HGLA SSA

		2010	2020	2030	AVERAGE ANNUAL GROWTH RATE
93501	Mojave	4,619	4,713	4,369	-0.3%
93527	Inyokern	1,904	1,866	2,268	0.9%
93554	Randsburg	45	39	298	9.9%
93555	Ridgecrest	30,965	31,602	31,084	0.0%
93505	California City	11,791	12,267	13,283	0.6%
	Totals	**49,324**	**50,487**	**51,302**	**0.2%**

Source: Greater Antelope Valley Economic Alliance (2009).

Table E-8 Estimated Development Costs by Year 2010$ (2017 $)[1]

	ANNUAL CONSTRUCTION COST ($2010/$2017)	CUMULATIVE CONSTRUCTION COST ($2010/$2017)
2019	$10,595,361 ($11,894,174)	$10,595,361 ($11,894,174)
2020	$6,426,470 ($7,214,247)	$17,021,832 ($19,108,421)
2021	$11,270,422 ($12,651,986)	$28,292,254 ($31,760,407)
2022	$19,689,724 ($22,103,353)	$47,981,978 ($53,863,760)
2023	$31,476,747 ($35,335,267)	$79,458,725 ($89,199,027)
2024	$33,610,264 ($37,730,317)	$113,068,989 ($126,929,344)
2025	$48,694,230 ($54,663,324)	$161,763,219 ($181,592,668)
2026	$34,796,962 ($39,062,485)	$196,560,181 ($220,655,153)
2027	$48,753,542 ($54,729,907)	$245,313,723 ($275,385,060)
2028	$20,208,760 ($22,686,014)	$265,522,483 ($298,071,074)
2029 (operational)	**$16,807,468** (**$18,867,781**)	-
Total Construction cost	**$265,522,483** (**$298,071,074**)	-

Source: POWER Engineers and Economic Planning Resources 2010.

[1] 2011-2019 Development costs where escalated from the Draft Environmental Impact Statement (DEIS) 2010 dollars to 2017 dollars, and the development period was changed to 2019-2029 period for illustrative purposes. The analysis utilized 2010 DEIS estimated development costs and 2011-2021 period.

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APPENDIX F

EMISSIONS CALCULATIONS

HAIWEE DRILL RIG EMISSIONS

Table F-1
Drilling Rig
Emissions Calculations – Tier 3 Drilling Rig
Haiwee Geothermal Leasing Area

Table 1: Emissions from Drilling Rig Engines for Initial Wells

		Exploration		Operation	
Average Power Rating (hp)	500	20	Number of Wells	12	Number of Wells
Fuel Type	Diesel	24	Operating Hours per day/drill rig	24	Operating Hours per day/drill rig
Total Operating Hours – Exploration	2400	5	Drilling days per well	60	60 Drilling Days per well
Total Operating Hours – Initial Wells	17280				
Load Factor	0.75				

	Tier 3 Emission Factors (grams/hp-hr)							No of Generators	Hrs Per Day	Total Hours	Emissions, lbs/hour								Emission, tons (total)							
	CO	**VOC**	**NOX**	**SOX**	**PM10**	**CO2**	**CH4**				**CO**	**VOC**	**NOX**	**SOX**	**PM10**	**PM2.5**	**CO2**	**CH4**	**CO**	**VOC**	**NOX**	**SOX**	**PM10**	**PM2.5**	**CO2**	**CH4**
Exploration	2.60E+00	1.50E-01	2.85	1.25E+00	1.50E-01	5.26E+02	3.86E-02	1	24	2400	2.15	0.12	2.36	1.03	0.12	0.12	435.00	0.03	2.58	0.15	2.83	1.24	0.15	0.15	522.00	0.04
Initial Well Drilling	2.60E+00	1.50E-01	2.85	1.25E+00	1.50E-01	5.26E+02	3.86E-02	1	24	17280	2.15	0.12	2.36	1.03	0.12	0.12	435.00	0.03	18.57	1.07	20.35	8.91	1.07	1.06	3758.37	0.28
										lbs/day	51.59	2.98	56.55	24.74	2.98	2.95	10439.91	0.77								

CONSTRUCTION HEAVY EQUIPMENT EMISSIONS

Table F-2
Construction Heavy Equipment Emissions
Haiwee Geothermal Leasing Area

Emission Factors

Equipment	**FUEL**	**HP**	**ROG (lb/hr)**	**CO (lb/hr)**	**NOX (lb/hr)**	**SOX (lb/hr)**	**PM10 (lb/hr)**	**PM2.5 (lb/hr)**	**CO2 (lb/hr)**	**CH4 (lb/hr)**	**N2O (lb/hr)**	**No of Equipment**	**Hrs Per Day**	**Days in Service**	**ROG lbs/day**	**CO lbs/day**	**NOX lbs/day**
Exploration																	
Tracked Loader	DIESEL	108	0.1354	0.4732	0.8257	0.0008	0.0709	0.0631	65	0.0122	0.0784	1	8	180	1.08	3.79	6.61
Wheeled Loader	DIESEL	164	0.1312	0.6288	1.0135	0.0012	0.0583	0.0519	106	0.0118	0.0963	1	11	180	1.44	6.92	11.15
Motor Grader	DIESEL	174	0.1554	0.7363	1.1931	0.0014	0.0688	0.0612	124	0.0140	0.1133	3	8	180	3.73	17.67	28.63
Water Truck	DIESEL	189	0.1469	0.3944	1.3513	0.0019	0.0461	0.0410	167	0.0133	0.1284	1	8	180	1.18	3.16	10.81
Subtotal															**7.43**	**31.53**	**57.20**
Wellfield Development																	
Tracked Loader	DIESEL	108	0.1354	0.4732	0.8257	0.0008	0.0709	0.0631	65	0.0122	0.0784	1	8	250	1.08	3.79	6.61
Wheeled Loader	DIESEL	164	0.1312	0.6288	1.0135	0.0012	0.0583	0.0519	106	0.0118	0.0963	1	11	250	1.44	6.92	11.15
Motor Grader	DIESEL	174	0.1554	0.7363	1.1931	0.0014	0.0688	0.0612	124	0.0140	0.1133	3	8	250	3.73	17.67	28.63
Water Truck	DIESEL	189	0.1469	0.3944	1.3513	0.0019	0.0461	0.0410	167	0.0133	0.1284	1	8	250	1.18	3.16	10.81
Subtotal															**7.43**	**31.53**	**57.20**
Power Plant Construction																	
Tracked Loader	DIESEL	108	0.1354	0.4732	0.8257	0.0008	0.0709	0.0631	65	0.0122	0.0784	1	8	250	1.08	3.79	6.61
Wheeled Loader	DIESEL	164	0.1312	0.6288	1.0135	0.0012	0.0583	0.0519	106	0.0118	0.0963	1	11	250	1.44	6.92	11.15
Motor Grader	DIESEL	174	0.1554	0.7363	1.1931	0.0014	0.0688	0.0612	124	0.0140	0.1133	3	8	250	3.73	17.67	28.63
Roller Compactor	DIESEL	95	0.1054	0.4098	0.6619	0.0007	0.0574	0.0511	59	0.0095	0.0629	1	11	250	1.16	4.51	7.28
Crane	DIESEL	399	0.1635	0.5691	1.5327	0.0018	0.0571	0.0508	180	0.0148	0.1456	1	11	250	1.80	6.26	16.86
Truck Mounted Lift	DIESEL	60	0.0607	0.2451	0.4012	0.0004	0.0324	0.0288	38	0.0055	0.0381	1	8	250	0.49	1.96	3.21
Water Truck	DIESEL	189	0.1469	0.3944	1.3513	0.0019	0.0461	0.0410	167	0.0133	0.1284	1	11	250	1.62	4.34	14.86
Subtotal															**11.32**	**45.44**	**88.60**

Assumptions: SCAQMD Emission Factors, 2012
Horsepower ratings from URBEMIS defaults

Table F-2
Construction Heavy Equipment Emissions
Haiwee Geothermal Leasing Area

	Emissions								Emission, tons (total)						
Equipment	**SOX lbs/day**	**PM10 lbs/day**	**PM2.5 lbs/day**	**CO2 lbs/day**	**CH4 lbs/day**	**N2O lbs/day**	**ROG tons (total)**	**CO tons (total)**	**NOX tons (total)**	**SOX tons (total)**	**PM10 tons (total)**	**PM2.5 tons (total)**	**CO2 tons (total)**	**CH4 tons (total)**	**N2O tons (total)**
Exploration															
Tracked Loader	0.01	0.57	0.50	519.16	0.10	0.63	0.097	0.341	0.595	0.001	0.051	0.045	47	0.009	0.056
Wheeled Loader	0.01	0.64	0.57	1169.47	0.13	1.06	0.130	0.622	1.003	0.001	0.058	0.051	105	0.012	0.095
Motor Grader	0.03	1.65	1.47	2974.12	0.34	2.72	0.336	1.590	2.577	0.003	0.149	0.132	268	0.030	0.245
Water Truck	0.01	0.37	0.33	1332.36	0.11	1.03	0.106	0.284	0.973	0.001	0.033	0.030	120	0.010	0.092
Subtotal	**0.07**	**3.23**	**2.87**	**5995.11**	**0.67**	**5.43**	**0.67**	**2.84**	**5.15**	**0.01**	**0.29**	**0.26**	**539.56**	**0.06**	**0.49**
Wellfield Development															
Tracked Loader	0.01	0.57	0.50	519.16	0.10	0.63	0.135	0.473	0.826	0.001	0.071	0.063	65	0.012	0.078
Wheeled Loader	0.01	0.64	0.57	1169.47	0.13	1.06	0.180	0.865	1.394	0.002	0.080	0.071	146	0.016	0.132
Motor Grader	0.03	1.65	1.47	2974.12	0.34	2.72	0.466	2.209	3.579	0.004	0.206	0.184	372	0.042	0.340
Water Truck	0.01	0.37	0.33	1332.36	0.11	1.03	0.147	0.394	1.351	0.002	0.046	0.041	167	0.013	0.128
Subtotal	**0.07**	**3.23**	**2.87**	**5995.11**	**0.67**	**5.43**	**0.93**	**3.94**	**7.15**	**0.01**	**0.40**	**0.36**	**749.39**	**0.08**	**0.68**
Power Plant Construction															
Tracked Loader	0.01	0.57	0.50	519.16	0.10	0.63	0.135	0.473	0.826	0.001	0.071	0.063	65	0.012	0.078
Wheeled Loader	0.01	0.64	0.57	1169.47	0.13	1.06	0.180	0.865	1.394	0.002	0.080	0.071	146	0.016	0.132
Motor Grader	0.03	1.65	1.47	2974.12	0.34	2.72	0.466	2.209	3.579	0.004	0.206	0.184	372	0.042	0.340
Roller Compactor	0.01	0.63	0.56	648.88	0.10	0.69	0.145	0.563	0.910	0.001	0.079	0.070	81	0.013	0.086
Crane	0.02	0.63	0.56	1981.11	0.16	1.60	0.225	0.783	2.107	0.002	0.079	0.070	248	0.020	0.200
Truck Mounted Lift	0.00	0.26	0.23	304.57	0.04	0.30	0.061	0.245	0.401	0.000	0.032	0.029	38	0.005	0.038
Water Truck	0.02	0.51	0.45	1832.00	0.15	1.41	0.202	0.542	1.858	0.003	0.063	0.056	229	0.018	0.177
Subtotal	**0.10**	**4.88**	**4.35**	**9429**	**1.02**	**8.42**	**1.41**	**5.68**	**11.08**	**0.01**	**0.61**	**0.54**	**1179**	**0.13**	**1.05**
					2.36	**19.28**	**3.01**	**12.46**	**23.37**	**0.03**	**1.30**	**1.16**	**2238.60**	**0.25**	**2.01**

Assumptions: SCAQMD Emission Factors, 2012
Horsepower ratings from URBEMIS defaults

FUGITIVE DUST EMISSION CALCULATIONS

Table F-3
Fugitive Dust Emission Calculations
Haiwee Geothermal Leasing Area

Fugitive Dust Emissions by Activity

With watering 3 times daily
Control Efficiency: 61 percent

Grading	**Total Area to be Disturbed**	**Maximum Daily Grading**	**Emission Factor, lbs PM10/acre/ day**	**Emissions, lbs PM10/day**	**Emissions, lbs PM2.5/day**	**Emissions, lbs PM10/day**	**Emissions, lbs PM2.5/day**
Exploration	62	6.2	20	124	26.04	48.36	10.1556
Wellfield Development	202	20.2	20	404	84.84	157.56	33.0876
Power Plant Construction	120	12	20	240	50.4	93.6	19.656

PM10 Emissions, tons/year	**PM2.5 Emissions, tons/year**
0.2418	0.050778
0.7878	0.165438
0.468	0.09828

Assume 10% of site to be graded per day.

CONSTRUCTION WORKER COMMUTE EMISSION CALCULATIONS

Table F-4
Construction Worker Commute Emission Calculations
Haiwee Geothermal Leasing Area

		No. of Workers	Speed	VMT	CO		NO_X		ROG						SOx		PM10				PM2.5				CO
Construction Phase	Vehicle Class	Per Construction Phase	(mph)	(mi/vehicle-day)	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Hot-Soak (g/trip)	Resting Loss (g/hr)	Running Evaporative (g/mi)	Diurnal Evaporative (g/hr)	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Tire Wear (g/mi)	Brake Wear (g/mi)	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Tire Wear (g/mi)	Brake Wear (g/mi)	Running Exhaust (g/mi)
Exploration	Light-Duty Auto	7	35	80	2.875	12.15	0.318	0.625	0.109	1.046	0.334	0.039	0.058	0.083	0.003	0.002	0.01	0.015	0.008	0.013	0.009	0.014	0.002	0.005	310.451
	Light-Duty Truck	3	35	80	7.009	20.759	0.827	0.867	0.29	1.602	0.542	0.068	0.121	0.137	0.004	0.002	0.016	0.019	0.008	0.013	0.014	0.017	0.002	0.005	384.226
Wellfield Development	Light-Duty Auto	100	35	80	2.875	12.15	0.318	0.625	0.109	1.046	0.334	0.039	0.058	0.083	0.003	0.002	0.01	0.015	0.008	0.013	0.009	0.014	0.002	0.005	310.451
	Light-Duty Truck	100	35	80	7.009	20.759	0.827	0.867	0.29	1.602	0.542	0.068	0.121	0.137	0.004	0.002	0.016	0.019	0.008	0.013	0.014	0.017	0.002	0.005	384.226
Power Plant Construction	Light-Duty Auto	100	35	80	2.875	12.15	0.318	0.625	0.109	1.046	0.334	0.039	0.058	0.083	0.003	0.002	0.01	0.015	0.008	0.013	0.009	0.014	0.002	0.005	310.451
	Light-Duty Truck	100	35	80	7.009	20.759	0.827	0.867	0.29	1.602	0.542	0.068	0.121	0.137	0.004	0.002	0.016	0.019	0.008	0.013	0.014	0.017	0.002	0.005	384.226

Paved Road Fugitive Dust
EPA's AP-42, Section 13.2.1, November 2006
E = k(sL/2)^0.65 x (W/3)^1.5 - C
For light-duty trucks assume 2 tons/vehicle
Assume silt loading for 10,000 ADT roadways = 0.03 g/m3
Assume k = 0.016 PM10
Assume 6 miles in addition for track-out for PM10
Emission Factors
PM10 9.81231E-05

Unpaved Road Fugitive Dust
EPA's AP-42, Section 13.2.2
Industrial Roads
E = k (s/12)^a x (W/3)^b
Assume 61% control efficiency for watering 3 x daily
For light-duty trucks assume 2 tons/vehicle
k = 1.5 for PM10, 0.15 for PM2.5
s = 8.5, a = 0.9, b = 0.45
Emission Factors
PM10 0.357378738
PM2.5 0.035737874

Emission Factors from EMFAC2007 Model, assuming 2012
Assume startup after 8 hours
Assume 45 minutes run time total

Table F-4
Construction Worker Commute Emission Calculations
Haiwee Geothermal Leasing Area

		)2	CH4		N2O		Emissions, lbs/day												Total Emissions, tons						
Construction Phase	Vehicle Class	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]	CO	NOx	VOCs	SOx	PM10	PM2.5	Paved Road Fugitive Dust PM10	Paved Road Fugitive Dust PM2.5	CO2	CH4	N2O	Construction Days	CO	NOx	VOCs	SOx	PM10	PM2.5	Paved Road Fugitive Dust PM10
Exploration	Light-Duty Auto	164.917	0.026	0.06	0.03	0.06	3.92	0.41	0.23	0.00	0.04	0.02	0.05	0.01	388.37	0.03	0.04	180	0.35	0.04	0.02114	3.39E-04	0.00349	0.00182	0.00495
	Light-Duty Truck	194.251	0.048	0.093	0.08	0.08	3.98	0.45	0.23	0.00	0.02	0.01	0.02	0.00	205.87	0.03	0.04	180	0.36	0.04	0.02075	1.93E-04	0.00178	0.00102	0.00212
							7.91	**0.86**	**0.47**	**0.01**	**0.06**	**0.03**	**0.08**	**0.02**	**594.24**	**0.06**	**0.08**		**0.71**	**0.08**	**0.04**	**0.00**	**0.01**	**0.00**	**0.01**
Wellfield Development	Light-Duty Auto	164.917	0.026	0.06	0.03	0.06	56.06	5.88	3.36	0.05	0.55	0.29	0.78	0.16	5548.16	0.49	0.56	250	7.01	0.74	0.41943	6.72E-03	0.06917	0.03605	0.09812
	Light-Duty Truck	194.251	0.048	0.093	0.08	0.08	132.77	14.97	7.68	0.07	0.66	0.38	0.78	0.16	6862.27	0.89	1.42	250	16.60	1.87	0.96042	8.93E-03	0.08262	0.04723	0.09812
							188.84	**20.85**	**11.04**	**0.13**	**1.21**	**0.67**	**1.57**	**0.33**	**12410.44**	**1.37**	**1.98**		**23.60**	**2.61**	**1.38**	**0.02**	**0.15**	**0.08**	**0.20**
Power Plant Construction	Light-Duty Auto	164.917	0.026	0.06	0.03	0.06	56.06	5.88	3.36	0.05	0.55	0.29	0.78	0.16	5548.16	0.49	0.56	250	7.01	0.74	0.41943	6.72E-03	0.06917	0.03605	0.09812
	Light-Duty Truck	194.251	0.048	0.093	0.08	0.08	132.77	14.97	7.68	0.07	0.66	0.38	0.78	0.16	6862.27	0.89	1.42	250	16.60	1.87	0.96042	8.93E-03	0.08262	0.04723	0.09812
							188.84	**20.85**	**11.04**	**0.13**	**1.21**	**0.67**	**1.57**	**0.33**	**12410.44**	**1.37**	**1.98**		**23.60**	**2.61**	**1.38**	**0.02**	**0.15**	**0.08**	**0.20**

Paved Road Fugitive Dust
EPA's AP-42, Section 13.2.1, November 2006
E = k(sL/2)^0.65 x (W/3)^1.5 - C
For light-duty trucks assume 2 tons/vehicle
Assume silt loading for 10,000 ADT roadways = 0.03 g/m3
Assume k = 0.016 PM10
Assume 6 miles in addition for track-out for PM10
Emission Factors
PM10 9.81231E-05

Unpaved Road Fugitive Dust
EPA's AP-42, Section 13.2.2
Industrial Roads
E = k (s/12)^a x (W/3)^b
Assume 61% control efficiency for watering 3 x daily
For light-duty trucks assume 2 tons/vehicle
k = 1.5 for PM10, 0.15 for PM2.5
s = 8.5, a = 0.9, b = 0.45
Emission Factors
PM10 0.357378738
PM2.5 0.035737874

Emission Factors from EMFAC2007 Model, assuming 2012
Assume startup after 8 hours
Assume 45 minutes run time total

Table F-4
Construction Worker Commute Emission Calculations
Haiwee Geothermal Leasing Area

Construction Phase	Vehicle Class	Total Emissions, tons Paved Road Fugitive Dust PM2.5	CO2	CH4	N2O
Exploration	Light-Duty Auto	0.00104	35	0.00306	0.00352
	Light-Duty Truck	0.00045	19	0.00240	0.00384
		0.00	**53.48**	**0.01**	**0.01**
Wellfield Development	Light-Duty Auto	0.02061	694	0.06063	0.06987
	Light-Duty Truck	0.02061	858	0.11095	0.17775
		0.04	**1551.30**	**0.17**	**0.25**
Power Plant Construction	Light-Duty Auto	0.02061	694	0.06063	0.06987
	Light-Duty Truck	0.02061	858	0.11095	0.17775
		0.04	**1551.30**	**0.17**	**0.25**

Paved Road Fugitive Dust
EPA's AP-42, Section 13.2.1, November 2006
E = k(sL/2)^0.65 x (W/3)^1.5 - C
For light-duty trucks assume 2 tons/vehicle
Assume silt loading for 10,000 ADT roadways = 0.03 g/m3
Assume k = 0.016 PM10
Assume 6 miles in addition for track-out for PM10
Emission Factors
PM10 9.81231E-05

Unpaved Road Fugitive Dust
EPA's AP-42, Section 13.2.2
Industrial Roads
E = k (s/12)^a x (W/3)^b
Assume 61% control efficiency for watering 3 x daily
For light-duty trucks assume 2 tons/vehicle
k = 1.5 for PM10, 0.15 for PM2.5
s = 8.5, a = 0.9, b = 0.45
Emission Factors
PM10 0.357378738
PM2.5 0.035737874

Emission Factors from EMFAC2007 Model, assuming 2012
Assume startup after 8 hours
Assume 45 minutes run time total

CONSTRUCTION TRUCK TRIP EMISSIONS

Table F-5
Construction Truck Trip Emissions
Haiwee Geothermal Leasing Area

Construction Phase	Vehicle Class	No. of Trucks per day	Speed (mph)	VMT (mi/vehicle-day)	CO Running Exhaust (g/mi)	NO_X Running Exhaust (g/mi)	ROG Running Exhaust (g/mi)	SOx Running Exhaust (g/mi)	PM10 Running Exhaust (g/mi)	PM10 Tire Wear (g/mi)	PM10 Brake Wear (g/mi)	PM2.5 Running Exhaust (g/mi)	PM2.5 Tire Wear (g/mi)	PM2.5 Brake Wear (g/mi)	CO2 Running Exhaust (g/mi)	CH4 Running Exhaust (g/mi)	N2O Running Exhaust (g/mi)	Emissions, lbs/day CO	NOx	VOCs	SOx	PM10
Exploration																						
Support Truck	Medium Duty Truck, Diesel	4	35	80	1.362	5.316	0.154	0.014	0.199	0.012	0.013	0.183	0.003	0.005	1505.00	0.007	0.51	0.96	3.75	0.11	0.01	0.16
Delivery Truck	Heavy Duty Truck, Diesel	1	35	80	3.883	13.537	0.769	0.017	0.434	0.036	0.028	0.399	0.009	0.012	1827.808	0.036	1.29	0.68	2.39	0.14	0.00	0.09
Wellfield Development																		**1.65**	**6.14**	**0.24**	**0.01**	**0.25**
Support Truck	Medium Duty Truck, Diesel	16	35	80	1.362	5.316	0.154	0.014	0.199	0.012	0.013	0.183	0.003	0.005	1505.00	0.007	0.51	3.84	15.00	0.43	0.04	0.63
Delivery Truck	Heavy Duty Truck, Diesel	3	35	80	3.883	13.537	0.769	0.017	0.434	0.036	0.028	0.399	0.009	0.012	1827.808	0.036	1.29	2.05	7.16	0.41	0.01	0.26
Power Plant Construction																		**5.90**	**22.16**	**0.84**	**0.05**	**0.90**
Support Truck	Medium Duty Truck, Diesel	8	35	80	1.362	5.316	0.154	0.014	0.199	0.012	0.013	0.183	0.003	0.005	1505.00	0.007	0.51	1.92	7.50	0.22	0.02	0.32
Delivery Truck	Heavy Duty Truck, Diesel	2	35	80	3.883	13.537	0.769	0.017	0.434	0.036	0.028	0.399	0.009	0.012	1827.808	0.036	1.29	1.37	4.78	0.27	0.01	0.18
																		3.29	**12.28**	**0.49**	**0.03**	**0.49**
Subtotal																						

Emission Factors from EMFAC2007 Model, assuming 2012 composite emission factors.
Assume startup after 8 hours
Assume 45 minutes run time total

Assume 45 minutes run time total
2012 Emission Factors from EMFAC2007, average temp 60F; Great Basin

Paved Road Fugitive Dust
EPA's AP-42, Section 13.2.1, November 2006
E = k(sL/2)^0.65 x (W/3)^1.5 - C
For LDT assume 2 tons/vehicle, MDT assume 13 tons/vehicle, HDT assume 20 tons/vehicle
Assume silt loading for 10,000 ADT roadways = 0.03 g/m3
Assume k = 0.016 PM10
Assume 6 miles in addition for track-out for PM10
Emission Factors

PM10, LDT	9.81231E-05
PM10, MDT	0.008944829
PM10, HDT	0.017495628

Unpaved Road Fugitive Dust
EPA's AP-42, Section 13.2.2
Industrial Roads
E = k (s/12)^a x (W/3)^b

For LDT assume 2 tons/vehicle, MDT assume 13 tons/vehicle, HDT assume 20 tons/vehicle
k = 1.5 for PM10, 0.15 for PM2.5
s = 8.5, a = 0.9, b = 0.45
Assume 61% control efficiency for watering 3x daily
Emission Factors

PM10, LDT	0.357378738
PM10, MDT	0.829735596
PM10, HDT	1.007230136
PM2.5, LDT	0.035737874
PM2.5, MDT	0.08297356
PM2.5, HDT	0.100723014

Assume 6 miles each way of unpaved road travel

Table F-5
Construction Truck Trip Emissions
Haiwee Geothermal Leasing Area

		Emissions, lbs/day							Total Emissions, tons										
Construction Phase	**Vehicle Class**	**PM2.5**	**Paved Road Fugitive Dust PM10**	**Paved Road Fugitive Dust PM2.5**	**CO2**	**CH4**	**N2O**	**Construction Days**	**CO**	**NOx**	**VOCs**	**SOx**	**PM10**	**PM2.5**	**Paved Road Fugitive Dust PM10**	**Paved Road Fugitive Dust PM2.5**	**CO2**	**CH4**	**CH4**
Exploration																			
Support Truck	Medium Duty Truck, Diesel	0.13	5.60	1.18	1061.75	0.00	0.36	180	0.09	0.34	0.00978	8.89E-04	0.01422	0.01213	0.50387	0.10581	96	0.00044	0.03207
Delivery Truck	Heavy Duty Truck, Diesel	0.07	1.40	0.29	322.37	0.01	0.23	180	0.06	0.21	0.01221	2.70E-04	0.00790	0.00667	0.12597	0.02645	29	0.00057	0.02041
Wellfield Development		**0.21**	**7.00**	**1.47**	**1384.12**	**0.01**	**0.58**		**0.15**	**0.55**	**0.02**	**0.00**	**0.02**	**0.02**	**0.63**	**0.13**	**124.57**	**0.00**	**0.05**
Support Truck	Medium Duty Truck, Diesel	0.54	22.39	4.70	4247.01	0.02	1.43	270	0.52	2.03	0.05867	5.33E-03	0.08534	0.07276	3.02324	0.63488	573	0.00267	0.19239
Delivery Truck	Heavy Duty Truck, Diesel	0.22	4.20	0.88	967.12	0.02	0.68	270	0.28	0.97	0.05493	1.21E-03	0.03557	0.03000	0.56686	0.11904	131	0.00257	0.09186
Power Plant Construction		**0.76**	**26.59**	**5.58**	**5214.12**	**0.04**	**2.11**		**0.80**	**2.99**	**0.11**	**0.01**	**0.12**	**0.10**	**3.59**	**0.75**	**703.91**	**0.01**	**0.28**
Support Truck	Medium Duty Truck, Diesel	0.27	11.20	2.35	2123.50	0.01	0.71	270	0.26	1.01	0.02933	2.67E-03	0.04267	0.03638	1.51162	0.31744	287	0.00133	0.09620
Delivery Truck	Heavy Duty Truck, Diesel	0.15	2.80	0.59	644.74	0.01	0.45	270	0.18	0.64	0.03662	8.10E-04	0.02371	0.02000	0.37791	0.07936	87	0.00171	0.06124
		0.42	**14.00**	**2.94**	**2768.25**	**0.02**	**1.17**		**0.44**	**1.66**	**0.07**	**0.00**	**0.07**	**0.06**	**1.89**	**0.40**	**373.71**	**0.00**	**0.16**
Subtotal																			

Emission Factors from EMFAC2007 Model, assuming 2012 composite emission factors.
Assume startup after 8 hours
Assume 45 minutes run time total

Assume 45 minutes run time total
2012 Emission Factors from EMFAC2007, average temp 60F; Great Basin

Paved Road Fugitive Dust
EPA's AP-42, Section 13.2.1, November 2006
E = k(sL/2)^0.65 x (W/3)^1.5 - C
For LDT assume 2 tons/vehicle, MDT assume 13 tons/vehicle, HDT assume 20 tons/vehicle
Assume silt loading for 10,000 ADT roadways = 0.03 g/m3
Assume k = 0.016 PM10
Assume 6 miles in addition for track-out for PM10
Emission Factors

PM10, LDT	9.81231E-05
PM10, MDT	0.008944829
PM10, HDT	0.017495628

Unpaved Road Fugitive Dust
EPA's AP-42, Section 13.2.2
Industrial Roads
E = k (s/12)^a x (W/3)^b

For LDT assume 2 tons/vehicle, MDT assume 13 tons/vehicle, HDT assume 20 tons/vehicle
k = 1.5 for PM10, 0.15 for PM2.5
s = 8.5, a = 0.9, b = 0.45
Assume 61% control efficiency for watering 3x daily
Emission Factors

PM10, LDT	0.357378738
PM10, MDT	0.829735596
PM10, HDT	1.007230136
PM2.5, LDT	0.035737874
PM2.5, MDT	0.08297356
PM2.5, HDT	0.100723014

Assume 6 miles each way of unpaved road travel

OPERATIONAL VEHICLE EMISSION CALCULATIONS

Table F-6
Operational Vehicle Emission Calculations
Haiwee Geothermal Leasing Area

Operations	Vehicle Class	No. of Workers Per Construction Phase	Speed (mph)	VMT (mi/vehicle-day)	CO		NOx		ROG						SOx		PM10				PM2.5				CO2	
					Running Exhaust (g/mi)	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Hot-Soak (g/trip)	Resting Loss (g/hr)	Running Evaporative (g/mi)	Diurnal Evaporative (g/hr)	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Tire Wear (g/mi)	Brake Wear (g/mi)	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Tire Wear (g/mi)	Brake Wear (g/mi)	Running Exhaust (g/mi)	Start-Up (g/start)[a]
Workers	Light-Duty Auto	60	35	80	2.875	12.15	0.318	0.625	0.109	1.046	0.334	0.039	0.058	0.083	0.003	0.002	0.01	0.015	0.008	0.013	0.009	0.014	0.002	0.005	310.451	164.917
	Light-Duty Truck	25	35	80	7.009	20.759	0.827	0.867	0.29	1.602	0.542	0.068	0.121	0.137	0.004	0.002	0.016	0.019	0.008	0.013	0.014	0.017	0.002	0.005	384.226	194.251

Paved Road Fugitive Dust
EPA's AP-42, Section 13.2.1, November 2006
E = k(sL/2)^0.65 x (W/3)^1.5 - C
For light-duty trucks assume 2 tons/vehicle
Assume silt loading for 10,000 ADT roadways = 0.03 g/m3
Assume k = 0.016 PM10
Assume 6 miles in addition for track-out for PM10
Emission Factors
PM10 9.81231E-05

Unpaved Road Fugitive Dust
EPA's AP-42, Section 13.2.2
Industrial Roads
E = k (s/12)^a x (W/3)^b
Assume 61% control efficiency for watering 3 x daily
For light-duty trucks assume 2 tons/vehicle
k = 1.5 for PM10, 0.15 for PM2.5
s = 8.5, a = 0.9, b = 0.45
Emission Factors
PM10 0.357378738
PM2.5 0.035737874

Emission Factors from EMFAC2007 Model, assuming 2012
composite emission factors.
Assume startup after 8 hours
Assume 45 minutes run time total

Table F-6
Operational Vehicle Emission Calculations
Haiwee Geothermal Leasing Area

		CH4		N2O		Emissions, lbs/day												Total Emissions, tons											
Operations	Vehicle Class	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]	CO	NOx	VOCs	SOx	PM10	PM2.5	Paved Road Fugitive Dust PM10	Paved Road Fugitive Dust PM2.5	CO2	CH4	N2O	Work Days	CO	NOx	VOCs	SOx	PM10	PM2.5	Paved Road Fugitive Dust PM10	Paved Road Fugitive Dust PM2.5	CO2	CH4	N2O
Workers	Light-Duty Auto	0.026	0.06	0.03	0.06	33.64	3.53	2.01	0.03	0.33	0.17	0.47	0.10	3328.90	0.29	0.34	250	4.20	0.44	0.25166	4.03E-03	0.04150	0.02163	0.05887	0.01236	416	0.03638	0.04192
	Light-Duty Truck	0.048	0.093	0.08	0.08	33.19	3.74	1.92	0.02	0.17	0.09	0.20	0.04	1715.57	0.22	0.36	250	4.15	0.47	0.24011	2.23E-03	0.02065	0.01181	0.02453	0.00515	214	0.02774	0.04444
						66.83	**7.27**	**3.93**	**0.05**	**0.50**	**0.27**	**0.67**	**0.14**	**5044.47**	**0.51**	**0.69**		**8.35**	**0.91**	**0.49**	**0.01**	**0.06**	**0.03**	**0.08**	**0.02**	**630.56**	**0.06**	**0.09**

Paved Road Fugitive Dust
EPA's AP-42, Section 13.2.1, November 2006
E = k(sL/2)^0.65 x (W/3)^1.5 - C
For light-duty trucks assume 2 tons/vehicle
Assume silt loading for 10,000 ADT roadways = 0.03 g/m3
Assume k = 0.016 PM10
Assume 6 miles in addition for track-out for PM10
Emission Factors
PM10 9.81231E-05

Unpaved Road Fugitive Dust
EPA's AP-42, Section 13.2.2
Industrial Roads
E = k (s/12)^a x (W/3)^b
Assume 61% control efficiency for watering 3 x daily
For light-duty trucks assume 2 tons/vehicle
k = 1.5 for PM10, 0.15 for PM2.5
s = 8.5, a = 0.9, b = 0.45
Emission Factors
PM10 0.357378738
PM2.5 0.035737874

Emission Factors from EMFAC2007 Model, assuming 2012
composite emission factors.
Assume startup after 8 hours
Assume 45 minutes run time total

APPENDIX G

NUMERICAL GROUNDWATER FLOW MODELING

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APPENDIX G

NUMERICAL GROUNDWATER FLOW MODELING
ROSE VALLEY, INYO, COUNTY, CALIFORNIA

Prepared by

Daniel W. Matthews, R.G.

On Behalf of
U.S. Bureau of Land Management

February 2010

G1. INTRODUCTION

This appendix describes the numerical groundwater flow model used to evaluate potential impacts of groundwater extraction from the uppermost groundwater-bearing zone in the Rose Valley, California, groundwater basin for the Geothermal Leasing Environmental Impact Statement (EIS) being prepared by Power Engineers on behalf of the U.S. Bureau of Land Management (BLM). For this project, GEOLOGICA Inc. (GEOLOGICA) revised and recalibrated a numerical model previously developed by GEOLOGICA (2008) for the Rose Valley groundwater basin. Groundwater flow evaluations were conducted using the U.S.G.S. MODFLOW computer code (McDonald and Harbaugh, 1988) implemented in the Groundwater Vistas graphical environment (Environmental Simulations, 2007).

G1.1. Purpose

The purpose of the evaluations and analysis described in this appendix were: to evaluate the groundwater conditions; and to analyze the potential impacts to groundwater resources in Rose Valley that might develop as a result of geothermal exploration, well, well field, and power plant construction, and well field and power plant operation and maintenance.

G1.2. Scope

The scope of this task included evaluating information regarding hydrogeologic conditions in Rose Valley, revising an existing numerical groundwater flow model of Rose Valley developed by GEOLOGICA (2008) to better represent those conditions, calibrating the model to new monitoring data collected by Inyo County between November 2007 and November 2009, and developing scenarios to forecast the potential impacts of alternatives to the proposed project. In addition, GEOLOGICA conducted sensitivity analyses to evaluate the impact of uncertainty in various input parameters on model predictions.

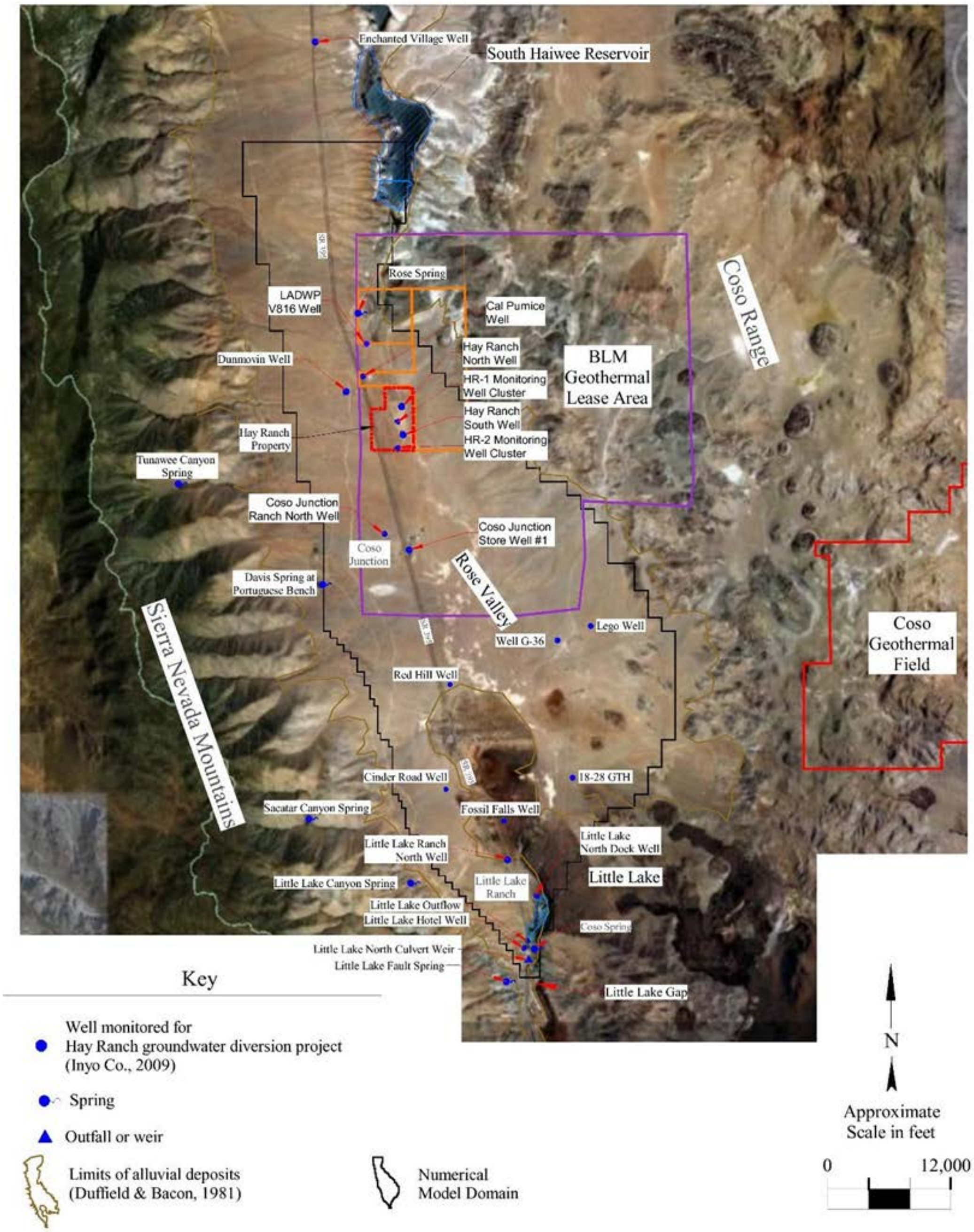
G2. ENVIRONMENTAL SETTING

Sections below describe the environmental setting of the study area including physiography, geology, hydrogeology, surface water, and concludes with an evaluation of the water budget for Rose Valley.

G2.1. Physiography

Rose Valley is a long, narrow valley located on the eastern flank of the Sierra Nevada Mountains in Inyo County, California. The alluvial portion of the groundwater basin is approximately 16 miles long from the southern end of the Haiwee Reservoir to just south of Little Lake, and has a maximum width of approximately 6 miles at its widest point.

Figure G-1: Physiographic Features of Rose Valley



Rose Valley is topographically separated from the Owens Valley to the north by Dunmovin Hill, a topographic high that is composed of a massive landslide or series of debris flow deposits that originated from the Sierra Nevada range to the west (Bauer, 2002). Rose Valley is separated from the Indian Wells Valley to the south by a topographic high formed by a combination of granitic rocks and volcanic flows, and by the Little Lake Gap, which is an approximately 1,000 ft wide water-carved canyon within the volcanics (Bauer, 2002). **Figure G-1** depicts relevant physiographic features of the study area. The ground surface of the valley floor generally slopes gently to the south at a rate of approximately 30 to 35 feet per mile.

G2.2 Geology

Rose Valley is a graben surrounded and underlain by igneous and metamorphic basement rocks of the Sierra Nevada and Coso Ranges. Alluvial sediments were encountered to depths as great as 3,489 feet in borings advanced in the north central portion of the basin (Schaer, 1981) and may extend to depths greater than 5,000 feet below ground surface (bgs) based on gravity surveys (GeoTrans, 2004). Younger (30 to 0.4 million years old) volcanic rocks of the Coso Range outcrop east of the central and northern Rose Valley and are predominately rhyolitic, dacitic, and andesitic in composition. The southern boundary of the Rose Valley groundwater basin is marked by outcrops of volcanic rocks related to eruptions within or flows from the Coso Range and volcanic cinder cones in the Red Hill area. **Figure G-2** provides a geologic map of the study area.

As summarized by Bauer (2002), the basin fill consists, in descending order, of recent alluvial fan deposits including debris flows from the bordering Sierra Nevada Mountains, volcanic deposits including basalt, ash, cinders, and tuff, lacustrine deposits of the Coso Formation, and older alluvial fan deposits from the Sierra Nevada and Coso Ranges. The recent alluvial deposits usually occur between ground surface and depths of up to 800 ft, and consist of a mixture of sands and gravels interbedded with clay. The maximum drilled thickness of these deposits occurs in the north central part of the valley near the Hay Ranch property. The Coso Formation uncomformably overlies basement rocks in the Coso Range and Rose Valley, and is comprised of a heterogeneous assemblage of primarily lacustrine deposits, with lesser amounts of volcanic tuff and alluvial fan deposits. Bauer (2002) described the Coso Formation as being comprised of four members in descending stratigraphic order: the Rhyolite Tuff Member, the Coso Lake Beds Member, the Coso Sand Member, and the Basal Fanglomerate Member.

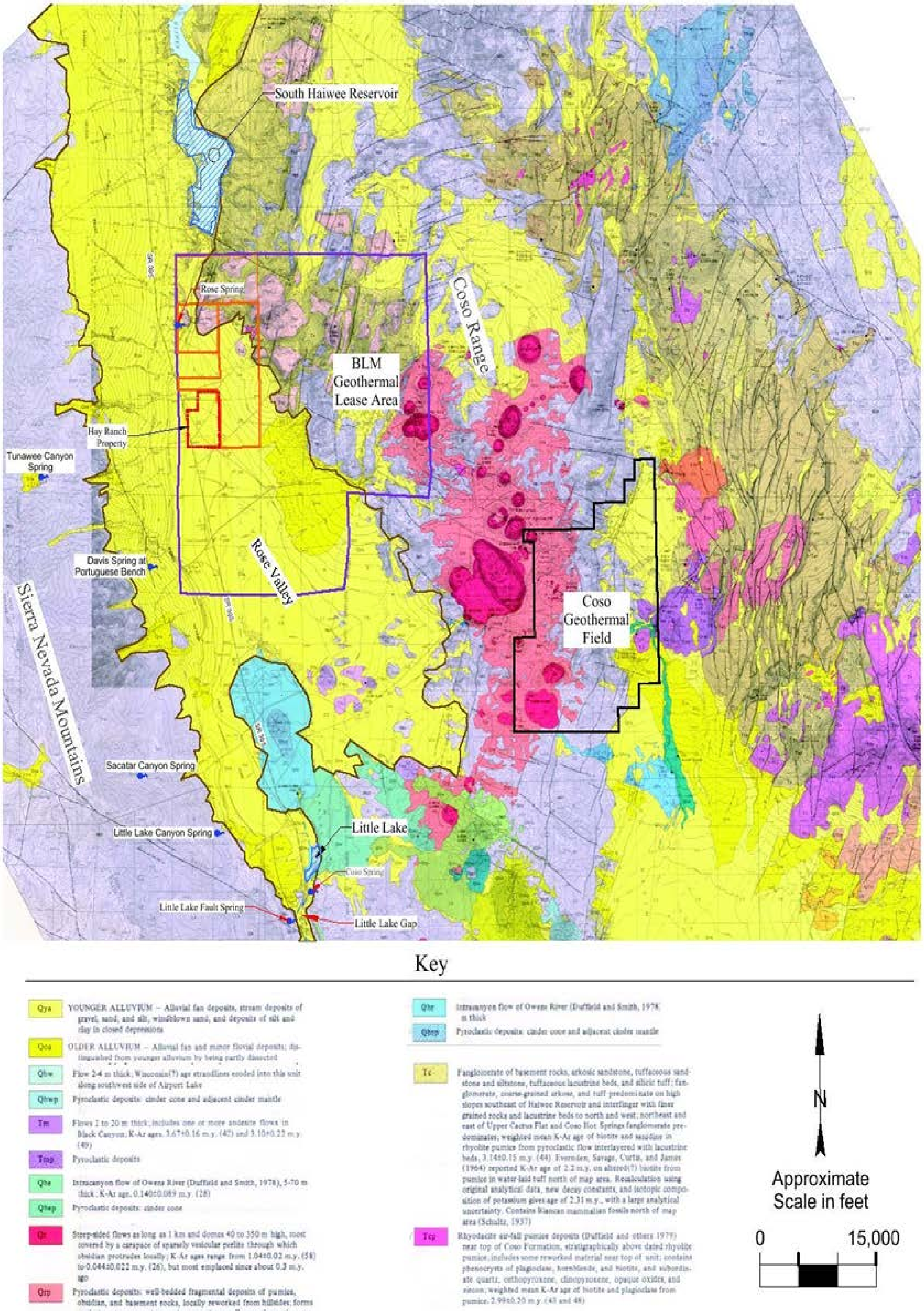
- **Rhyolite Tuff Member** – The Rhyolite Tuff Member occurs along the east side of the southern Haiwee Reservoir and extends south into the north end of the valley along the western slope of the Coso Range.

- **Coso Lake Beds Member** – The Coso Lake Beds Member reportedly is composed of alternating beds of fine to-coarse-grained sand, arkosic, green clay with interspersed volcanic ash, and thin-bedded white rhyolitic tuffs containing pumice fragments. Deposits of the Coso Lake Beds Member reportedly extend north into the southern Owens Valley, where it is known as the Owens Lake Bed Member.

- **Coso Sand Member** – The Coso Sand Member consists of poorly consolidated, fine-to-coarse grained alluvial gravels, sand, and red clay beds derived from the granitic basement rocks of the Coso Range and reworked Sierra Nevada alluvial fan materials. The Coso Sand Member occurs at depths from 1,500 ft to 3,000 ft bgs and the unit is thickest to the west, decreasing in thickness rapidly to the east.

- **Basal Fanglomerate Member** – The Basal Fanglomerate Member was infrequently encountered in well borings drilled in the valley. It consists of reworked colluvial deposits localized by basement topography and structures.

Figure G-2: Geologic Map



*Basemap and key from
Geologic Map of the Coso Volcanic Field and Adjacent Areas, Inyo County, California
by Wendell A. Duffield and Charles R. Bacon. 1981

Geologic Map

Coso Operating Company (COC) recently completed two sets of clustered multi-level monitoring wells to depths of up to 605 feet (ft) below ground surface (bgs) on the Hay Ranch property (SGSI, 2009a; 2009b; and 2009c). The lithology encountered during drilling was described as alluvium consisting of fine to coarse sand with gravel to 20 ft bgs, which is underlain by fluvial-type deposits containing silt, fine to coarse sand, cobbles, and boulders down to 200 feet bgs. Below 200 feet bgs SGSI reported encountering lacustrine-type deposits containing fine to coarse sand, numerous silt and clay interbeds, and occasional gravel interbeds to a total depth of 570 feet bgs. At depths of approximately 308 to 336 feet bgs and 464 to 478 feet bgs, two significant swelling clay units were encountered in the HR-1 and HR-2 well clusters which were confirmed by geophysical logging. The lithology observed in HR-1 and HR-2 is not inconsistent with the existing model construction.

G3.

G3.1 Hydrogeology

G3.1.1 Hydrostratigraphic Units

The principal hydrostratigraphic units that comprise the Rose Valley aquifer consist of recent alluvial deposits, and the Coso Lake Bed and Coso Sand Members of the Coso Formation. Older bedrock is largely impermeable or low permeability and typically impedes or excludes groundwater flow.

SGSI (2009c) concluded that the uppermost groundwater-bearing unit in Rose Valley, which occurs within the upper 600 ft of the sediment column is separated into three aquifer-zones (upper, intermediate, and deep) as a result of the presence of low permeability clay horizons encountered at depths of approximately 325 ft and 475 ft bgs in the HR-1 well cluster and approximately 30 ft deeper in the HR-2 well cluster and south Hay Ranch production well. The horizontal extent of the clay horizons cannot be determined with available information.

G3.1.2 Groundwater Occurrence and Flow

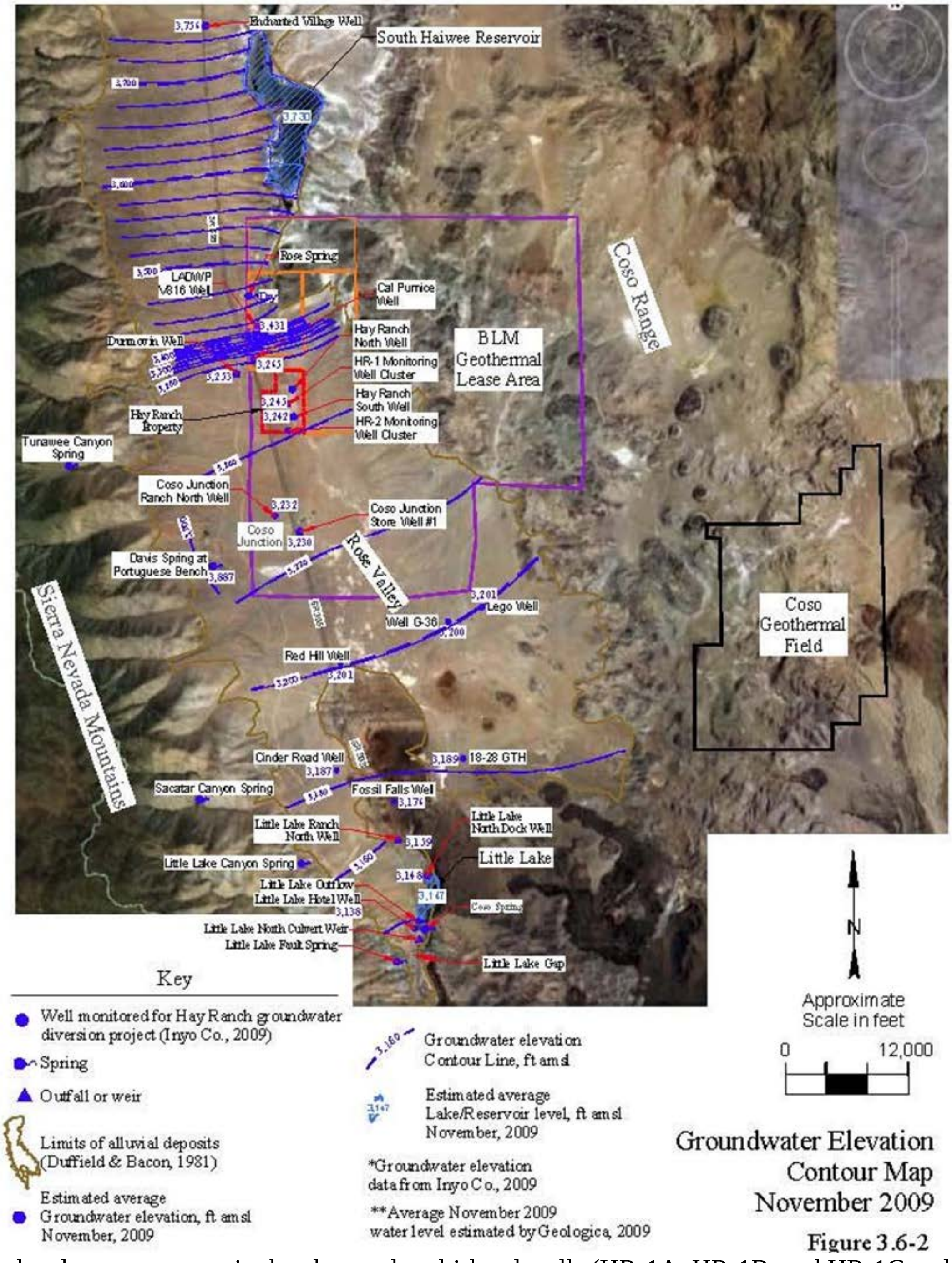
The groundwater table is typically first encountered during drilling within the upper portion of the recent alluvial deposits. Depth to groundwater ranges from 140 to 240 ft bgs in the north and central parts of Rose Valley, decreases to approximately 40 ft bgs at the northern end of the Little Lake Ranch, and surfaces near the south end of the Little Lake Ranch property. Because the ground surface slopes more steeply to the south than the groundwater table, the groundwater table surfaces at and discharges from springs beneath Little Lake, sustaining the lake and the surface water discharge from Coso Spring immediately to the south of the lake. At the south end of Rose Valley, groundwater flow through the Little Lake Gap is constrained by bedrock on the west, an apparent subsurface bedrock rise below, and low or reduced permeability in the basalt lava flows to the east.

Groundwater elevation data obtained from the Inyo County for the Hay Ranch Monitoring Project (Inyo Co. 2009, 2010) were used to develop a groundwater elevation contour map for November 2009 (**Figure G-3**). Groundwater elevation data used to develop the contour map are tabulated in **Table G-1**. The November 2009 groundwater elevation contour map of Rose Valley indicated southeasterly groundwater flow along the axis of the northwest to southeast trending valley.

Table G-1: Rose Valley Groundwater Elevation Data

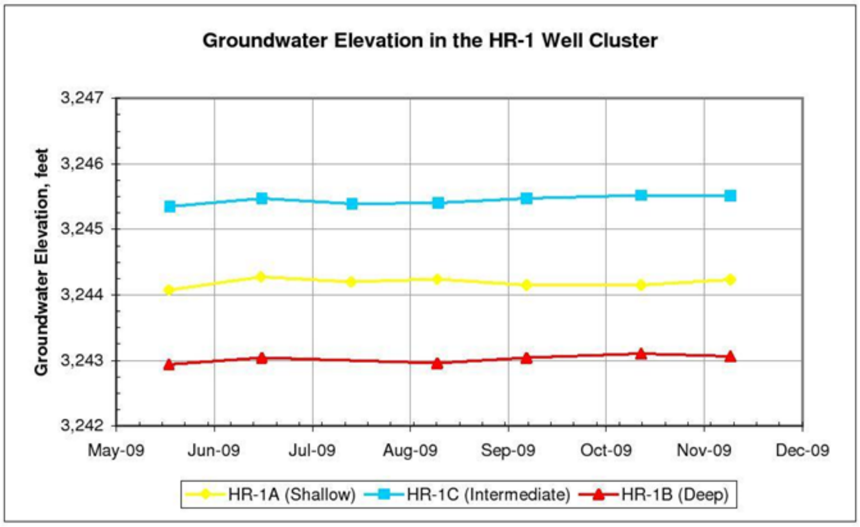
Groundwater Elevation, ft amsl		
Well	November 2007(1)	November 2009(2)
Enchanted Village	NM	3,755.5
LADWP 816	3435.2	3,438
Dunmovin	NM	3,253.0
Cal Pumice	3266	3,265.4
Hay Ranch North	3,245	3,245.3
HR-1A	NM	3,244.3
HR-1B	NM	3,243.1
HR-1C	NM	3,245.6
HR-2A	NM	3,241.1
HR-2B	NM	3,238.5
HR-2C	NM	3,242.6
Hay Ranch South	3,240.90	3,241.8
Coso Junction Ranch	3232.7	3,232.2
Coso Junction Store #1	3229.3	3,229.8
Red Hill	NM	3,200.8
Lego	3200.5	3,200.6
G-36	3199.6	3,200.0
Cinder Road	NM	3,187.0
18-28 GTH	3188.2	3,188.5
Fossil Falls	NM	3,175.6
Little Lake Ranch North	3158.95	3,158.9
Little Lake Ranch Dock	NM	3,147.9
Little Lake Surface	NM	3,147.4
Little Lake Ranch Hotel	NM	3,138.3
Notes:		
(1) MHA (2008).		
(2) Average November 2009 groundwater elevation estimated by Geologica from groundwater elevation hydrographs presented at the Inyo County Water Department's Hay Ranch Monitoring Website, http://www.inyowater.org/coso/default.html accessed December 4, 2009.		
** See Figure G-3 for well locations.		
NM = Not measured.		

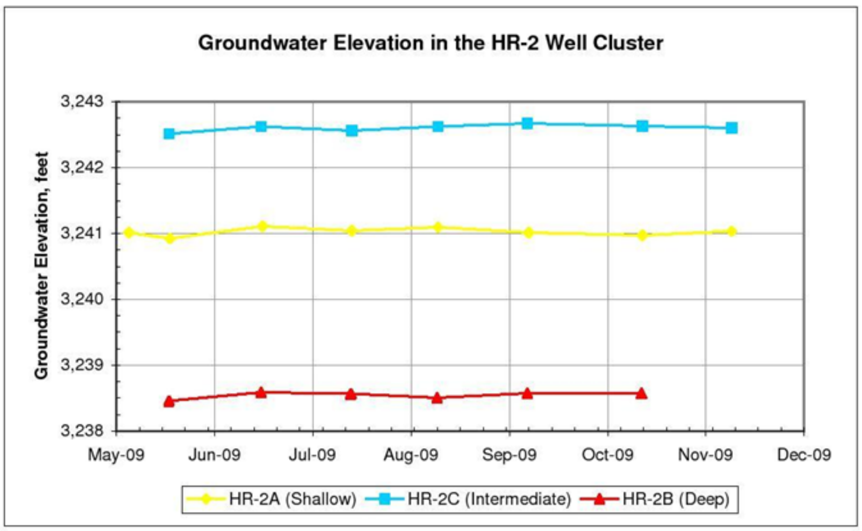
Figure G-3: November 2009 Groundwater Elevation Contour Map



Water level measurements in the clustered multi-level wells (HR-1A, HR-1B, and HR-1C and HR-2A, HR-2B, and HR-2C) advanced on the Hay Ranch property in the north central part of the valley indicated the presence of groundwater elevation differences that suggest generally downward hydraulic gradients overall but with higher potentiometric elevations in the intermediate groundwater-bearing zone compared to the upper and deep groundwater-bearing zones (see **Figure G-4**).

Figure G-4: Vertical Groundwater Elevation Gradients on the Hay Ranch Property





Groundwater elevation hydrographs published at the Inyo County Water Department's website (Inyo Co., 2010) for wells monitored in Rose Valley were reviewed to evaluate long-term trends in groundwater elevation. Over the 2-year model calibration period from November 2007 to November 2009, water levels in wells in Rose Valley generally changed less than 0.5 ft. Observations over the longer term are summarized as follows:

- The LADWP 816 well located at the north end of Rose Valley shows fluctuations of up to 5 ft between January 1995 and January 2010 with a relatively steady average level of approximately 3,438 ft.
- The Pumice Mine well (aka Cal Pumice) generally shows small fluctuations of up to 1 to 2 ft with a relatively steady average level of approximately 3,265.5 ft, except for a sudden unexplained 5 ft drop in December 2009.
- Water level monitoring data for the Hay Ranch North production well, Hay Ranch South production well, and Coso Ranch North well, Coso Junction Store #1 well between January 2003 and January 2010 indicate a generally upward trend of 1-1/2 to 2 ft.
- Rising water level trends of 1 to 1-1/2 ft were also observed in the Lego and G-36 wells on Navy property approximately 3-1/2 miles southeast of Coso Junction

- Long term monitoring data were not available for the wells near the south end of the valley (Cinder Road, Red Hill, or Fossil Falls) or the wells on the Little Lake Ranch property.

The groundwater levels in the LADWP wells 2 miles south of the Haiwee Reservoir were consistently approximately 170 ft higher than groundwater levels in the closest monitored well to the south, Cal-Pumice, throughout the long term monitoring period, consistent with a surface water flow component or input from a groundwater basin at a different groundwater elevation potential (i.e., Owens Valley), and, the presence of a lower permeability zone between the LADWP property and the remainder of the valley. Groundwater levels in the LADWP wells were more variable than any other wells in the valley. The source of this variation is unknown. Water levels in Haiwee Reservoir and the flow rate in the LADWP aqueduct rose during the time water levels were monitored for the 2007 pumping test while groundwater levels in the LADWP wells fell; positive correlation between rising reservoir levels and groundwater elevation would be expected if seepage from the reservoir strongly influenced groundwater levels. The absence of correlation between reservoir levels and groundwater levels in the LADWP wells suggests varying rates of groundwater influx from Owens Valley may be the cause of groundwater level fluctuations at the north end of Rose Valley. The cause of the apparent rising water level trend in the central part of the valley is unknown but could reflect changes in recharge along the margins of the valley and/or long term recovery from agricultural pumping on the Hay Ranch property in the 1970's.

G3.1.3 Aquifer Properties

The transmissivity of the upper portion of the alluvial deposits was previously estimated to range from 9,000 to 69,800 gpd/ft (1,200 to 9,330 ft^2/day) based on data presented in the Rockwell Report (1980). Based on 24-hour pumping tests conducted in the Hay Ranch wells, GeoTrans (2003) concluded that the transmissivity of the Rose Valley aquifer near Hay Ranch was approximately 10,000 ft^2/day and estimated that the horizontal hydraulic conductivity was approximately 20 ft/day. GeoTrans concluded that they had insufficient data to estimate aquifer storage properties.

Based on a 14-day pumping test conducted in the southern production well on the Hay Ranch property and monitored in wells throughout the valley, GEOLOGICA (2008) estimated the transmissivity and horizontal hydraulic conductivity of the aquifer were approximately 14,750 ft^2/day and 24 ft/day, respectively. The vertical hydraulic conductivity of the alluvial aquifer in central Rose Valley was estimated to be 0.01 ft/day using a Neuman "Beta" coefficient of 0.01 from the aquifer testing type curve match and an aquifer thickness of 600 ft. The storage coefficient applicable to early time response and saturated soil below the water table was found to be 0.001.

The City of Los Angeles Department of Water & Power (LADWP) conducted a short-term pumping test on property they own at the north end of Rose Valley in the spring of 2009 (LADWP, 2009). Well V817 was pumped at a rate of 1.84 cubic feet per second (cfs) for 6.5 days. The pumping test resulted in 270 feet of drawdown in the pumping well, 48 feet of drawdown in monitoring well V816 located 197 feet west of the pumping well, and no drawdown in other nearby wells. LADWP concluded that the observed response indicated a small zone of influence and a deep cone of depression. LADWP estimated an average transmissivity of 1,340 ft^2/day and a storage coefficient of 0.004 using pumping test data for the aquifer near well V817.

G3.2 Surface Water

The average annual precipitation in Rose Valley ranges from 5 to 7 inches while the area's annual evapotransporation rate is estimated to be on the order of 65 inches (CWRCB, 1993). Consequently, surface water bodies in the Rose Valley area consist of perennial springs sustained by groundwater flow, ephemeral streams and washes that mainly flow in the winter, and a groundwater-fed lake (Little Lake) and nearby ponds. Surface water features of interest are shown on **Figure G-1** and discussed below.

G3.2.1 Haiwee Reservoir

The South Haiwee Reservoir is located at the north end of Rose Valley approximately 6 miles north of Coso Junction, CA. The crest of the south Haiwee Dam is located at an elevation of approximately 3,766 ft MSL.

Because of seismic stability concerns, the water level in the reservoir is currently limited to a maximum elevation 3,742 ft MSL. During construction of the dam, a trench was reportedly excavated to a depth of up to 120 ft below ground surface, until it tagged basalt bedrock, and backfilled with clay to seal the base of the dam (LADPS, 1916); however, the remainder of the reservoir is unlined. Weiss (1979) estimated that underflow from Haiwee Reservoir contributed approximately 600 acre-ft of water per year to the Rose Valley groundwater basin.

G3.2.2 Springs

Several springs are located in or near Rose Valley as follows:

- **Rose Spring** – Rose Spring is reportedly (USGS Topographic Map) located in the Haiwee Geothermal Leasing Area approximately two miles south and west of the South Haiwee Reservoir at an elevation of approximately 3,640 feet amsl. A table of spring discharge data presented in Rockwell (1980) indicated that the spring was flowing in November 1975 but did not list discharge rates data for the spring. While the Rose Spring was reportedly sampled by the USGS in the early 1970's, no discharge has been observed from the spring in recent years. During a biological reconnaissance survey conducted on April 5, 2008, no surface water was observed. A concrete storage structure lies below the spring; however, water pipes that once fed the structure are no longer functioning (MHA 2008). When flowing, the spring apparently drains shallow groundwater in alluvial sediments south of the reservoir. Due to its higher elevation and lack of discharge, the Rose Spring is not believed to be directly connected to the Rose Valley groundwater aquifer system.

- **Tunawee Canyon Spring** – Tunawee Canyon Spring is located in Tunawee Canyon approximately four miles northwest of the town of Coso Junction at approximately 5,200 feet amsl. Several springs are identified in the upper reaches of Tunawee Canyon on the USGS topographic map of the area. Tunawee Canyon Spring is likely sustained by high elevation precipitation infiltration in the Sierra Nevada Mountains to the west. Rockwell (1980) reported discharge rates of 1.6 to 15 gallons per minute (2.6 to 24 acre-feet/yr) from the spring in November 1975.

- **Davis Spring** – The Davis Spring is located on the Davis Ranch, approximately two miles west of Coso Junction. The Davis Spring is located on the west central side of Rose Valley at Portuguese Bench at an elevation of approximately 3,870 feet amsl. The estimated groundwater discharge rate from the Davis Spring was reported to be approximately 7 acre-feet per year (ac-ft/yr) on an annualized basis in November/December 2007 (MHA 2008), and approximately 9 ac-ft/yr in October/November 2009 (Inyo Co. 2009). The Davis Spring discharge point is located more than 600 feet higher than the groundwater table in the Rose Valley aquifer east of the Davis property at Coso Junction. Spring flow is sustained by high elevation precipitation infiltration in the Sierra Nevada Mountains west of the Davis property. Discharge from the spring that is not used on the Davis property infiltrates back into the ground, after which it percolates downward to recharge the alluvial aquifer. Due to its higher elevation, the Davis Spring is not believed to be directly connected to the Rose Valley groundwater aquifer system. Differences in the stable isotopic composition of the discharge from Davis Spring and Rose Valley waters support the conclusion that the source of Davis Spring is separate from Rose Valley groundwater (MHA, 2008)

- **Sacatar and Little Lake Canyon Springs** – Rockwell (1980) presents data from sampling springs in Sacatar Canyon and Little Lake Canyon in February 1979. The springs were reportedly located at elevations of 4,950 and 3,650 ft amsl, respectively. Sacatar Spring reportedly flowed at a rate of 1 to 5 gallons per minute (1.6 to 8 acre-feet/yr) in November 1975. No flow rate data were identified for Little Lake Canyon Spring. Both springs are located in bedrock outcrops above and west of Rose Valley; and, as a result are not believed to be directly connected to the Rose Valley groundwater aquifer system.

- **Little Lake Fault and Coso Springs** – The Little Lake Fault Spring and Coso Spring are located at the south end of Rose Valley. Little Lake Fault Spring is located on the west side of US 395 approximately one mile south of Little Lake. Coso Spring is located on the east side of US 395, on the Little Lake Ranch property, approximately ¼ mile south of Little Lake. No data have been identified regarding the groundwater discharge rate from the Little Lake Fault Spring. Because it is located in close proximity to Little Lake, Coso Spring is discussed further in the "Little Lake" section below.

G3.2.3 Lakes, Ponds, and Other Surface Water Features

Little Lake, is a perennial lake located at the south end of Rose Valley, to the south of the Haiwee Geothermal Leasing Area, approximately seven miles south of the town of Coso Junction (**Figure G-1**). The majority of Little Lake is located within the Little Lake Ranch, which is a 1,200 acre privately-owned recreational preserve owned and managed by Little Lake Ranch, Inc. Ten acres at the southeast corner of Little Lake is owned by the BLM and includes a visitor overlook. The property includes the approximately 90-acre Little Lake, two smaller perennial ponds, a "siphon well", several other ponds that reportedly contain water intermittently, and adjacent wetland habitat. Little Lake is reportedly 3 to 5 feet deep (MHA 2008); the depths of the other ponds are unknown. The depth and area of the lake have been enhanced by the construction of a low dike along its southern perimeter; consequently, the water level in the lake is regulated by the rate of groundwater inflow into the lake and the setting of a discharge weir located at the south end of the lake.

Because the Little Lake Ranch property is located in a desert area that receives little rainfall, the surface water features and riparian habitat on the property are heavily dependent on an uninterrupted supply of groundwater to maintain surface water flow rates and to sustain plant growth. As a requirement of the approval of the Hay Ranch groundwater diversion project, Inyo County is currently monitoring surface water discharge rates at three locations on the property including the Little Lake Outlet, Coso Spring, and a surface water collection ditch called the North Culvert as well as water levels in Little Lake, several wells on the property (Inyo Co., 2009), and additional wells throughout Rose Valley.

G3.3 Conceptual Groundwater Water Budget

The Rose Valley groundwater system is primarily recharged by mountain front recharge derived from precipitation and snowmelt that falls at higher elevation in the Sierra Nevada front range. The south sloping groundwater table observed at the north end of Rose Valley indicates groundwater enters Rose Valley from Owens Valley to the north and/or from seepages losses from the south Haiwee Reservoir. This inflow is incorporated into the model.

Some precipitation recharge likely occurs in the Coso Range on the east side of the valley but was conservatively neglected for the current modeling effort. The U.S.G.S. (2009) estimated that the recharge from the Coso range might be on the order of 310 to 630 acre-ft/yr, based on analysis using what they termed an "uncalibrated" regional recharge basin characterization model. Also, perhaps as much as 250 acre-ft/yr of groundwater may enter southeastern Rose Valley as upwelling from the Coso geothermal system based on proportions of chloride and stable isotopes in groundwater in southeastern Rose Valley, but was conservatively neglected in this analysis. Leakage from the LADPW aqueducts that traverse Rose Valley was assumed to be a negligible component of total groundwater inflow to the basin.

Currently, the principal groundwater outflow components consist of groundwater underflow and surface water discharges to the Indian Wells Valley to the south, and evapotranspiration from Little Lake and phreatophytic vegetation on the Little Lake Ranch property. Because of the dry climate, essentially all of the precipitation falling on Rose Valley is lost to evapotranspiration. However, because the groundwater table is located 40 or more feet below ground surface over all but the southern tip of the valley, evapotranspiration does not factor into the groundwater budget except on the Little Lake Ranch property. On the Little Lake Ranch property, groundwater rises to the surface through springs, and sustains the 90-acre lake and several ponds. In this area, evaporation from the lake and ponds and transpiration from riparian plants are significant. Inflow and outflow components of the groundwater budget for Rose Valley are discussed in more detail below.

G3.3.1 Simulated Groundwater Inflow Components

Principal inflow components consist of mountain front recharge, groundwater inflow from Owens Valley to the north and/or seepage from Haiwee Reservoir.

- **Mountain Front Recharge** – Precipitation recharge in the Sierra Nevada range west of Rose Valley is the principal source of groundwater to the Rose Valley basin. Due to the rain shadow effect caused by the Sierra Nevada's, the precipitation rate in the Coso Range on the east side of Rose Valley is low. To be conservative, it was assumed that the evapotranspiration potential exceeded potential precipitation recharge throughout Rose Valley and the Coso Range. Methodologies to directly measure mountain front recharge are poorly defined; typically groundwater recharge from precipitation is estimated as a percentage of total recharge.

  Brown and Caldwell (2006) concluded that precipitation rates in the Rose Valley area range from about 6 inches per year (in/yr) on the valley floor to up to 20 in/yr at the crest of the Sierra Nevada range and that only precipitation falling at elevations above 4,500 ft results in groundwater recharge. In the mountains, precipitation rate (including rainfall and snow melt) is strongly dependent on altitude. Danskin (1998) established an empirical relationship between precipitation rate and altitude based on precipitation and snow records collected routinely for more than 50 years in 20 survey stations along the western side of Owens Valley. Using the empirical relationship developed in the Danskin report, Brown and Caldwell estimated that the average precipitation rate for the elevation ranging from 4,500 ft to 6,500 ft was 10 in/yr, increasing to 15 in/yr for parts of the watershed above 6,500 ft. Using a geographic information system (GIS), to evaluate the contribution from areas of varying elevation in the Sierras west of Rose Valley, Brown and Caldwell estimated that the total precipitation volume that could potentially recharge the Rose Valley groundwater basin was approximately 42,000 acre-ft/yr.

  For the purposes of the initial evaluation of potential impacts of groundwater development at Hay Ranch, they further assumed that only 10 % (4,200 acre-ft/yr) of the potential mountain front precipitation recharge actually reaches Rose Valley. Danskin (1998) used a value equivalent to 6% of Sierra Nevada range precipitation for the mountain front recharge component of the numerical groundwater flow model developed to evaluate groundwater development in Owens Valley. Williams (2004) estimated that mountain front precipitation recharge in Indian Wells Valley amounted to approximately 8% of precipitation in the Sierra Nevada range to the west. However, Williams noted that the Maxey-Eakin Method for estimating precipitation recharge in the Sierra Nevada range conservatively neglects areas receiving less than 8 in/yr of precipitation; consequently, higher recharge rates are possible. Because the mountain front precipitation recharge rate as assumed for the Brown and Caldwell groundwater flow model yielded reasonable calibration results in the steady state model, a recharge rate of approximately 4,200 acre-ft/yr was also used in this study.

- **Groundwater Inflow/Seepage from the North** – As noted previously, Weiss (1979) estimated seepage losses from the Haiwee Reservoir to be on the order of 600 acre-ft/yr. Previous investigators (Bauer, 2002; Brown and Caldwell, 2006) and GEOLOGICA's review of groundwater elevation contour patterns in the north end of Rose Valley indicate that groundwater inflow from southern Owens Valley and/or seepage losses from the south Haiwee Reservoir recharge the Rose Valley groundwater basin at the north end of the valley. Using a steady-state numerical groundwater flow model of the Rose Valley groundwater basin, Brown and Caldwell (2006) estimated the groundwater influx from the north to be approximately 788 acre-ft/yr, which is similar to the estimate of Weiss (1979). Recalibration of the numerical groundwater flow model for the 2008 Hay Ranch EIR indicated a slightly higher groundwater inflow rate from the north (Owens Valley/Haiwee Reservoir) of 890 acre-ft/yr.

G3.3.2 Simulated Groundwater Outflow Components

Principal groundwater outflow components from Rose Valley consist of discharge to the Indian Wells Valley from the Little Lake area and an area in the southeast part of the valley, east of Red Hill, and evapotranspiration in the Little Lake area. Limited groundwater extraction was identified in Rose Valley.

- **Groundwater Discharge from Southeastern Rose Valley** – Brown and Caldwell (2006) estimated that approximately 2,050 acre-ft/yr of groundwater discharges from Rose Valley in the southeast part of the valley (southeast of Navy well 18-28) as underflow to Indian Wells Valley. Williams (2004) concluded that existing estimates of recharge to the Indian Wells Valley significantly underestimated interbasin transfers and referenced an estimate of groundwater underflow from Rose Valley to Indian Wells Valley of 10,000 acre-ft/yr developed by Thompson (1929). Recalibration of the numerical groundwater flow model for Rose Valley indicated an underflow rate from Rose Valley to Indian Wells Valley in this area of 850 acre-ft/yr. This is less than half the value of 2,050 acre-ft/yr assigned to this term in the Brown and Caldwell (2006) numerical modeling analysis. This difference is discussed in the model calibration section.

- **Groundwater Discharge at Little Lake** – Groundwater discharge by several processes in the Little Lake area is the dominant outflow component from Rose Valley. The processes operating at Little Lake include:

  - Evaporation from the lake surface;
  - Transpiration from phreatophyte plants on the property;
  - Discharge from Coso Spring;
  - Discharge from the Little Lake Weir; and
  - Discharge from the Little Lake Siphon well.

  Bauer (2002) estimated that evaporation from the Little Lake water surface consumes approximately 500 acre-ft/yr based on a lake surface area of 75-90 acres and evaporation rate of 80 in/yr. Plant communities identified on the Little Lake Ranch property were described as akalai desert (saltbush scrub), palustrine (pond) and lacustrine (lake) wetlands, and riparian (creek) habitat. Beginning in 2000, Little Lake Ranch, Inc., conducted various projects intended to restore or enhance 90 acres of lacustrine wetlands, 10 acres of palustrine emergent wetlands, about 6 acres of palustrine/riparian habitat (1.6 mile long creek corridor), and an additional 220 acres of wetland and upland habitat, and 1 acre of wetland and associated upland habitat was acquired. As a result of shallow groundwater in this area, plant communities on and near the Little Lake Ranch property have greater access to groundwater than occurs elsewhere in the valley. GEOLOGICA (2008) estimated that transpiration processes in the Little Lake area could consume up to 700 acre-ft of groundwater per year. The domestic well by the ranch house, several irrigation wells, and the former Little Lake Hotel well are not believed to extract significant quantities of groundwater. All of the groundwater discharged in the Little Lake area that is not evaporated or transpired by plants reportedly infiltrates back into the ground on the property and continues as groundwater underflow to Indian Wells Valley (no surface water flow leaves the property). Because of considerable uncertainty in actual evapotranspiration rates, and the relative contribution of groundwater underflow, overland flow, and evaporation from ponds and other surface water features further south on the ranch property, groundwater consumption on the Little Lake Ranch property was calculated in the 2010 version of the numerical model using evapotranspiration cells to represent evaporation from Little Lake and drain cells to represent discharge to Indian Wells Valley and all other consumptive uses of groundwater on the property.

- **Existing Extraction Wells** – Groundwater in Rose Valley is used for domestic drinking water supply, limited irrigation, light industrial processes, and, at the south end of the valley, for maintenance of riparian habitat in the Little Lake area. The Draft EIR for the Hay Ranch Water Extraction and Delivery System Project (MHA 2008) estimated that approximately 40 acre-ft/yr of groundwater production from wells occurs in Rose Valley. As many as 30 domestic wells are believed to extract relatively small quantities of groundwater for domestic uses and small scale irrigation in the Dunmovin area. Several wells at Coso Junction including a well at the Coso Junction Ranch, Coso store, and the CalTrans rest area produce water for drinking, irrigation, or light industrial purposes. The Coso Ranch North well and northern Coso Junction Store well (Coso Junction #1) are not being used at present. Rockwell (1980) reported that irrigation pumping at the Rose Valley Ranch (now referred to as the Hay Ranch) started in 1975, and averaged approximately 3,000 acre-ft/yr. In 1979 the Rose Valley Ranch reportedly pumped approximately 3,130 acre-ft/yr of groundwater from the two wells on the property for alfalfa irrigation. Alfalfa farming ceased sometime in the early 1980's. No significant agricultural irrigation, or groundwater extraction for any other purpose, has occurred in the valley since that time. Wells on the Navy property in Rose Valley including the Lego well, well G-36, and well 18-28 are not being pumped.

Groundwater extraction is specified in several existing wells in Rose Valley in the steady-state model including:

- Domestic supply in the Dunmovin area is represented in the groundwater flow model with a single well pumping at a steady rate of 8.5 acre-ft/yr based on estimates from the Rockwell (1980) hydrologic study.
- Water supply for the Coso Junction store and CalTrans rest stop is represented in the groundwater flow model with a single well pumping at a steady rate of 17 acre-ft/yr.
- Irrigation and light industrial supply at the Coso Junction Ranch property is represented in the groundwater flow model with a single well pumping at a steady rate of 17 acre-ft/yr.

The same steady state groundwater extraction rates were specified in the transient model. In addition, two intervals of pumping from the LADWP's V817 well in March 2009 (of 1-1/2 days and 6-1/2 days) and pumping for 14 days from the Hay Ranch south well in late November 2007 were simulated in the transient calibration model.

G3.3.3 Groundwater Budget

The groundwater elevation monitoring data suggest that groundwater inflows have equaled or slightly exceeded groundwater outflows from the Rose Valley groundwater basin in the past five years. Assuming that groundwater inflows equal outflows, that is, that steady state conditions prevail, the resulting conceptual Rose Valley groundwater budget is tabulated in the table below. Some of these components are estimated based on independent studies (e.g. Mountain Front Recharge) and some values are derived from the model after adjustments for model calibration (e.g. groundwater underflow from Rose Valley to Indian Wells Valley). Values from the 2008 version of the Rose Valley numerical groundwater flow model are also listed for comparison purposes:

Table G-2: Rose Valley Groundwater Budget					
Budget Components	**Values Cited in the Literature**	**2008 Model**		**2010 Model**	
		Flow Rate acre-ft/yr	**Simulation Package used in Model**	**Flow Rate acre-ft/yr**	**Simulation Package used in Model**
Groundwater Inflow					
Mountain Front Recharge from west	2,040-4,070(5)	4,197	Well (Specified Flux)	4,197	Well (Specified Flux)
Recharge from Coso Range	310-630(5)	0	--	0	--
Groundwater Underflow from the North	0(5) 600(6) 788(1)	898	Constant Head	898	Well (Specified Flux)
Total Inflow		**5,095**		**5,095**	
Groundwater Outflow					
Existing extraction wells		38	--	42	Well
Groundwater underflow to Indian Wells Valley exiting from southeastern Rose Valley	2,050(1)	848	General Head	2,102	General Head
Evaporation from Little Lake	500(2)	462	Evapo-transpiration	416	Evapo-transpiration
Phreatophyte and Riparian plant transpiration on Little Lake Ranch property	700(7)	--	--	--	--
Groundwater Discharge through Little Lake Gap to Indian Wells Valley	0(5) 3,300(3) 10,000(4)	3,747	General Head	2,537	Drain
Total Outflow		**5,097**		**5,097**	

Source:
1) Brown & Caldwell (2006)
2) Bauer (2002)
3) Williams (2004)
4) Thompson (1929)
5) U.S.G.S. (2009)
6) Weiss (1979)
7) GEOLOGICA (2008)

G4. NUMERICAL MODEL DEVELOPMENT

Brown and Caldwell (2006) developed a three-dimensional, numerical model of the Rose Valley groundwater basin which was then revised, and recalibrated, by GEOLOGICA for the Hay Ranch Groundwater Extraction Project EIR (GEOLOGICA, 2008), and, revised and recalibrated, by GEOLOGICA for the current study. Groundwater flow evaluations were conducted using the U.S.G.S. MODFLOW computer code (McDonald and Harbaugh, 1988) implemented in the Groundwater Vistas graphical environment (Version 5, Environmental Simulations, 2007). The revised model incorporates new groundwater elevation data and lithologic information from monitoring well drilling and logging conducted for the Hay Ranch Monitoring Project (Inyo Co. 2009, 2010), as well as time-drawdown data from a 6-1/2-day pumping test conducted on the LADWP property in March 2009.

G4.1. Overview of Model Revisions

The numerical groundwater flow model of Rose Valley modified for Hay Ranch Groundwater Extraction Project EIR (GEOLOGICA, 2008), aka, the Rose Valley Model, was revised for the current study to better represent the structure of the local aquifer system, and to address comments from various sources regarding model input parameters, boundary conditions, calibration, and sensitivity analysis. Specific revisions are summarized below:

- **Northern Inflow Boundary** – The 2008 version of the Rose Valley Model utilized a Constant Head Boundary condition along the northern edge of the model domain to represent groundwater inflow from Owens Valley, seepage losses from the South Haiwee Reservoir, and mountain front recharge at the far north end of the valley. Several reviewers noted that the groundwater flux calculated by MODFLOW for a Constant Head Boundary could be artificially high if groundwater extraction was specified too close to the boundary. For the current study, the Constant Head Boundary nodes were removed from the model and replaced with specified flux (well) cells to limit groundwater inflow in this area to specified rates based on the water budget analysis discussed in Section G.2.5.1.

- **Southern Outflow Boundary** – The 2008 version of the Rose Valley Model utilized a General Head Boundary condition along the southern edge of the model domain near Little Lake to represent groundwater outflow from the Rose Valley aquifer to the Indian Wells valley to the south. Several reviewers commented that under conditions of extreme aquifer drawdown, the General Head Boundary nodes could allow the simulation code to force water to enter the model along the southern boundary, which is implausible in the conceptual model for the site. In addition, the U.S.G.S. (2009) noted that the close proximity of the General Head Boundary nodes to the evapotranspiration nodes specified to represent evaporation from Little Lake could make the model unstable. The General Head Boundary nodes were replaced with Drain nodes, which only allow outflow, and moved approximately 2,000 feet to the south to provide additional separation from Little Lake.

- **Model Layering Scheme** – The 2008 version of the Rose Valley Model was subdivided into 4 model layers, with the two uppermost layers representing alluvial deposits, and the two lower layers representing the Coso

- Lake Bed and Coso Sand members, respectively. Several reviewers commented that the representation of the Coso Lake Bed and Coso Sand geologic units in the model exaggerated the amount of groundwater available for extraction. Consequently, to ensure a conservative evaluation of impacts from groundwater extraction in the valley, the two lower model layers were removed from the model. It should be noted that the revised model, comprised of two model layers, only approximately represents groundwater conditions in the north central part of the valley around the Hay Ranch property where recent drilling and lithologic logging activity suggests that there may be three groundwater-bearing zones, which would require, at a minimum, three model layers to represent in greater detail. Revising the model to represent this condition was beyond the scope of this study and impractical with available hydrogeologic data.

- **Location of Mountain Front Recharge** – The U.S.G.S. (2009) noted that the presence of springs east of the Sierra Nevada mountain front suggests that there is a lateral barrier to groundwater flow (on the western edge of the model domain) that would limit the direct infiltration of mountain front recharge such that most, if not all, of the mountain-front recharge should be simulated in model-layer 1. Consequently, mountain-front recharge simulated using specified flux cells was limited to model-layer 1 in the revised model rather than being distributed across the deeper model layers as was done previously.

- **Lack of Transient Calibration** – Several reviewers commented that the 2008 version of the Rose Valley Model was only calibrated to steady-state conditions which may unconservatively represent conditions during pumping. To address this concern, a transient calibration was conducted using water level data collected in Rose Valley during the two year period from November 2007 to November 2009. In addition, the model was calibrated to time-water level data collected during pumping tests conducted in September/October 2007 on the Hay Ranch property and March 2009 on the LADWP property. The accuracy of the transient model calibration was further assessed by conducting a model confirmation run using time-water level data from the first nine days of intermittent pumping for the Hay Ranch Groundwater Transfer Project beginning in late December 2009.

- **Uncertainty in Aquifer Storage Properties** – Because insufficient data were available to estimate aquifer specific yield, the 2008 version of the Rose Valley Model used a range of values (10, 20, and 30%) for groundwater resource development scenarios that were not used in the model calibration process. The groundwater development scenarios used in the current development impact analysis utilize the final calibrated specific yield value estimated from the transient model calibration. In addition, sensitivity analysis was conducted to assess the sensitivity of the transient model calibration to uncertainty in specific yield.

- **Excessive Model Error near LADWP Wells** – The reviewer for the LADWP noted that the 2008 version of the Rose Valley Model underpredicts groundwater elevation at the LADWP's wells at the north end of the valley by nearly 120 ft. Using data from the pumping test conducted on that property in March 2009 to adjust local aquifer properties, the recalibrated model reduces the error in simulated groundwater elevation at this location to less than 3 ft.

- Model Grid Spacing – To further improve the accuracy of the model, the maximum grid spacing was reduced from ¼ mile (1,320 ft) to 1/8 mile (660 ft). In addition, the model grid was refined to a minimum spacing of approximately 220 ft near the Hay Ranch property where new monitoring wells were recently installed to allow better representation of response to pumping.

G4.2 Model Domain and Finite Difference Grid

The model domain covers approximately 132 square miles, extending up to 8.25 miles in the east-west direction and up to 16 miles in the north-south direction (**Figure G-1**). The model domain extends from the groundwater divide near the south Haiwee Reservoir on the north to the Little Lake Gap area to the south, and is bounded by impermeable boundaries representing the Sierra Nevada Mountains on the west and by Coso Range to the east. Consistent with the representation developed in the 2006 and 2008 numerical models of Rose Valley, the southern edge of the active portion of the model grid extends to just beyond the south edge of Little Lake; consequently, Coso spring, the Little Lake Ranch siphon well, and palustrine and riparian wetland areas south of Little Lake are not explicitly represented in the model.

The model domain was discretized into 137 rows, 71 columns, and 2 layers. The maximum cell size of the grid is 1/8 mile in both length and width, representing a 10-acre area. The model grid was refined to a minimum spacing of approximately 220 ft near the Hay Ranch property where new monitoring wells were recently installed to allow better representation of response to pumping. No flow (inactive) model cells were specified along the east and west margins of the model domain to represent the shape of the aquifer within basin fill deposits.

G4.2.1 Model Layer Configuration

Three model layers were originally used to represent the aquifer system in the 2006 version of the Rose Valley groundwater model. As part of the 2008 recalibration process, GEOLOGICA subdivided the uppermost model layer into two layers to better represent the semi-confined behavior of the aquifer, resulting in a four-layer model. The location of the contact between layers 1 and 2 was specified as being just below the bottom depth of shallower wells in the valley (including Cal-Pumice, Coso Store #1 and #2, and the Lego, G-36, and 18-28 wells) which is on the order of 400 ft bgs. The uppermost two layers (layers 1 and 2) were configured to represent: debris flows and debris avalanche in the Dunmovin Hill in the northern part of Rose Valley; the recent alluvial deposits in the center of Rose Valley, and interbedded volcanic deposits and alluvium in the south and southeast part of Rose Valley. The lower two layers were intended to represent the Coso Lake Bed and Coso Sand members, respectively. As noted in Section G3.1, the two lower model layers were removed from the current version of the Rose Valley model to more conservatively represent potential impacts from groundwater extraction.

Model layer 1 is specified as unconfined with transmissivity determined by MODFLOW as the product of horizontal hydraulic conductivity and current saturated thickness and storage represented using specific yield.

Layer 2 is configured as a confined, but variable transmissivity unit in MODFLOW with transmissivity calculated as the product of horizontal hydraulic conductivity and the layer thickness at that location and storage represented using a confined aquifer storativity value.

Model layers 1 and 2, together, were constructed to have variable thickness and spatial extent. The basis for specifying layer thickness and the bottom elevation of each of layers is described in Brown and Caldwell (2006). Total model thickness from land surface ranges from 150 ft within Little Lake Gap to approximately 800 ft near the Hay Ranch property.

G4.2.2 Model Boundary Conditions

The active portion of the model domain is bounded on the west and east by by inactive cells representing igneous and metamorphic rocks of the Sierra Nevada and Coso Range which are presumed to be impermeable. Groundwater discharge to Indian Wells Valley in the southeast part of Rose Valley (east of Red Hill) through fractured basalt flows and/or basalt flows overlying alluvial deposits was represented using a head dependent boundary condition. Model cells that represent bedrock areas form the inactive portion of the model domain and also serve as no-flow boundaries. Boundary conditions specified in Layers 1 and 2 are depicted in Figures G-a and G-b, respectively.

- **No Flow Boundaries/Inactive Cells** – The location of no flow boundaries, and thereby, inactive cells in the model domain were similar to those specified in the 2008 model with the exception that after the model grid spacing was refined, the shape of the southern model boundary was smoothed to better conform to the estimated extent of alluvial deposits in that area. **Figure G-5** shows the location/configuration of inactive model cells.

- **Specified Flux Boundaries** – Specified flux boundary cells in model layer 1 were used to represent mountain front recharge derived from precipitation and snowmelt that falls on the Sierra Nevada on the west side of the model grid, and, groundwater inflow from the north and seepage from the South Haiwee Reservoir along the northern model boundary. The flow rates for the specified flux cells were set to constant annualized rates based on the groundwater budget developed for the Hay Ranch EIR (Geologica, 2008) and discussed in

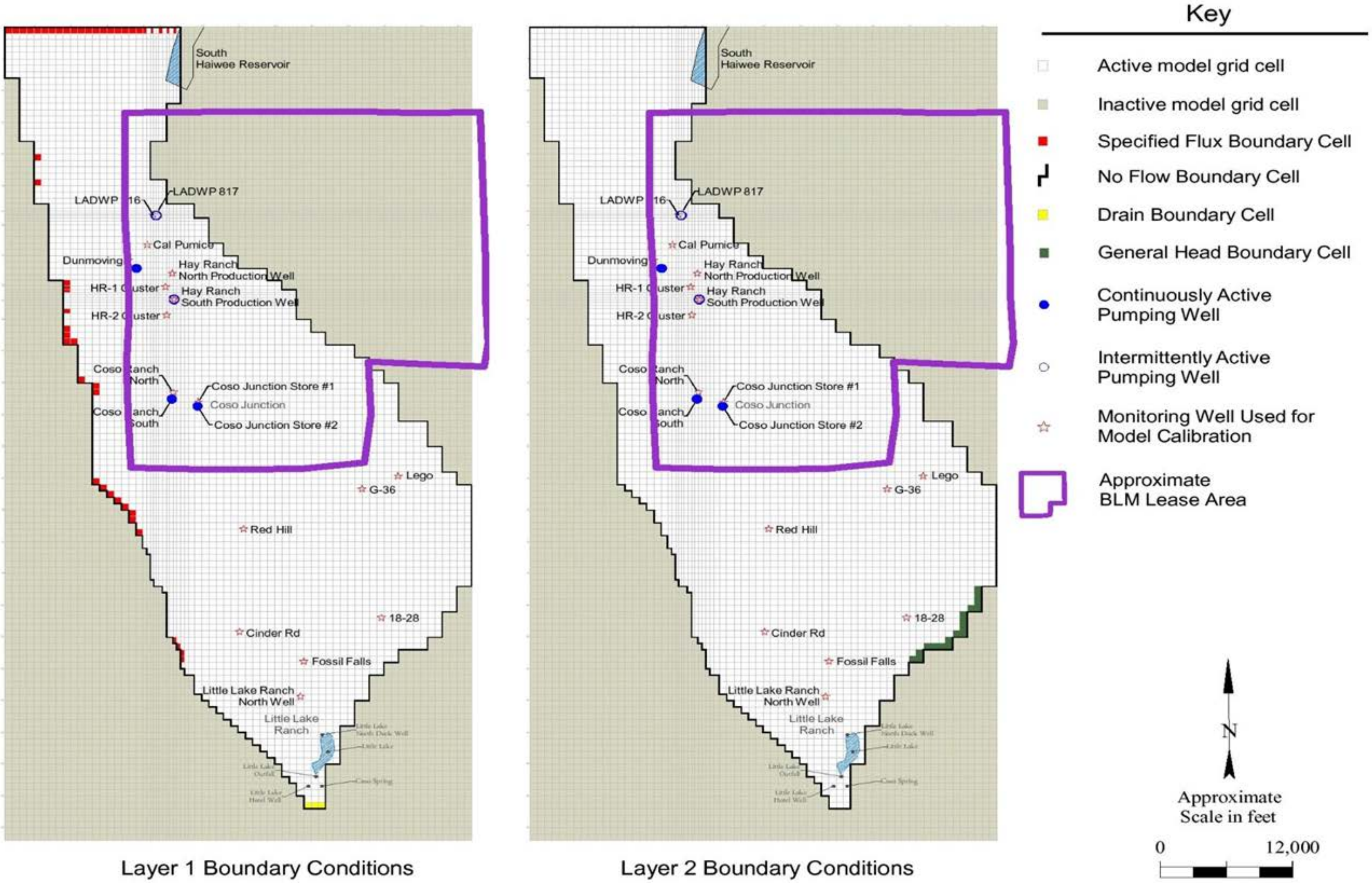
- **Section G2.5**. Sensitivity analyses, discussed in **Section G-3.3.3**, were conducted to evaluate the sensitivity of the steady-state and transient model calibration results to the magnitude of the northern boundary inflow and western boundary inflow.

- **Evapotranspiration** – Surface water evaporation from Little Lake and evapotranspiration from phreatophyte plants around the lake was represented using the MODFLOW Evapotranspiration (ET) package with ET cells specified in model layer 1 over the approximate footprint of the lake. The extinction depth for the ET cells was set to 15 ft below ground surface, the same value as was used in the 2006 model, and consistent with the value used in the USGS model of Owens Valley (Danskin, 1998). Bauer (2002) estimated the surface water evaporation rate from Little Lake to be approximately 500 acre-ft per year, presumably when the lake is at its maximum depth. The relationship between lake level and surface area is unknown, presumably, at lower water levels the lake covers less area and may lose less water to evaporation. MODFLOW reduces the calculated evapotranspiration loss in proportion to the groundwater table depth below ground surface; no evapotranspiration occurs when the groundwater table is at or below the extinction depth (15 ft), half as much evapotranspiration is calculated when the groundwater table is located at half the extinction depth (7.5 ft) below ground surface. The evapotranspiration rate was adjusted during model calibration to yield a total evapotranspiration loss of approximately 500 acre-ft per year in the steady state model, consistent with the 2006 model.

- **General Head Boundary** – Groundwater outflow to Indian Wells Valley from the southeast part of Rose Valley near well 18-28 was simulated using general head boundary (GHB) cells specified in model layer 2. GHB cells in MODFLOW allow groundwater inflow or outflow from the model at a rate dependent on the difference between groundwater elevation in the model and a specified elevation and a conductance assigned to the general head boundary cell; however, the groundwater elevation in the GHB cell is calculated by MODFLOW during a simulation, not fixed like a Constant Head boundary cell. Brown and Caldwell used groundwater elevations measured in the Lego Well in Rose Valley and historical water level elevations measured in the Indian Wells Valley (presented in Bloyd and Robson, 1971) to estimate the flow across this boundary. The conductance and groundwater elevation in the GHB cells were adjusted during this model calibration process to better simulate groundwater elevations observed in the southeast part of Rose Valley.

- **Drain Nodes** – The groundwater outflow to Indian Wells Valley in the Little Lake area was represented using MODFLOW Drain nodes specified in Model Layer 1, at the south end of the model grid near Little Lake (**Figure G-5**). This is a departure from the treatment of this groundwater outflow term in the 2008 model in which General Head Boundary cells were used to represent groundwater discharge from the south end of Rose Valley.

Figure G-5: Model Boundary Conditions – Layers 1 and 2



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G4.2.3 Initial Aquifer Parameters

Initial values for key aquifer parameters including horizontal hydraulic conductivity (Kh), vertical hydraulic conductivity (Kz), water table specific yield (Sy), and aquifer storativity (Ss) were specified based on the final calibrated values used in the 2008 version of the Rose Valley model (GEOLOGICA, 2008). Initial Kh values ranged from 0.55 foot per day (ft/day) in the north end of the model grid (from well V816 north), to 24 ft/day in the central portion of the grid, to 200 ft/day in the southern end of the model domain near Little Lake Ranch. Initial Kz values ranged from 0.05 ft/day in the north end of the model grid (from well V816 north), to 0.019 ft/day in the central portion of the grid, to 20 ft/day in the southern end of the model domain near Little Lake Ranch. A uniform storativity value of 1×10^{-7}/ft was used throughout the model domain in accordance with the 2008 version of the model. An initial specific yield value of 0.1 (10%) which was the lowest specific yield value used in groundwater resource development evaluations for the Hay Ranch EIR (RMT, 2008) was used in initial calibration efforts.

G4.3 Model Recalibration

Recalibration of the 2008 version of the numerical model of groundwater flow conditions in Rose Valley was conducted in an iterative process which consisted of calibrating a steady-state model to groundwater elevations observed in Rose Valley at the beginning of November 2007, followed by calibration of a transient model to groundwater elevations observed in wells monitored in the valley between November 2007 and November 2009. The transient model used the same aquifer parameters as the steady-state model, with the exception that it included aquifer storage coefficients that are not used in a steady-state model. The transient model was linked to the steady-state model in that it used the final groundwater elevations from the steady-state model as initial groundwater elevations for the transient simulations. In addition to water level data from the Hay Ranch Monitoring Program (Inyo Co., 2009, 2010), the transient model used time-drawdown data from a 14 day pumping test conducted on the Hay Ranch property in November 2007 (GEOLOGICA, 2008) and 1-1/2 and 6-1/2 day pumping tests conducted on the LADWP property in March 2009 (LADWP, 2009). During the model calibration process, model input parameters were iteratively adjusted until a visual best fit was observed between simulated groundwater elevations and observed groundwater levels during the calibration period, and, the summed squared error between observed and simulated elevations was minimized. Parameters adjusted included:

- Horizontal and vertical hydraulic conductivity;
- Aquifer storativity and specific yield;
- General Head Boundary elevation and conductance;
- Drain elevation and conductance.

G4.3.1 Final Calibrated Model Parameters

Final parameter values are listed in **Table G-3**. The spatial distributions of calibrated parameter values are illustrated on **Figures G-6** and **G-7**. The main changes in aquifer parameter values in the revised model compared to the 2008 model were in the horizontal hydraulic conductivity in the north and central parts of the model grid, vertical hydraulic conductivity in the central part of the grid, storativity values in the central and northern part of the grid, and specific yield throughout the model domain.

Horizontal hydraulic conductivity at the north end of the model grid including, and north of the LADWP property, was set to 0.55 ft/day in the 2008 model, yielding an aquifer transmissivity in that area of approximately 500 ft^2/day. However, a pumping test conducted by LADWP (2009) on their property in March 2009 indicated higher transmissivity in the area on the order of 1,340 ft^2/day. Horizontal hydraulic conductivity in this area was increased to 2 ft/day during the model calibration process, yielding a significantly better fit between observed and simulated steady-state groundwater elevation. An apparent low permeability zone was identified between the Cal Pumice well and LADWP wells 816 and 817, based on the presence of very high groundwater elevation gradients in that area (see **Figure G-3**). Horizontal hydraulic conductivity was decreased in that region in model layers 1 and 2 in an iterative fashion to improve the match between simulated and observed groundwater elevations north of this region.

Table G-3: Summary of Final Calibrated Parameter Values

Parameter	Parameter Value	Units
Northern Boundary Kh	2	ft/day
Northern Boundary Kz	0.02	ft/day
V816 to Pumice Well Kh	0.24	ft/day
V816 to Pumice Kz	0.024	ft/day
Hay Ranch Transition Kh	7.5	ft/day
Hay Ranch Transition Kz	0.75	ft/day
Central Valley Kh L1	50	ft/day
Central Valley L1 Kz	0.001	ft/day
Central Valley Kh L2	12.8	ft/day
Central Valley L2 Kz	0.01	ft/day
Southeastern Kh	100	ft/day
Southeastern Kz	10	ft/day
Volcanics Kh	1	ft/day
Volcanics Kz	0.1	ft/day
Little Lake Kh	112.5	ft/day
Little Lake Kz	11.25	ft/day
Southeast General Head Boundary Elevation	3,140	ft
Southeast General Head Boundary Conductance	367	ft2/day
Little Lake Drain Boundary Elevation	3,110	ft
LittleLake Drain Boundary Conductance	6.60E+05	ft2/day
Northern Boundary Specified Flux	107,088	cfd
Sierra Recharge	500,560	cfd
Northern Sy	0.035	-
Northern Ss	3.50E-06	1/ft
Central Sy	0.1	-
Central Ss	1.50E-06	1/ft
Southern Sy	0.1	-
Southern Ss	3.50E-06	1/ft

Lithologic logging data made available by construction of two sets of clustered monitoring wells on the Hay Ranch property in 2009 (SGSI, 2009a, 2009b, and 2009c) revealed more strongly anisotropic soils in the area than previously estimated. Soils in the upper 200 feet of the soil column were gravelly, while soils below that depth were found to be more fine-grained. In addition, two distinct clay horizons were identified in both clustered boring locations that SGSI concluded would function as aquitards. These two clay aquitards cannot be represented explicitly in the two-layer numerical model. The hydraulic effect of the shallow high permeability gravel horizon overlaying less permeable sands and silts at depth was represented by assigning a higher horizontal hydraulic conductivity (50 ft/day) in the central portion of model layer 1 and lower horizontal hydraulic conductivity (12.8 ft/day) in model layer 2. The hydraulic effect of the two clay aquitards was represented by assigning low vertical hydraulic conductivities to model layers 1 and 2 of 0.001 and 0.01 ft/day, respectively, resulting in vertical anisotropy ratios of 50,000 to 1 and 1,280 to 1. Elsewhere in the model, higher vertical anisotropy ratios of 10 to 1, more typical of natural sediments absent low permeability aquitards, were used.

Figure G-6: Hydraulic Conductivity Distribution – Layers 1 and 2

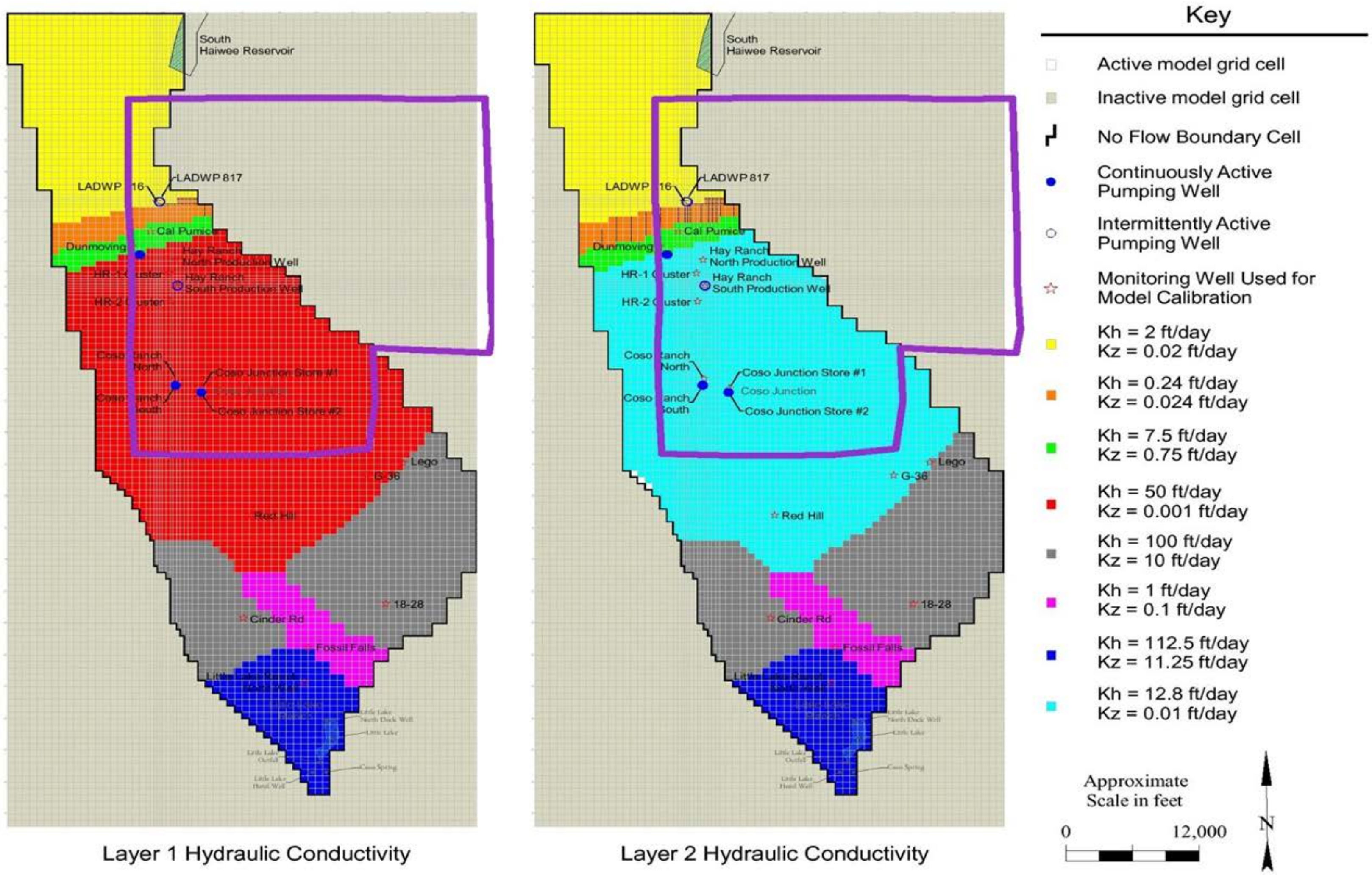

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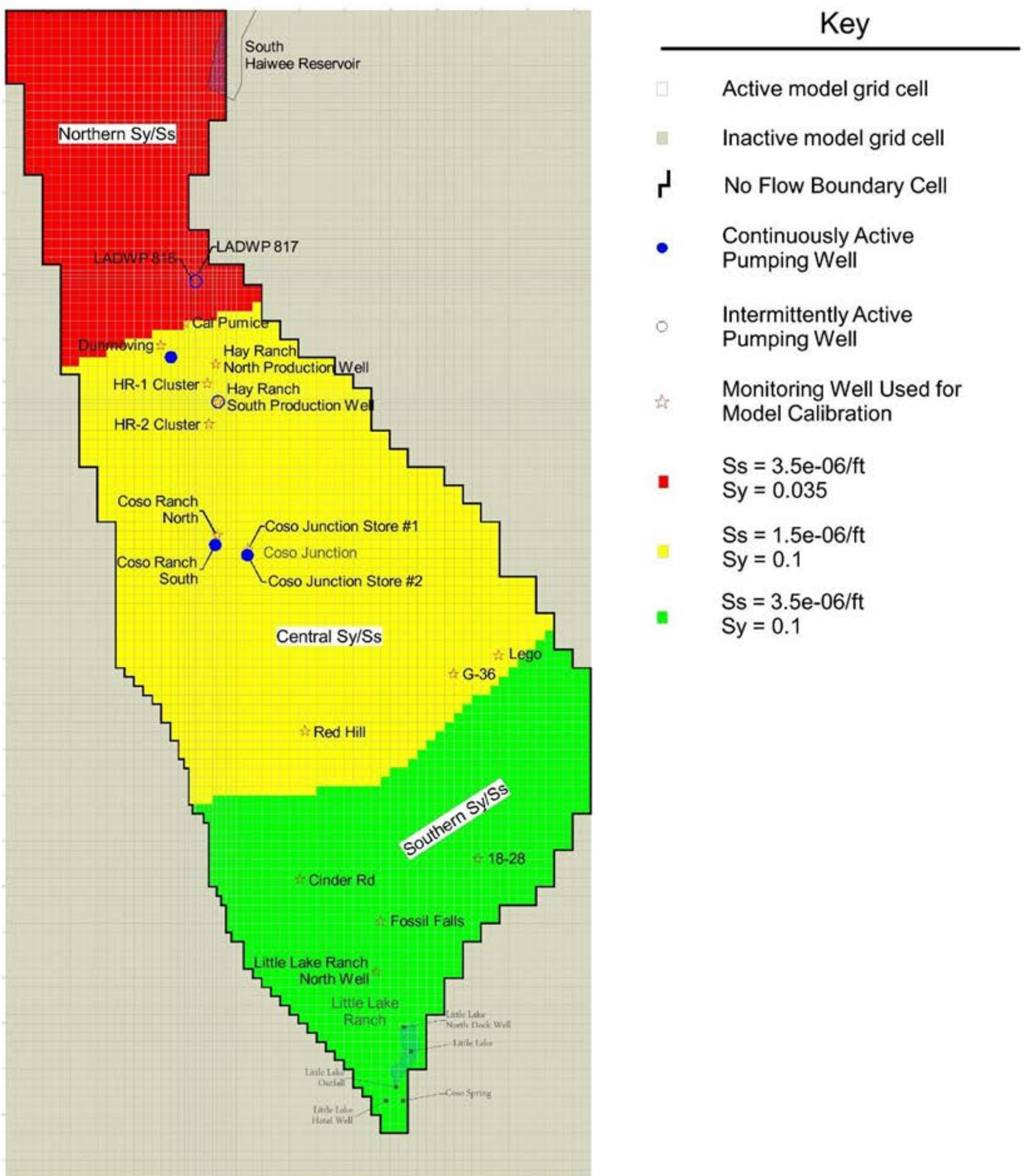
Figure G-7: Storage Property Distribution – Layers 1 and 2



For the 2010 model calibration, the model domain was subdivided into three subregions, north, central, and southern as depicted in **Figure G-7** for the specification of aquifer storage properties. Then specific yield and aquifer storativity were iteratively adjusted during the transient model calibration process until a best fit was obtained between simulated and observed groundwater elevations.

G4.3.3. Calibrated Model Accuracy

The accuracy of the model calibration effort was evaluated by comparison of simulated groundwater elevations and groundwater elevations observed in November 2007.

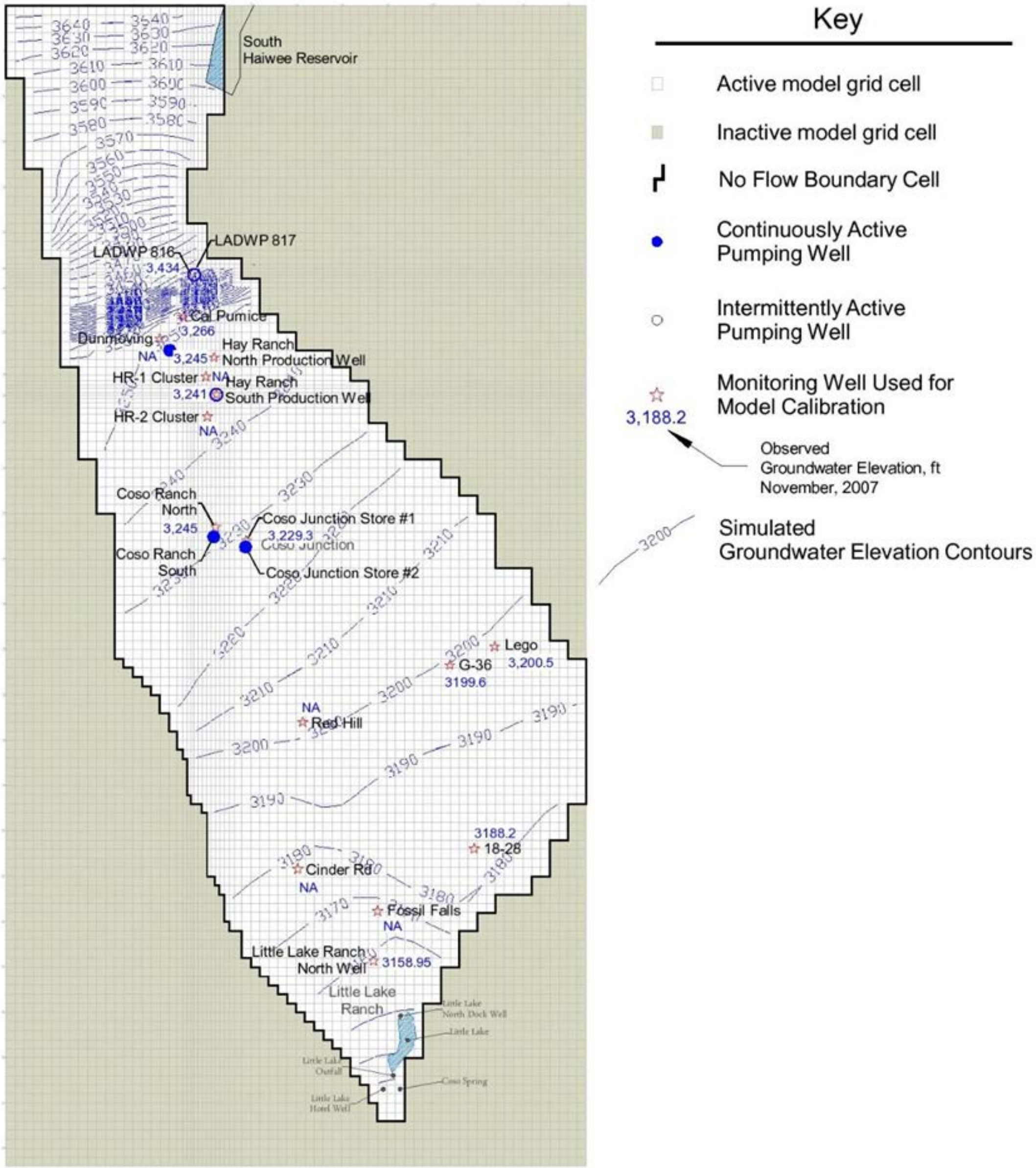
- **Steady-State Model – Figure G-8** presents a plan view map comparing simulated groundwater elevation contours versus groundwater elevations observed in November 2007. **Table G-4** below summarizes simulated versus observed groundwater elevations at 10 selected monitoring well locations for the 2008 and 2010 steady-state model calibrations, respectively.

Table G-4: Steady-State Model Calibration Summary

Well Name	Observed Groundwater Elevation, ft	2008 Model Simulated Groundwater Elevation, ft	2008 Model Calibration Residual Difference	2010 Model Simulated Groundwater Elevation, ft	2010 Model Calibration Residual Difference
LADWP V816	3434	3326.0	108	3431.1	2.9
Cal-Pumice	3266	3247.9	18.1	3253.4	12.6
Hay Ranch North	3245	3243.8	1.2	3244.6	0.4
Hay Ranch South	3241	3242.2	-1.2	3241.2	-0.2
Coso Ranch North	3232.7	3231.0	1.7	3232.1	0.6
Coso Junction #1	3229.3	3227.1	2.2	3228.2	1.8
Navy Lego	3200.5	3203.3	-2.8	3197.3	3.2
Navy G-36	3199.6	3203.3	-3.7	3198.8	0.8
Navy 18-28	3188.2	3182.2	6.0	3182.4	5.6
Little Lake Ranch North	3158.95	3158.1	0.8	3158.7	0.3
Steady-State Calibration Statistics					
Residual Mean			13.0		2.8
Res. Std. Dev.			32.2		3.7
Sum of Squared Residuals			12069		212.3
Abs. Res. Mean			14.6		2.8
Minimum Residual Difference			-3.7		-0.2
Maximum Residual Difference			108		12.6
Range in Target Values			275		275
Std. Dev./Range			0.12		0.013

The calibration residuals for the 2010 model show considerable improvement at the north end of the valley on the LADWP property where the difference between observed and simulated groundwater elevation decreased from 108 ft in the 2008 model to less than 3 ft in the 2010 model. Calibration residuals for the remaining observation wells were generally lower in the 2010 model and except for the Cal-Pumice well, north of the Hay Ranch property, and the Navy 18-28 well in the southeast end of the valley, are less than 4 ft.

Figure G-8: Steady-State Model Calibration Results



- **Transient Model** – Figures G-9-1 through G-9-5 depict simulated versus observed groundwater elevation in fourteen selected monitoring wells in Rose Valley. **Table G-5** summarizes calibration statistics calculated by Groundwater Vistas for the 2010 transient model calibration.

Table G-5: Transient Model Calibration Statistics	
Residual Mean	1.3
Res. Std. Dev.	3.4
Sum of Squared Residuals	18075.7
Abs. Res. Mean	1.7
Minimum Residual Difference	-15.3
Maximum Residual Difference	13.7
Range in Target Values	290.6
Std. Dev./Range	0.012

Figure G-9-1: Transient Calibration Results

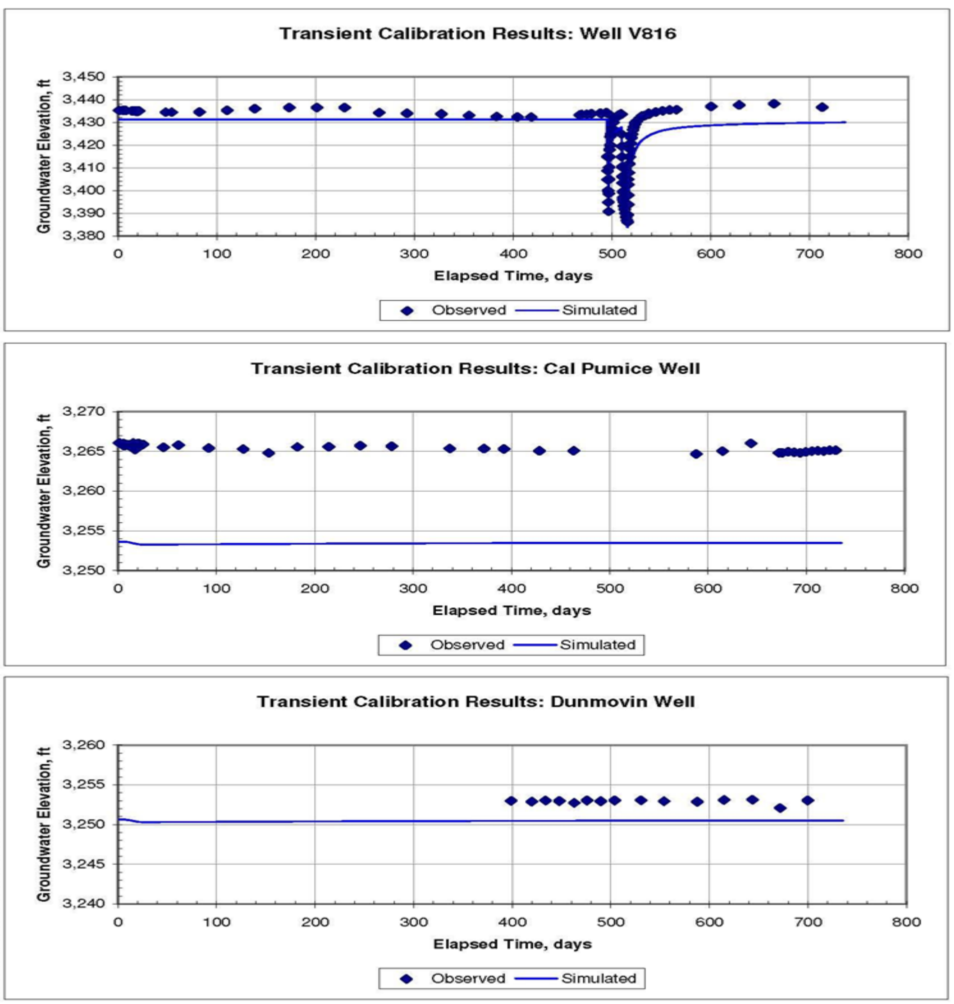
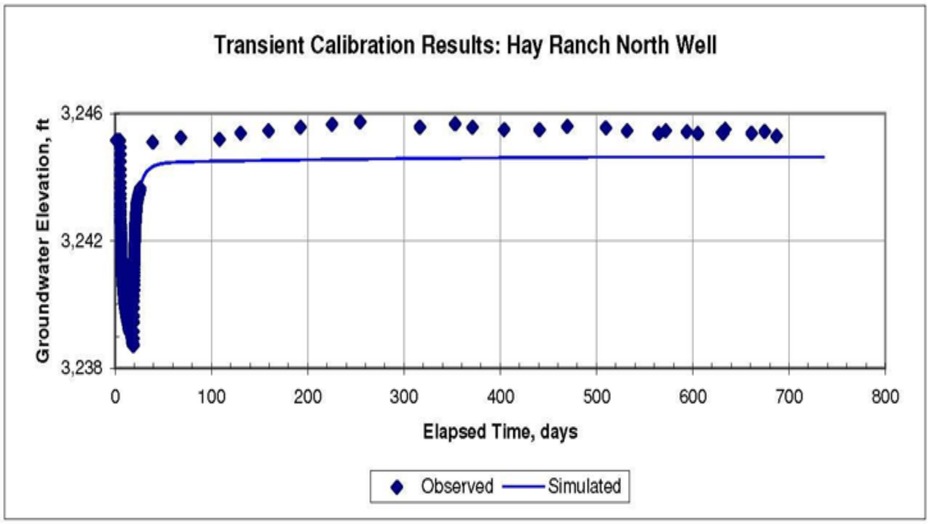
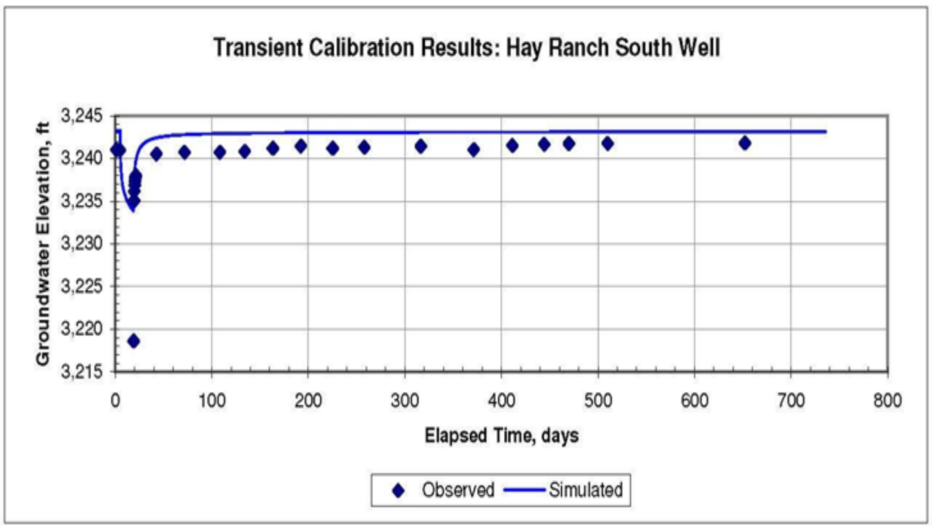


Figure G-9-2: Transient Calibration Results (continued)





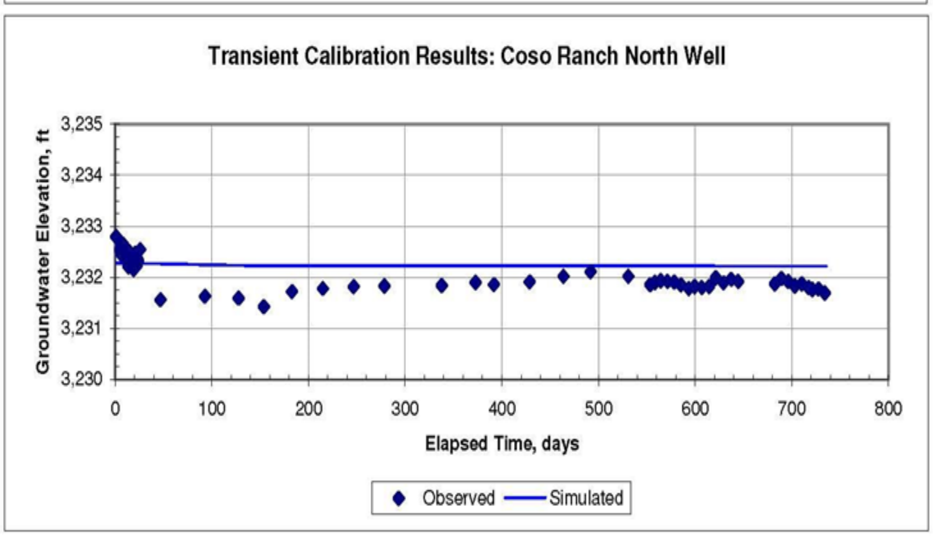
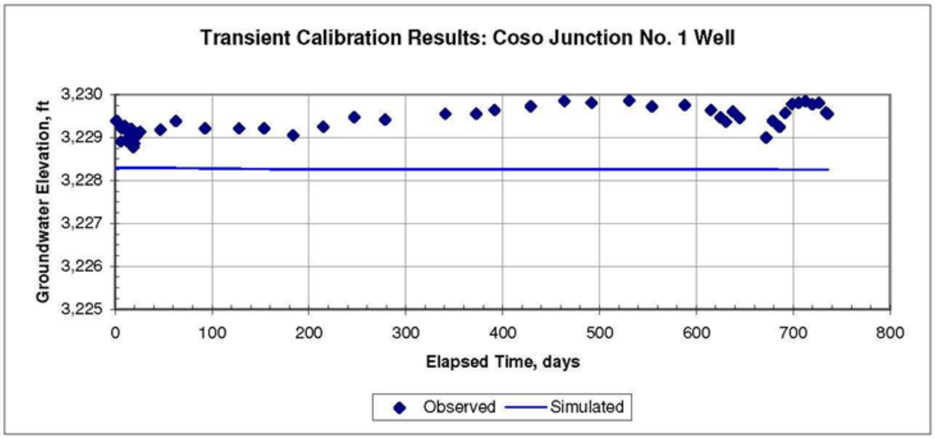
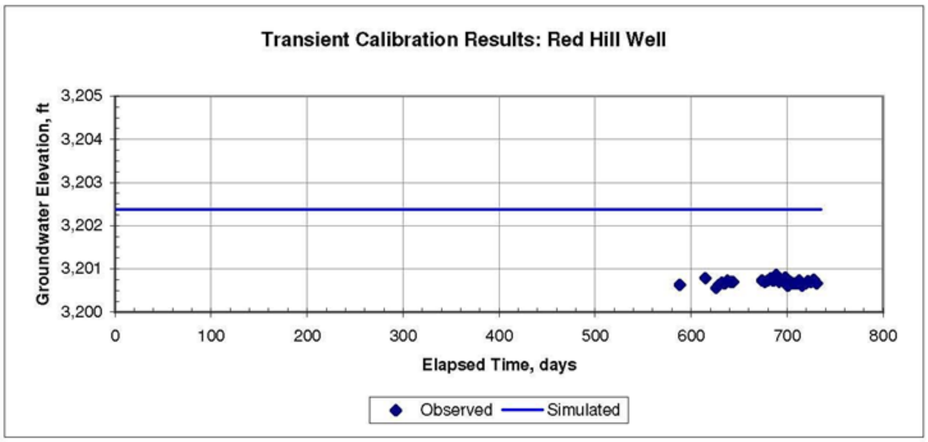


Figure G-9-3: Transient Calibration Results (continued)





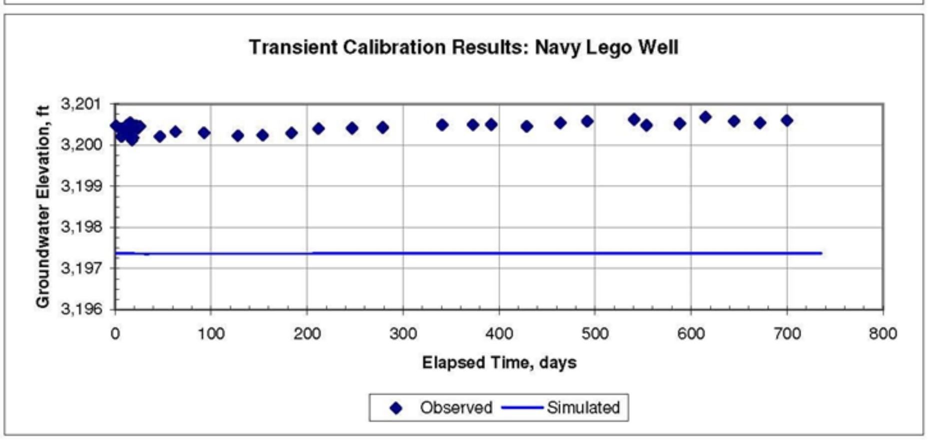
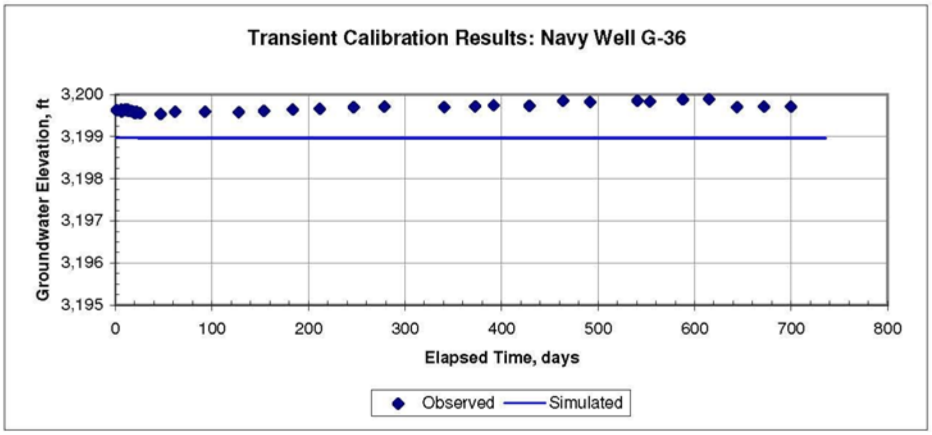
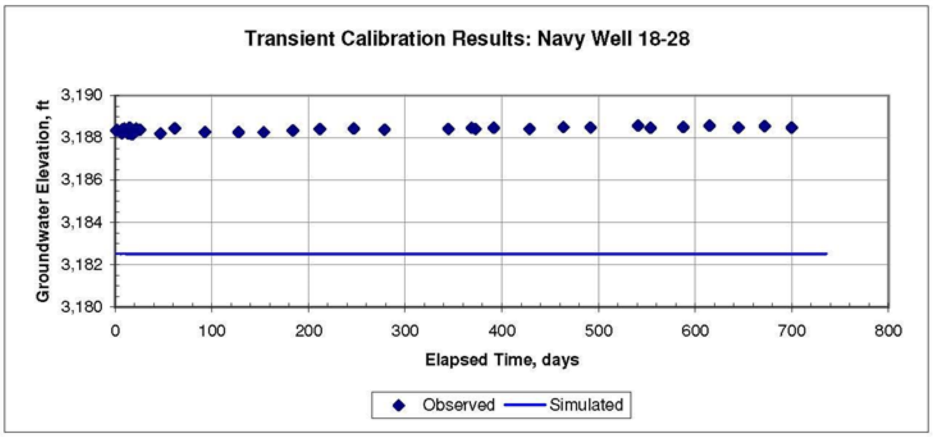


Figure G-9-4: Transient Calibration Results (continued)





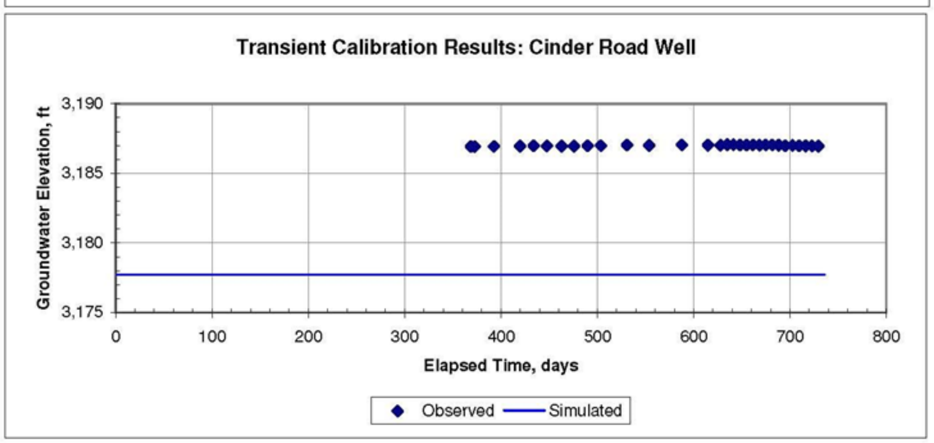
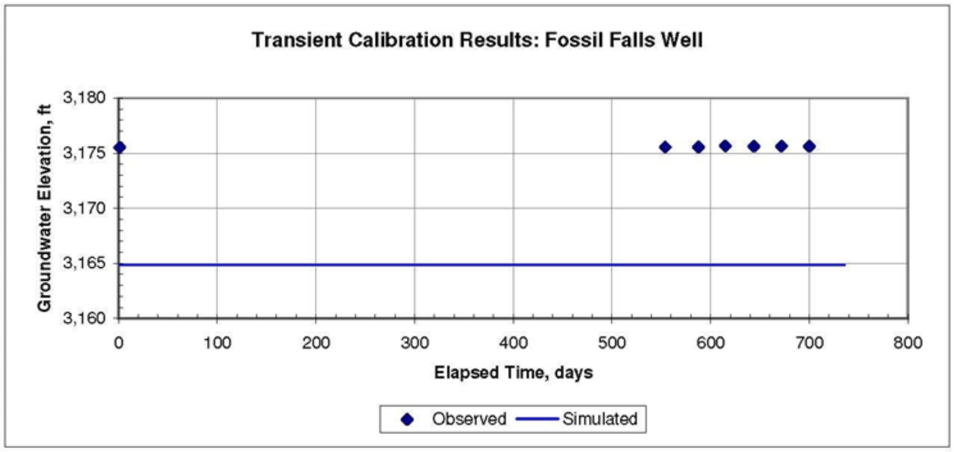
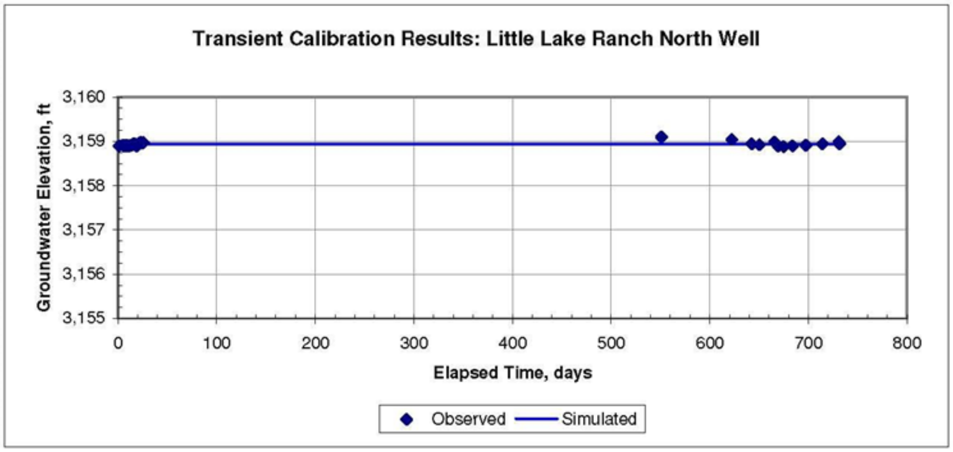


Figure G-9-5: Transient Calibration Results (continued)





As illustrated in **Figure G-9**, the transient model generally provides a good fit between simulated and observed groundwater levels in key areas of the model – the Little Lake Ranch property, the Hay Ranch property, Coso Junction, and the LADWP property. The transient model underestimates groundwater elevation in the southern part of valley, north of the Little Lake Ranch property and south of Coso Junction at the locations of the Cinder Road, Fossil Falls, and Navy 18-28 wells by 6 to 10 ft. This may be an indication of groundwater inflow from outside the valley that is not accounted for in the model.

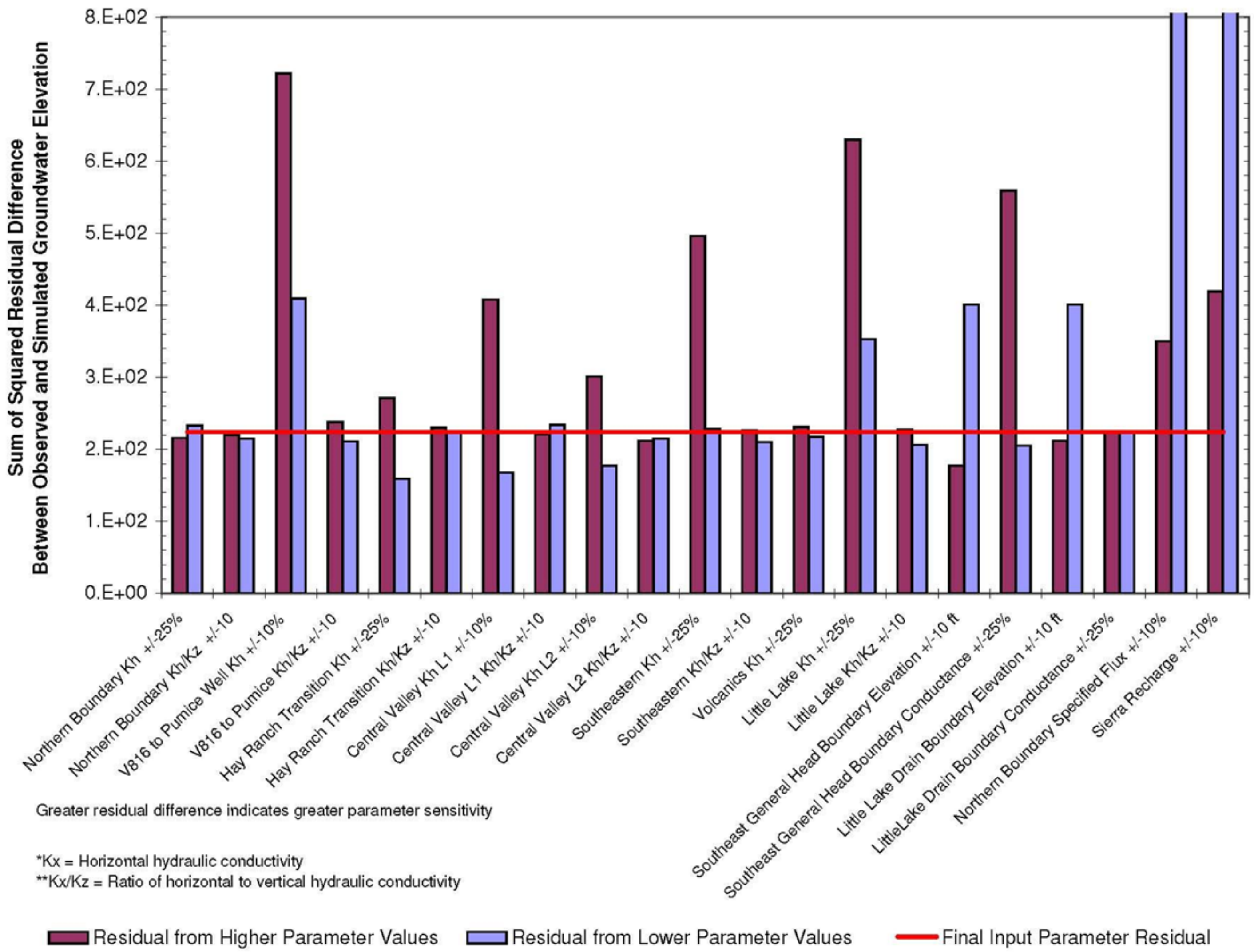
G4.3.3. Parameter Sensitivity Analysis

Input parameter sensitivity analysis was conducted to evaluate the sensitivity of the fit between observed and simulated groundwater elevation values in the steady-state and transient model calibration runs to uncertainty in the model input parameters. Parameters tested, the range of parameter values used for sensitivity analysis, and estimated parameter sensitivity reported as the Sum of Squared Residual Differences between observed and simulated groundwater elevations at selected monitoring wells are summarized in **Table M-6**, and graphically depicted in **Figures G-5** and **G-6** for the steady-state and transient calibration models, respectively.

Table M-6: Summary of Individual Parameter Sensitivity Analysis Results

		Parameter Values for Sensitivity Analysis				Steady-State Model Sensitivity Analysis Results			Transient Model Sensitivity Analysis Results		
						Sum of Residual Squared Differences			Sum of Residual Squared Differences		
Parameter	Final Calibrated Parameter Value	Multiplier	Low Value	High Value	Units	Residual from Lower Parameter Value	Residual from Higher Parameter Value	Residual from Final Parameter Value	Residual from Lower Parameter Value	Residual from Higher Parameter Value	Residual from Final Parameter Value
Northern Boundary Kh	2	+/-25%	1.5	2.5	ft/day	233	216	224	2.34E+04	1.77E+04	1.87E+04
Northern Boundary Kh/Kz	10% (0.02)	+/-10	0.002	0.2	-	215	220	224	1.83E+04	1.79E+04	1.87E+04
V816 to Pumice Well Kh	0.24	+/-10%	0.216	0.26	ft/day	409	722	224	3.76E+04	4.44E+04	1.87E+04
V816 to Pumice Kh/Kz	10% (0.024)	+/-10	0.0024	0.24	-	211	238	224	1.79E+04	1.95E+04	1.87E+04
Hay Ranch Transition Kh	7.5	+/-25%	5.6	9.4	ft/day	159	271	224	1.56E+04	2.11E+04	1.87E+04
Hay Ranch Transition Kh/Kz	10% (0.75)	+/-10	0.075	7.50	-	224	230	224	2.13E+04	1.90E+04	1.87E+04
Central Valley Kh L1	50	+/-10%	45	55.00	ft/day	168	408	224	2.13E+04	3.06E+04	1.87E+04
Central Valley L1 Kh/Kz	0.2% (0.001 ft/day)	+/-10	0.0001	0.010	-	234	221	224	1.98E+04	1.91E+04	1.87E+04
Central Valley Kh L2	12.8	+/-10%	11.52	14.08	ft/day	177	301	224	1.78E+04	2.32E+04	1.87E+04
Central Valley L2 Kh/Kz	0.2% (0.01 ft/day)	+/-10	0.001	0.10	-	215	212	224	1.91E+04	1.87E+04	1.87E+04
Southeastern Kh	100	+/-25%	75.0	125.0	ft/day	228	496	224	3.44E+04	3.70E+04	1.87E+04
Southeastern Kh/Kz	10% (10)	+/-10	1	100.0	-	210	226	224	1.82E+04	1.88E+04	1.87E+04
Volcanics Kh	1	+/-25%	0.75	1.25	ft/day	217	231	224	1.84E+04	1.90E+04	1.87E+04
Little Lake Kh	112.5	+/-25%	84.4	140.6	ft/day	353	630	224	2.81E+04	4.38E+04	1.87E+04
Little Lake Kh/Kz	10% (11.25)	+/-10	1.13	112.5	-	206	227	224	1.75E+04	1.89E+04	1.87E+04
Southeast General Head Boundary Elevation	3,140	+/-10 ft	3,130	3,150	ft	401	177	224	4.74E+04	2.33E+04	1.87E+04
Southeast General Head Boundary Conductance	367	+/-25%	275.3	458.8	ft2/day	205	559	224	2.70E+04	3.95E+04	1.87E+04
Little Lake Drain Boundary Elevation	3,110	+/-10 ft	3,100	3,120	ft	401	212	224	2.92E+04	1.64E+04	1.87E+04
LittleLake Drain Boundary Conductance	6.60E+05	+/-25%	5.0E+05	8.3E+05	ft2/day	223	224	224	1.87E+04	1.87E+04	1.87E+04
Northern Boundary Specified Flux	107,088	+/-10%	96,379	117,797	cfd	890	350	224	5.44E+04	2.53E+04	1.87E+04
Sierra Recharge	500,560	+/-10%	450504	550616	cfd	1320	419	224	9.92E+04	5.25E+04	1.87E+04
Northern Sy	0.035	0.01 - 0.1	0.01	0.1	-	--	--	--	3.05E+04	2.38E+04	1.87E+04
Northern Ss	3.50E-06	+/-10	3.50E-07	3.50E-05	1/ft	--	--	--	1.87E+04	1.87E+04	1.87E+04
Central Sy	0.1	0.01 - 0.2	0.01	0.2	-	--	--	--	1.97E+04	1.87E+04	1.87E+04
Central Ss	1.50E-06	+/-10	1.50E-07	1.50E-05	1/ft	--	--	--	1.96E+04	2.16E+04	1.87E+04
Southern Sy	0.1	0.01 - 0.2	0.01	0.2	-	--	--	--	1.87E+04	1.87E+04	1.87E+04
Southern Ss	3.50E-06	+/-10	3.50E-07	3.50E-05	1/ft	--	--	--	1.87E+04	1.87E+04	1.87E+04

Figure G-10: Summary of Steady-State Model Recalibration Input Parameter Sensitivity Analysis



- **Steady-State Model Sensitivity to Input Parameters** – The steady-state model was found to be most sensitive to specified flux parameters including the flux across the northern boundary of the model (Northern Boundary Specified Flux) and recharge from the Sierra Nevada mountain range (Sierra Recharge on Figure G-10). The steady-state model is relatively highly sensitive to the horizontal hydraulic conductivity (Kh) in the low permeability region between the LADWP property and Pumice Mine well (V816 to Pumice Mine Kh on Figure G-10), central valley horizontal hydraulic conductivity in layer 1, and Little Lake are horizontal hydraulic conductivity, and then the elevations specified for the drain cells and general head boundary cells in the south and southeast portions of the model grid.

- **Transient Model Sensitivity to Input Parameters** – The transient model was also found to be most sensitive to specified flux parameters including the flux across the northern boundary of the model (Northern Boundary Specified Flux) and recharge from the Sierra Nevada mountain range (Sierra Recharge on Figure G-11). The transient model was similarly sensitive to horizontal hydraulic conductivity in generally the same regions as the steady-state model. Neither model was very sensitive to vertical hydraulic conductivity, however, most of the monitoring well data is from wells screened near the water table, or wells that essentially fully penetrate the aquifer, so there is insufficient monitoring data to fully assess this parameter. Likewise, the transient model is relatively insensitive to aquifer storage properties. This is also mostly an artifact of the data available to calibrate the model which consists of three short pumping periods in the LADWP and Hay Ranch wells, with relatively steady water levels in the rest of Rose Valley the remainder of the calibration period (November 2007 to November 2009).

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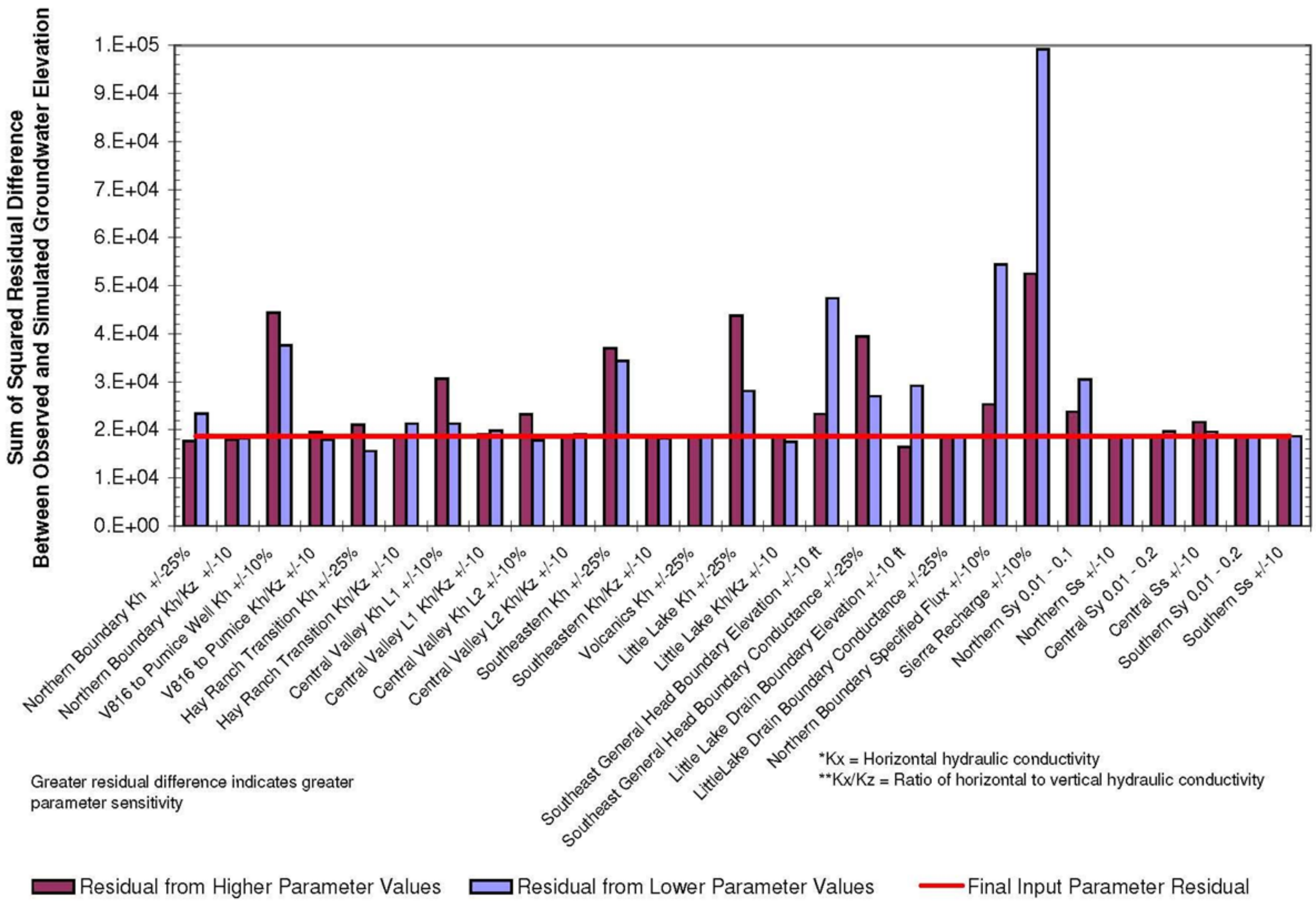
Figure G-11: Summary of Transient Model Recalibration Input Parameter Sensitivity Analysis



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G5. GROUNDWATER DEVELOPMENT IMPACT EVALUATION

This section describes procedures used to evaluate potential impacts of groundwater development associated with development of geothermal resources within the Haiwee Geothermal Leasing Area. Groundwater impacts associated with short-term groundwater extraction for well drilling, dust control, and minor operations and maintenance are unlikely to persist, or extend more than a short distance from wells used to supply these purposes. However, based on the analysis presented in the Hay Ranch Groundwater Extraction Project EIS (RMT, 2008), long-term groundwater extraction to support geothermal reservoir development has significant potential for impacting groundwater resources in Rose Valley. In the course of operation of a typical geothermal flash power plant, high temperature fluids are extracted from the geothermal reservoir, piped through a generator set to generate electricity, and then cooled and condensed for reinjection into the reservoir. During the cooling cycle of a flash steam power plant, a portion of the extracted fluid is lost by evaporation, consequently, more fluid is extracted from the geothermal reservoir on an annual basis than is available to re-inject, leading to a gradual decline in reservoir pressures, and a concomitant loss in electrical generating capacity.

Haizlip (2010) estimated that the water required to provide 100% injection of produced geothermal fluids (aka zero net withdrawal by mass from the reservoir) is equivalent to the fluid lost during power generation under the proposed development scenarios and is approximately 1,450 gallons per minute (gpm), or as much as 2,340 acre-ft per year (ac-ft/yr) for a typical 30 MWe dual flash geothermal power plant[1]. This estimate assumes that 100% of the fluid lost during evaporative cooling would be made-up and reinjected along with the condensate and waste brine by the addition of locally produced. Reinjection of less water than is produced from the geothermal reservoir may result in a gradual reduction in reservoir pressures and/or geothermal fluid yield, and as a consequence result in a gradual reduction in the quantity of steam available to generate power from the initial wells. However, most geothermal reservoirs have experienced pressure decline, most geothermal reservoir pressure decline is managed by a combination of injection and make-up drilling. With new wells and injection management, many geothermal reservoirs have produced for decades without 100% injection.

The rate of pressure decline would presumably be reduced with greater rates of injection. The rate of reduction in geothermal fluid availability with declining reservoir pressure is dependent on reservoir properties, the degree of development relative to the size and sustainable yield of the geothermal reservoir, and the rate of natural recharge of the geothermal reservoir. As these characteristics have not been determined for the Rose Valley geothermal lease area, the water needed to mitigate reservoir decline was estimated to provide zero net withdrawal from the reservoir.

For the Haiwee Geothermal Leasing Area EIS, the assumption was made that up to two 30 MWe dual flash geothermal power plants would be constructed within the Haiwee Action Area. As no specific development plans have been identified as yet, the main purpose of the analysis described below was to assess whether or not groundwater extraction to augment geothermal fluid injection, and thus bolster geothermal reservoir pressures, could be conducted at any location(s) within the Haiwee Action Area. Based on the unique hydrogeologic setting of Rose Valley, and existing groundwater uses, potential impacts from long-term groundwater extraction can be broadly classified into two categories: impacts to existing water supply wells related to possible increased depth to groundwater or reduced well yield; and, impacts to the sensitive surface water features at the Little Lake Ranch property at the south end of the valley.

G5.1. Evaluation Procedures

Transient groundwater flow simulations were conducted to evaluate the impacts of potential long-term groundwater extraction to augment geothermal fluids. Input parameters from the recalibrated transient numerical model of Rose Valley described in Section G3 were used to run a series of simulation scenarios to forecast potential impacts on groundwater elevation and groundwater quantity. Starting groundwater elevations and boundary conditions were set equal to the final values from the transient calibration model representing

[1] Also see Appendix J for annual water consumption of the RFD and other technologies.

groundwater elevations in Rose Valley in November 2009. Pumping from existing domestic, commercial and light industrial supply wells was specified as described for the transient calibration model. Pumping on the LADWP and Hay Ranch properties was not simulated in these analyses. A timeline for the LADWP groundwater development project to capture seepage from the South Haiwee Reservoir has not been established. Pumping for the Hay Ranch Groundwater Extraction Project began in December 2009 (Harrington, 2010) at an initial rate of approximately 700 gpm (1,130 acre-ft/yr); however, a schedule for implementation of the planned operation at 1,859 gpm (3,000 acre-ft/yr) allowed by the Conditional Use Permit for the project has not been established. Consequently, the following discussion pertains to groundwater extraction for the geothermal development project, only.

The cumulative impact of multiple groundwater development projects is more or less additive, that is, if one extraction well causes ten feet of drawdown at a particular location, two wells will likely produce double that amount of drawdown. The timing of cumulative impacts will of course be dependent on the pumping schedule for individual projects, the location of the individual extraction wells relative to sensitive receptors, and the extraction rate of each extraction well. The cumulative impact resulting from augmenting geothermal reservoir pressures, and conducting either or both the LADWP's proposed seepage capture project and the Hay Ranch Groundwater Extraction Project are not evaluated here, but can reasonably be assumed to be greater than the impacts of any individual project.

Because of the unique hydrogeologic conditions that exist in Rose Valley, previous studies (RMT, 2008) found that some amount of groundwater table drawdown resulting from long-term groundwater extraction may persist for a period after pumping is stopped, and, that for locations more distant from the extraction well, the time of maximum drawdown effects may occur after the active pumping period for a project ends. Therefore, drawdown impact forecasts were conducted with varying numbers of extraction wells (one or two) and several different locations (north or south in the Haiwee Action Area) to assess potential impacts of different potential development scenarios. In addition, 200 year long numerical simulations were conducted to assess the magnitude of maximum impacts and their timing relative to the active extraction period.

Two groundwater development scenarios associated with geothermal development were considered:

G1.1.1. Scenario 1 – Extraction to Replace 100% of Lost Fluid

For this scenario, numerical groundwater flow model simulations were conducted to evaluate the potential groundwater resource impacts that might develop in the event that groundwater was extracted to provide water to support injection at rates comparable to 100% of the average annual geothermal fluid loss rate. Extraction was assumed to occur continuously for the 30 year geothermal project lifespan. Several sub-scenarios were evaluated including:

- Extraction from one well at a rate of 2,340 acre-ft/yr to support one 30 MWe dual flash geothermal power plant at the north end of the proposed BLM geothermal lease area, approximately 3 miles from north of Coso Junction (1 plant north);
- As above, but from an extraction well at the south end of the proposed BLM geothermal lease area, approximately 1-1/4 miles south of Coso Junction (1 plant south);
- Extraction from two wells at a total rate of 4,680 acre-ft/yr to support two 30 MWe dual flash geothermal power plants at the north end of the proposed BLM geothermal lease area, approximately 3 miles north of Coso Junction (2 plants north);
- As above, but from two extraction wells located at the south end of the proposed Haiwee Action Area, approximately 1-1/4 miles south of Coso Junction (2 plants south).

G2.1.1. Scenario 2 – Sustainable Extraction at Rate Unlikely to Impact Little Lake

For this scenario, numerical groundwater flow model simulations were conducted to evaluate the groundwater extraction rate that could be sustained for a geothermal project lifespan without causing excessive drawdown or capturing groundwater needed to support surface water features and riparian habitat at the south end of Rose Valley on the Little Lake Ranch property. This criterion was adapted from the Hay Ranch Groundwater Extraction Project Hydrologic Monitoring and Mitigation Plan (HMMP), RMT (2008) which determined that drawdown from groundwater extraction in Rose Valley could not be allowed to cause a greater than 10% reduction in groundwater flow towards the Little Lake Ranch property to avoid causing significant and potentially irreversible impacts to surface water features on the property. For this evaluation, numerical simulations were conducted in iterative fashion to evaluate the maximum groundwater extraction rate that could be sustained for a 30 year project life, without causing a greater than 10% reduction in groundwater flow towards the Little Lake Ranch property. Two sub-scenarios were evaluated including:

- Groundwater extraction at the north end of the Haiwee Action Area, approximately 3 miles north of Coso Junction; and,
- Groundwater extraction at the south end of the Haiwee Action Area, approximately 1-1/4 miles south of Coso Junction.

G5.2. Potential Drawdown Impacts

G5.2.1 Predicted Impacts from Pumping at Full Augmentation Rate

The predicted drawdown impacts of pumping at the full rate needed to augment a geothermal reservoir due to operation of one (1) or two (2) 30 MWe power plants are illustrated in **Figures G-12** and **G-13**, respectively. **Figure G-14** illustrates potential impacts of groundwater development to augment the geothermal reservoir on groundwater flow available to the surface water features at the Little Lake Ranch property at the south end of the valley.

In the north and central parts of Rose Valley, the primary impact to existing or proposed water wells is the reduction in water levels (drawdown) resulting from extraction for geothermal reservoir augmentation. The magnitude of potential impacts depends on the amount of extraction and the location of extraction relative to the property of interest. The drawdown induced by wells operated to support geothermal reservoir augmentation could make some wells unusable without deepening and increase well lift, and thereby increase energy costs for pumping, or reduce well yields. Predicted drawdown near the LADWP property at the north end of the valley may be as little as 10 ft for a single geothermal augmentation well situated at the south end of the Haiwee Action Area, which is predicted to increase to as much as 40 ft if two geothermal augmentation wells were situated at the north end of the Haiwee Action Area.

Predicted drawdown near the Dunmovin community, which has a number of private domestic supply wells, was similarly predicted to range from over 10 ft for a single geothermal augmentation well situated at the south end of the Haiwee Action Area, to greater than 70 ft if two geothermal augmentation wells were situated at the north end of the Haiwee Action Area. Well construction details for wells in the Dunmovin area are not available, but the latter impact scenario would likely impact a number of wells in that area.

Predicted drawdown near Coso Junction, which has several currently active water supply wells, was predicted to range from approximately 20 ft for a single geothermal augmentation well situated at the south end of the Haiwee Action Area, to greater than 50 ft if two geothermal augmentation wells were situated at the south end of the Haiwee Action Area (map not shown). Wells serving the Coso Junction Store (Coso Junction #2) and the Coso Ranch (Coso Ranch South) might not need to be deepened as a result of these impacts, but would likely experience greater pumping costs due to increased lift requirements, and possibly reduced yield.

The effects of simultaneous groundwater extraction on the Hay Ranch property for the Hay Ranch Extraction and Delivery System project to augment geothermal reservoir recovery at the Coso Geothermal Field are not considered in this forecast; however, pumping effects would be additive, consequently greater impacts would occur if both projects extracted groundwater in Rose Valley.

Groundwater extraction to support geothermal reservoir augmentation could also reduce the amount of groundwater available to sustain surface water features on the Little Lake Ranch property. As shown on Figure G-14, all of the scenarios evaluated in which continuous pumping at rates of 1,450 gpm or 2,340 acre-ft/yr from each well for 30 years, result in a reduction in groundwater flow towards Little Lake. The reduction in groundwater flow is greater for two wells (supporting two geothermal power plants) and greater for extraction wells located closer to Little Lake. However, in all cases, the predicted reduction in groundwater flow exceeds the threshold of 10 percent identified as protective of Little Lake surface water features in the Hay Ranch Groundwater Extraction Project Hydrologic Monitoring and Mitigation Plan (HMMP) prepared by MHA (2008). That is, supplying groundwater for 100% injection (zero net withdrawal) requiring operation of one geothermal reservoir augmentation well for the 30 year project life would likely reduce groundwater flow to Little Lake by greater than 10 percent potentially causing adverse impacts to surface water features on the property.

Figure G-12: Potential Drawdown from Pumping One Well for Geothermal Augmentation at 2,340 acre-ft/yr

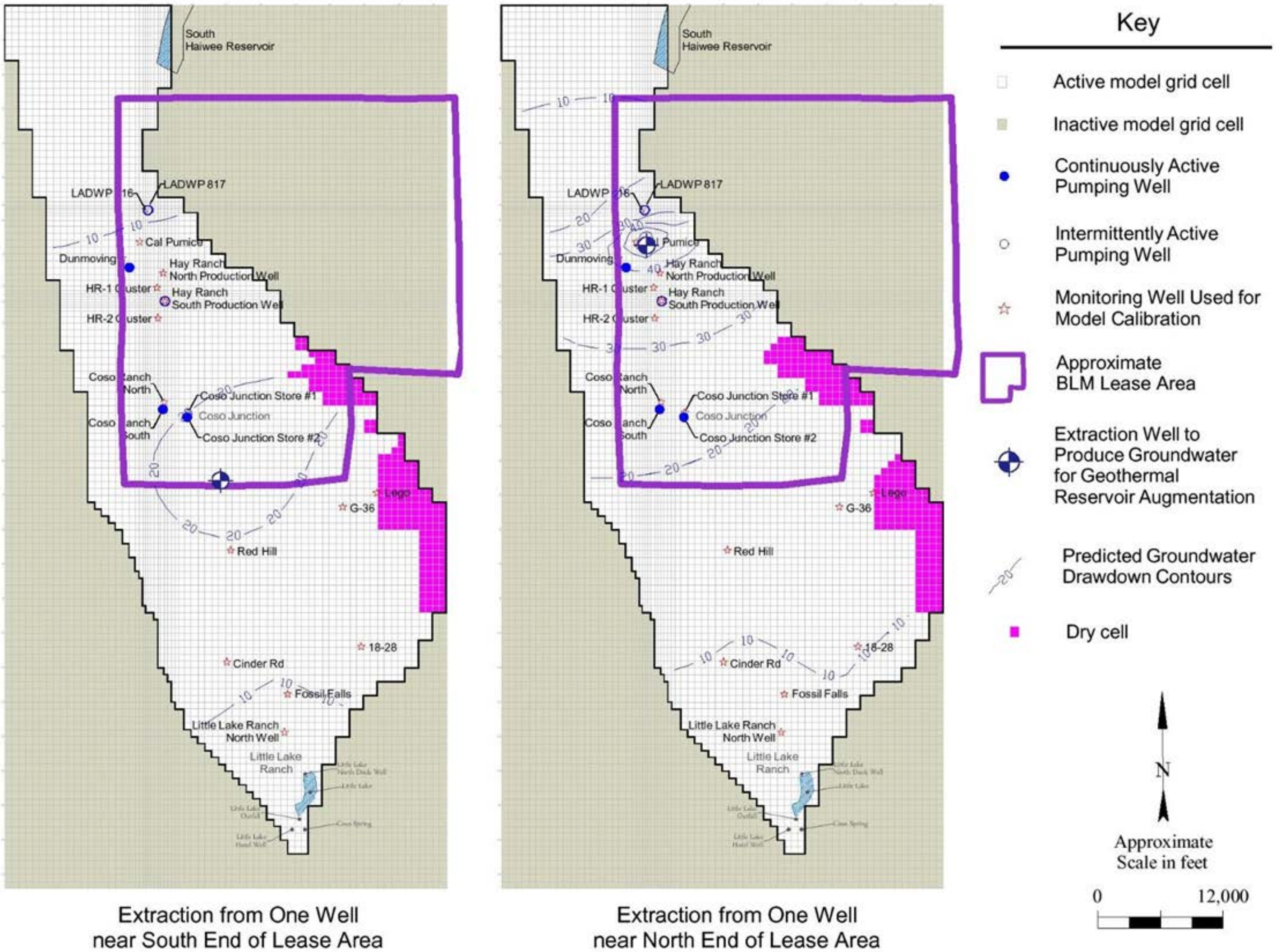
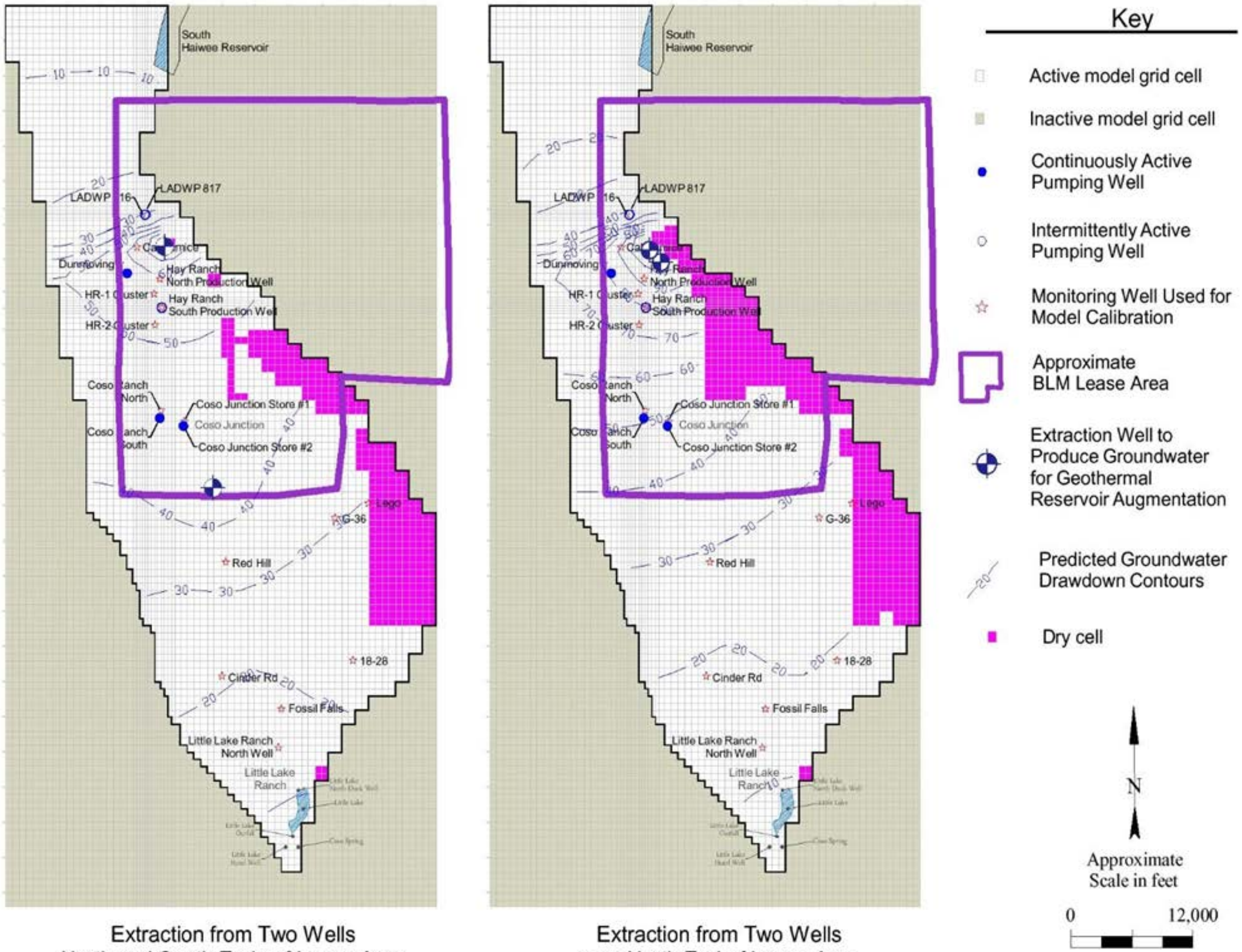


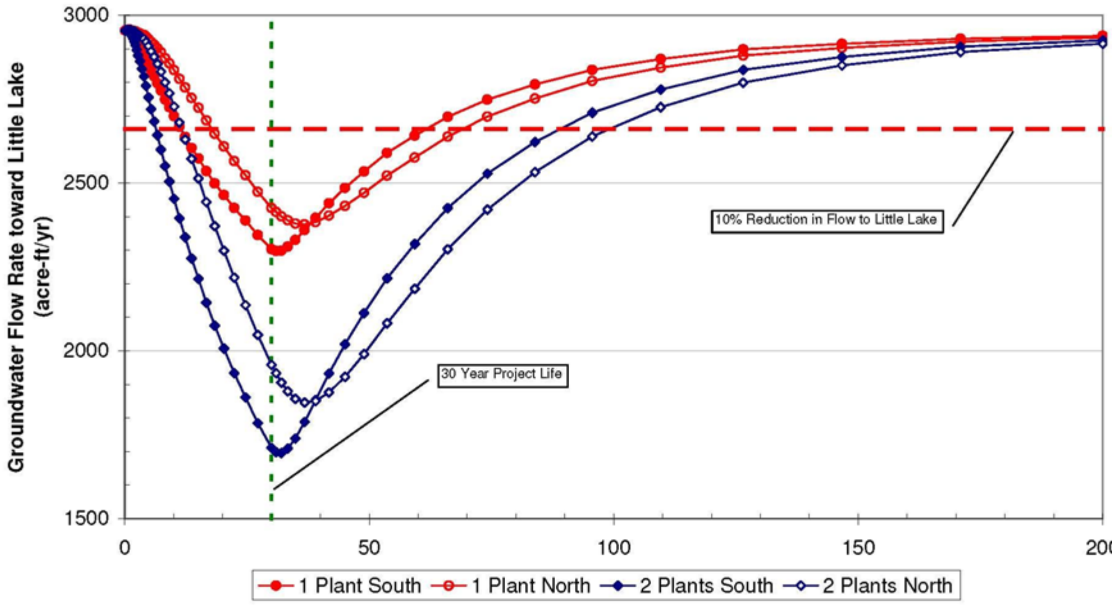
Figure G-13: Potential Drawdown from Pumping Two Wells for Geothermal Augmentation at 4,680 acre-ft/yr



Extraction from Two Wells North and South Ends of Lease Area

Extraction from Two Wells near North End of Lease Area

Figure G-14: Potential Reduction in Groundwater Flow to Little Lake from Pumping for 100% Geothermal Augmentation



G5.2.2. Predicted Impacts from Pumping at Reduced Augmentation Rate

For Scenario 2, simulation runs were conducted to forecast the potential impacts of pumping at reduced rates designed to provide some water for geothermal reservoir augmentation but specifically intended to reduce the risk of adverse impacts to surface water features at Little Lake. As discussed in Section G4.1.2, several simulation scenarios were conducted to forecast potential impacts. These evaluations indicated that pumping from a single extraction well located at the northern end of the Haiwee Action Area would have the least potential for impacting Little Lake, while pumping from an extraction well located at the southern end of the Haiwee Action Area would likely have greater impact. The model simulations indicated that pumping at a rate of 625 gpm or 1,000 acre-ft/yr from a well located near the southern end of the Haiwee Action Area could be sustained for 30 years without reducing groundwater flow towards Little Lake by more than 10 percent. However, the same simulation indicated that the maximum predicted drawdown at the Little Lake Ranch North well, located near the north end of the Little Lake Ranch property could exceed 3.5 ft approximately 30 years after the start of pumping at that rate, which exceeds the Maximum Acceptable Drawdown threshold of 0.4 feet established for this well in the Hay Ranch HMMP. A simulation scenario with a single groundwater extraction well located at the northern end of the Haiwee Action Area indicated that a pumping rate of approximately 715 gpm or 1,150 acre-ft/yr could be sustained for 30 years without reducing groundwater flow towards Little Lake by more than 10 percent. However, the same simulation indicated that the maximum predicted drawdown at the Little Lake Ranch North well, located near the north end of the Little Lake Ranch property could exceed 3.5 ft approximately 30 years after the start of pumping at that rate, which also exceeds the Maximum Acceptable Drawdown threshold of 0.4 feet established for this well in the Hay Ranch HMMP. Consequently, lower pumping rates may be required to meet both the groundwater flow and drawdown thresholds established in the Hay Ranch HMMP for protection of surface water features at Little Lake. As was noted in the previous section, the effects of other major groundwater development projects in Rose Valley, including the Hay Ranch Groundwater Extraction and Transfer project and the LADWP's proposed Haiwee Reservoir seepage capture project are not included in this analysis; however, the effects of additional pumping are expected to be additive, with greater impact resulting from higher combined pumping rates or pumping durations.

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APPENDIX I

LAND UNDER BUREAU OF LAND MANAGEMENT STEWARDSHIP

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APPENDIX I

LANDS UNDER BUREAU OF LAND MANAGEMENT STEWARDSHIP

Fee Ownership

Mount Diablo Meridian,
T. 21 S., R. 37 E.,
sec. 11, lot 1, 2, 9 to 11, inclusive, 14, NW1/4SW1/4NW1/4NE1/4, E1/2NW1/4NW1/4NE1/4, NE1/4NW1/4, SE1/4SW1/4;
sec. 12;
sec. 13;
sec. 14, lots 1 to 3, inclusive, 5 to 10, inclusive, W1/2NE1/4NW1/4, NW1/4SW1/4, S1/2SW1/4, SE1/4SE1/4.
sec. 23, N1/2S1/2, N1/2S1/2S1/2, S1/2SE1/4SE1/4;
sec. 25;
sec. 26, E1/2E1/2;
sec. 35,
sec. 36.

Mount Diablo Meridian,
T. 22 S., R. 37 E.,
sec. 1;
sec. 2, lots 1 and 2 in the NE1/4, lots 1 and 2 in the NW1/4, SW1/4, excluding patent 1084708;
sec. 11;
sec. 12.

Mount Diablo Meridian,
T. 21 S., R. 38 E.,
sec. 7;
sec. 8;
sec. 9;
sec. 10;
sec. 15;
sec. 17;
sec. 18;
sec. 19;
sec. 20;
sec. 21;
sec. 22;
sec. 27;
sec. 28;
sec. 29;
sec. 30;
sec. 31;
sec. 32;
sec. 33;
sec. 34.

HGLA Lands Under BLM Stewardship (cont'd):

Mount Diablo Meridian,
T. 22 S., R. 38 E.,
sec. 5;
sec. 6, lots 3 to 14, inclusive;
sec. 7;
sec. 8.
Containing 22,548 acres more or less.

Mineral Only

Mount Diablo Meridian,
T. 21 S., R. 37 E.,
sec. 11, lots 4 to 7, inclusive, 12, 13, NE1/4NE1/4, E1/2NW1/4NE1/4, E1/2W1/2NW1/4NE1/4, SW1/4SW1/4NW1/4NE1/4, E1/2SE1/4SW1/4, S1/2SE1/4;
sec. 14, lot 11, E1/2NE1/4NW1/4;
sec. 23, S1/2S1/2SW1/4, S1/2SW1/4SE1/4
sec. 26, SW1/4, W1/2E1/2.
Containing 2,288 acres more or less.

Private Lands within HGLA

Township, Range, Section	Inyo County Plan Land Use Designation
T21S R37E Sec 23 N ½	NR-Natural Resources
T21S R37E Sec 23 S ½ of S ½ of SW ¼, S ½ of SW ¼ of SE ¼	RC-Retail Commercial NR-Natural Resources
T21S R37E Sec 26 W ½ of E ½, W ½	NR-Natural Resources
T22S R37E Sec 2 SW ¼	A-Agriculture RC-Retail Commercial RRH-Residential Rural High Density
T22S R38E Sec 6 W ½ of W ½	NR-Natural Resources

Source: Inyo County Plan Land Use and Conservation/Open Space Elements Maps, Diagrams 1 & 22

APPENDIX K

LEASE STIPULATIONS AND PROGRAMMATIC BMPS

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APPENDIX K

STANDARD LEASE STIPULATIONS AND GEOTHERMAL PROGRAMMATIC BEST MANAGEMENT PRACTICES

K.1.0 INTRODUCTION

To ensure leasing decisions remain appropriate in light of continually changing circumstances and new information, the BLM develops and applies criteria for lease stipulations exceptions, waivers, and modifications. An exception, waiver, or modification may not be approved unless, 1) the Authorized Officer determines that the factors leading to inclusion of the stipulation in the lease have changed sufficiently to make the protection provided by the stipulation no longer justified; or 2) the proposed operations would not cause unacceptable impacts. (43 CFR 3101.1-4)

- An **exception** is a one-time exemption for a particular site within the leasehold; exceptions are determined on a case-by-case basis; the stipulation continues to apply to all other sites within the leasehold. An exception is a limited type of waiver.

- A **waiver** is a permanent exemption from a lease stipulation. The stipulation no longer applies anywhere within the leasehold.

- A **modification** is a change to the provisions of a lease stipulation, either temporarily or for the term of the lease. Depending on the specific modification, the stipulation may or may not apply to all sites within the leasehold to which the restrictive criteria are applied.

An exception, waiver, or modification may be approved if the record shows that circumstances or relative resource values have changed or that the lessee can demonstrate that operations can be conducted without causing unacceptable impacts and that less restrictive requirements would meet resource management objectives. This process is more fully explained in the Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States Programmatic Environmental Impact Statement (BLM 2008a), Chapter 2 and is incorporated into this document by reference.

K.2.0 STANDARD STIPULATIONS

In direct response to public comment, consultation, and staff recommendation, the following standard lease stipulations were developed for the HGLA. These stipulations will be required and applied to each of the action alternatives that authorize geothermal leasing (Alternatives A, B, and C) with the two following exceptions: NSO-HGLA-1 shall only apply to Alternatives B and C.

K.2.1 No Surface Occupancy (NSO) Stipulations

NSO-HGLA-1: No surface occupancy or use is allowed on the lands within the identified sensitive resources area within the HGLA.

This stipulation has been removed from the Special Administration Stipulations being considered for HGLA in this FSEIS. Refer to NSO-HGLA-2 below.

NSO-HGLA-2: No surface occupancy or surface use is allowed within any ACEC within the HGLA.

The locations of the ACECs are detailed in the DRECP LUPA (BLM 2015).

Purpose: This stipulation is for the protection of cultural and historical resources found within the Rose Springs ACEC.

Exception: This stipulation will only be granted an exception by the Authorized Officer under extraordinary circumstances.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

K.2.2 CONTROLLED SURFACE USE (CSU) STIPULATIONS

CSU-HGLA-1: The use of all lands within the HGLA shall be controlled with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is generally defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

Purpose: To conserve the Mojave ground squirrel (*Xerospermophilus mojavensis*) (MGS) and its habitat. Potential MGS habitat is defined as any area where MGS is likely to occur based on compatible vegetation, soil, elevation, climate, and region. Known MGS habitat is defined as those areas where MGS have been observed. The HGLA site contains potential and known habitat for the MGS. This habitat is identified by creosote bush scrub with a diverse mix of sub-shrubs and herbaceous plants, with shrubs in the Chenopodiaceae (Goosefoot Family) such as spiny hopsage (*Grayia spinosa*), winterfat (*Krascheninnikovia lanata*), and saltbush (*Atriplex* species) being favored.

1) In areas where potential habitat for the MGS exists, presence shall be assumed and spring trapping surveys are to be conducted prior to any ground disturbing activity on undisturbed ground. Such surveys shall be conducted according to the California Department of Fish and Wildlife (CDFW) protocol i.e. the trapping methodologies outlined in the *California Department of Fish and Game Mojave Ground Squirrel Survey Guidelines* (2010).

2) If MGS are detected using trapping surveys, the proponent must obtain a 2081 Incidental Take Permit from CDFW prior to proceeding with any ground disturbing activity.

3) If trapping that follows CDFW protocol does not detect MGS, or if identified MGS habitat does not exist within the area of proposed disturbance, mitigation and a permit are not necessary for the year in which the ground-disturbing activity will occur.
4) If ground-disturbing activities do not begin within the year that trapping was conducted, presence of the species shall be assumed, and the procedure identified in a) above shall be followed.

Exception: An exception to this stipulation may be granted by the Authorized Officer after coordination with CDFW if the operator submits a plan that demonstrates that impacts from the proposed action can be fully mitigated.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

CSU-HGLA-2: The use of all lands within the HGLA shall be controlled with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

Purpose: to protect federally listed threatened and endangered species, or other special status and state listed species, because the lease area may contain plants or animals determined to be threatened or endangered, or other special status species and their habitats

a) BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid activities that will contribute to a need to list such species or their habitat.

b) BLM will disapprove or require modifications to a proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of designated or proposed critical habitat.

c) BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its statutory obligations under the Endangered Species Act as amended, 16 USC 1531 et seq., including completion of any required procedure for conference or consultation.

d) The holder shall comply with the Biological Opinion for listed species and Conference Opinion for proposed species associated with this project issued by the US Fish and Wildlife Service (USFWS). Failure to comply with the requirements of the Biological Opinion or Conference Opinion shall be cause for lease suspension or termination as provided in 43 CFR 3213.17 and 43 CFR 3200.4.

e) Unless otherwise agreed to in writing by the Authorized Officer, power lines shall be constructed in accordance with standards outlined in *Suggested Practices for Avian Protection on Power Lines: State of the Art in 2006* (APLIC 2006). The holder shall assume the burden and expense of proving that pole designs not shown in the above publication are "eagle safe." Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modifications or additions to all power line structures placed on the right-of-way, should they be necessary, to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States Government.

f) Bald and/or golden eagles may be found to use the project area. The BLM will not issue a notice to proceed for any project that is likely to result in take of bald eagles and/or golden eagles until the applicant completes its obligation under applicable requirements of the Bald and Golden Eagle Protection Act (BGEPA), including completion of any required coordination with the USFWS. The BLM hereby notifies the applicant that compliance with the BGEPA is a dynamic and adaptable process which may require the applicant to conduct further analysis and mitigation following assessment of operational impacts. Any additional analysis or mitigation required to comply with the BGEPA will be developed with the USFWS and coordinated with the BLM. The BLM will require the applicant to prepare a Bird and Bat Conservation Strategy (BBCS) that defines mitigation and conservation measures relative to avian and bat species in the area.

Exception: An exception to this stipulation may be granted by the Authorized Officer in coordination with the USFWS if the operator submits a plan that demonstrates that impacts from the proposed action are discountable or can be fully mitigated.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

CSU-HGLA-3: The use of all lands within the HGLA shall be controlled with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

Purpose: to consider effects to historic properties and cultural resources consistent with the National Historic Preservation Act (NHPA), Archaeological Resources Protection Act (ARPA), National Environmental Policy Act (NEPA), Federal Land Policy and Management Act (FLPMA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and other statutes, regulations, and policies.

a) All fieldwork required after a proposed leasing development has been submitted to the BLM will be performed under the terms of a CRUP and FA issued by the BLM.
b) A Class I records search and literature review must be undertaken prior to submission of a FA permit request to BLM. The Class I shall be utilized to develop a research design and work plan for all cultural resource studies in the project development area including those portions of the development that extend outside the area to be leased.
c) A new Class III inventory, subject to conditions and the establishment of a proposed Area of Potential Effects, must be prepared after an authorization to proceed by BLM has been granted.
d) BLM will require the development of a geo-archaeological study of the entire direct effects APE and may require the development of a separate historic-built environment study.
e) Any technical reports generated for the project will require a BLM-mandated peer review. Encountered resources may have to undergo field testing to determine if the find is a historic property or not.
f) Before, during or after the fieldwork is taking place, BLM will consult with tribal stakeholders to identify any resources in the project area that have cultural or religious significance to the Tribes or Tribal Organizations. The BLM may require the development of an ethnographic assessment for the project if the Tribes or Tribal Organizations indicate that they have additional information that should be considered in the Section 106 review process.
g) Historic properties encountered during the Class III or the ethnographic assessments of the project will be avoided, where possible, during construction, operations, and decommissioning. If technical research suggests a resource is not a historic property, BLM may decide at its discretion that the resource must be nonetheless avoided.
h) Avoidance of impacts through project design will be given priority over other treatments associated with potential adverse effects. Avoidance measures include moving project elements away from site locations or into areas bearing previous development impacts or restricting travel to existing roads.
i) When adverse effects to historic properties from any proposed renewable energy project application within the developmental area are identified, the BLM will execute a project-specific MOA pursuant to 36 C.F.R. § 800.6 to fulfill the intent of the DRECP PA. Historic properties will be treated and managed in accordance with process defined under the MOA. Any data recovery as treatment of adverse effects will be preceded by approval of a detailed research design.
j) The BLM will identify all mitigation measures for historic properties that will be adversely affected by a specific project in an Historic Properties Treatment Plan (HPTP) that will be included as an appendix to the MOA. The Applicant is responsible for implementing all of the terms of the MOA, with BLM oversight.
k) The BLM, in consultation with the SHPO, the ACHP (if participating), and project-specific consulting parties, will develop a comprehensive plan to manage post-review discoveries and unanticipated effects during project construction. The plan will be attached to any project-specific MOA or PA as an appendix, and implemented by the Applicant, with BLM oversight.
l) If an area exhibits a high potential for containing subsurface cultural resources, but no resources were observed during a Class III inventory, monitoring by a qualified archaeologist could be required during all excavation and earthmoving in the high-potential area.
m) If long-term management of historic properties is required, BLM shall ensure that a Historic Properties Management Plan (HPMP) will be developed for all projects where historic properties

require long term management. The HPMP will be developed in consultation with the SHPO, the ACHP (if participating), and project-specific consulting parties. The HPMP will identify how historic properties will be managed through project Operations and Maintenance, and Decommissioning. The Applicant is responsible for implementing the terms of the HPMP, with BLM oversight.

Exception: An exception to this stipulation may be granted by the Authorized Officer if the operator submits a plan that demonstrates that impacts from the proposed action or elements of the proposed action is unlikely to impact a historic property.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

K.2.3 TIMING LIMITATION (TL) STIPULATIONS

TL-HGLA-1: The use of all lands within the HGLA shall be controlled with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

Purpose: To conserve the desert tortoise (*Gopherus agassizii*) and its habitat, the following stipulations apply:

a) The HGLA is situated in the northern extent of the desert tortoise's range. Prior to ground disturbance, desert tortoise protocol surveys shall be conducted according to guidelines set forth by the U.S. Fish and Wildlife Service.

b) The lease holder shall retain a desert tortoise Authorized Biologist approved by USFWS who would be responsible for ensuring compliance with desert tortoise stipulations prior to the initiation of and during ground-disturbing activities, including installation of desert tortoise exclusion fencing. The Authorized Biologist shall conduct clearance surveys within the desert tortoise exclusion fence, and other duties such as tortoise handling, artificial burrow construction, egg handling and other procedures as necessary in accordance with the *Guidelines for Handling Desert Tortoise during Construction Projects* (Desert Tortoise Council 1994) or the most current guidance provided by USFWS.

c) The Authorized Biologist shall be present on the project site from March 15 through October 31 (active season) during ground-disturbing activities in areas that have not been enclosed with tortoise exclusion fencing. The Authorized Biologist will be on-call from November 1 to March 14 (inactive season) and shall check construction areas that have not been enclosed with tortoise exclusion fencing immediately before construction activities begin at all times.

d) The lease holder shall incorporate desert tortoise exclusion fencing, approved by USFWS, into any permanent fencing surrounding the proposed facility prior to the initiation of ground disturbing activities to avoid potential harm to desert tortoise in the project area. Tortoise exclusion fencing should be constructed in accordance with the *Desert Tortoise Exclusion Fence Specifications* (USFWS 2005) or the most current guidance provided by USFWS and CDFW.

e) The lease holder shall install desert tortoise exclusion fencing around temporary project disturbance areas such as staging areas, storage yards, excavations, and linear facilities during construction. Construct fences in late winter or early spring to minimize impacts to tortoises and accommodate subsequent tortoise surveys.

f) Within 24 hours prior to the initiation of construction of tortoise exclusion fence, the Authorized Biologist shall survey the fence alignment to ensure it is cleared of desert tortoises. Following construction of the tortoise-exclusion fence, the Authorized Biologist shall conduct clearance surveys within the fenced area to ensure as many desert tortoises as possible have been removed from the site following the guidance in the approved desert tortoise translocation plan.

g) The lease holder shall install and regularly maintain exclusion fencing to prevent desert tortoise passage into the project area.

h) Heavy equipment shall only be allowed to enter the project site following the completion of desert tortoise clearance surveys of the project area by the Authorized Biologist. The Authorized Biologist shall monitor initial clearing and grading activities to ensure any tortoises missed during the initial clearance survey are moved from harm's way following the guidance in the approved desert tortoise translocation plan.

i) Following installation, the permanent fencing should be inspected quarterly and after major rainfall events to ensure fences are intact and there is no ground clearance under the fence that would allow tortoises to pass. The lease holder shall ensure that any damage to the permanent or temporary fencing is immediately blocked to prevent tortoise access and permanently repaired within 72 hours between March 15 and October 31, and within 7 days between November 1 and March 14.

j) The Authorized Biologist shall inspect any construction pipe, culvert, or similar structure with a diameter greater than 3 inches, stored less than 8 inches above ground and within desert tortoise habitat (i.e., outside the permanently fenced area) for one or more nights, before the material is moved, buried or capped. As an alternative, all such structures may be capped before being stored outside the fenced area or placed on pipe racks. These materials would not need to be inspected or capped if they are stored within the permanently fenced area after desert tortoise clearance surveys have been completed.

k) The lease holder shall ensure vehicular traffic does not exceed 25 miles per hour within the delineated project areas or on access roads in desert tortoise habitat. On unpaved roads the speed limit should be 10 miles per hour to suppress dust and protect air quality.

l) Any time a vehicle or construction equipment is parked in desert tortoise habitat outside the permanently fenced area, the Authorized Biologist or drivers of the vehicle shall inspect the ground under the vehicle for the presence of desert tortoise before it is moved. If a desert tortoise is observed, it should be left to move on its own. If it does not move within 15 minutes, the Authorized Biologist may remove and relocate the animal to a safe location.

m) The lease holder shall design culverts to allow safe passage of tortoises.

n) If desert tortoise relocation is determined to be an appropriate conservation measure, the lease holder shall develop and implement a Desert Tortoise Translocation Plan for approval by CDFW, USFWS and BLM. The Plan shall designate a relocation site as close as possible to the disturbance site that provides suitable conditions for long term survival of the relocated desert tortoise and outline a method for monitoring the relocated tortoise.

o) If desert tortoises are observed within the HGLA, consult with USFWS and CDFW to determine the need for and/or feasibility of conducting relocation or translocation as minimization or mitigation for project impacts. Development and implementation of a translocation plan may require, but not be limited to, additional surveys of potential recipient sites; disease testing and health assessments of translocated and resident tortoises; and consideration of climatic conditions at the time of translocation. Because of the potential magnitude of the impacts to desert tortoise from proposed renewable energy projects, USFWS and CDFW must evaluate translocation efforts on a project by project basis in the context of cumulative effects.

p) If the desert tortoise protocol surveys indicate that there are no desert tortoises, and/or desert tortoise habitat, within the project area, the lease holder may apply for a waiver to one or more of the above stipulations.

<u>Exception</u>: An exception to this stipulation may be granted by the Authorized Officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

<u>Modification</u>: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

<u>Waiver</u>: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

K.2.4 SPECIAL ADMINISTRATION (SA) STIPULATIONS

<u>SA-HGLA-1</u>: The BLM Authorized Officer for the administration of this lease is the Field Manager, Ridgecrest Field Office, Ridgecrest, CA; Phone 760-384-5400.

Exception: This stipulation will only be granted an exception by the Authorized Officer under extraordinary circumstances.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

SA-HGLA-2: Unitization Stipulation: This has been removed from the Special Administration Stipulations being considered for HGLA in this DSEIS.

SA-HGLA-3: The lease holder shall construct, operate, and maintain the facilities, improvements, and structures within this geothermal lease area in strict conformity with the approved Plan of Development (POD), as amended or supplemented by approval of the Authorized Officer. All exploration, development, construction, and reclamation activities shall conform as closely as possible to the latest edition of the BLM/U.S. Forest Service publication: The Gold Book – *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (Available Online at https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/operations-and-production/the-gold-book)*. Any surface disturbing activity, additional construction, or use that is not in accord with the approved Plan of Development shall not be initiated without the prior written approval of the Authorized Officer. A copy of the lease, including all stipulations and approved Plan of Development, shall be available at all times onsite during construction, operation, and decommissioning. Noncompliance with the above will be grounds for immediate temporary suspension of activities if it constitutes a threat to public health or safety or the environment.
Exception: An exception to this stipulation may be granted by the Authorized Officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.
Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

SA-HGLA-4: Actions and activities of the lease holder within the HGLA will be governed by all mitigation measures and best management practices (BMPs) detailed in the *Best Management Practices and Guidance Manual: Desert Renewable Energy Projects*, September 2010, as directed by the Authorized Officer, as well as applicable Conservation Management Actions (CMA) and BMPs listed in the DRECP.

Exception: An exception to this stipulation may be granted by the Authorized Officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: A modification to this stipulation may be granted by the Authorized Officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

SA-HGLA-5: Actions and activities of the lease holder within the HGLA will be governed by all mitigation measures and best management practices as detailed in the *Geothermal Resources Leasing Programmatic EIS,* October 2008, as directed by the Authorized Officer.

Exception: An exception to this stipulation may be granted by the Authorized Officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: A modification to this stipulation may be granted by the Authorized Officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.
Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

SA-HGLA-6: The leaseholder will be liable for all fire suppression costs resulting from fires caused during construction, operations, or decommissioning. The lease holder shall comply with all guidelines and restrictions imposed by agency fire control officials.

Exception: This stipulation will only be granted an exception by the Authorized Officer under extraordinary circumstances.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

SA-HGLA-7: The three noncompetitive lease applications (CACA 043998, CACA 044082, CACA 043993) within the HGLA were pending on August 8, 2005. Therefore, all geothermal leases will be issued subject to the revised regulations at *43 CFR 3200.8 (b)(1)* and *(b)(3)*. The lease applicant must make its election and provide written notice to the BLM of their preference for payment of royalties on production before the lease may be issued.

Exception: This stipulation will only be granted an exception by the Authorized Officer under extraordinary circumstances.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

SA-HGLA-8: Potential geothermal lessees should be aware of the revised due diligence requirements contained in the federal regulations at *43 CFR § 3207*. Leases are typically issued for an initial term of 10 years and may be extended if diligent work requirements have been satisfied and the BLM believes that the lessee has made satisfactory progress in complying with the lease terms and stipulations.

Exception: This stipulation will only be granted an exception by the Authorized Officer under extraordinary circumstances.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

SA-HGLA-9: The BLM may, after giving 30 days written notice, terminate a lease if it has been determined that there has been a violation of any of the requirements of *43 CFR § 3200.4*, including but not limited to compliance with the terms and conditions of the lease, including any and all lease stipulations, and the nonpayment of required annual rentals or royalties and fees (*43 CFR § 3213.17*.)

Exception: This stipulation will only be granted an exception by the Authorized Officer under extraordinary circumstances.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

SA-HGLA-10: The consumptive use of water within the HGLA shall be controlled in accordance with applicable Inyo County, State of California Regulations, and with regard to the following set of stipulations. The HGLA is within the Mount Diablo Meridian and is defined as lands within the following sections:

Township 21 South, Range 37 East, Sections 11-14, 23-26, 35-36
Township 21 South, Range 38 East, Sections 7-10, 15, 17-22, 27-34
Township 22 South, Range 37 East, Sections 1-2, 11-12
Township 22 South, Range 38 East, Sections 5-8

Purpose: to protect and conserve the water resources that may be present within the HGLA and the Rose Valley Basin. The following stipulations are the governing rules for groundwater use.

d) Groundwater extraction for consumptive use during geothermal exploration, development, and project operations activities may be allowed, with the expressed approval of the Authorized Officer, for some leases to the extent that groundwater extraction and water loss to the Rose Valley Aquifer, in combination with all other authorized groundwater uses, does not exceed the safe yield, as defined in item g) below, in the Rose Valley Aquifer, and does not cause a decline of 10 percent or more to the average annual flow of water flowing into the surface features at Little Lake, when combined with all other approved uses.

e) Water produced or used for the construction, operation, maintenance, or remediation of the project shall be solely for the beneficial use of the renewable energy project or its associated mitigation and remediation measures, as specified in approved plans and permits.

f) The siting, construction, operation, maintenance, and remediation of all wells shall conform to specifications contained in the California Department of Water Resources Bulletins #74-81 and #74-90.

g) A water supply assessment shall be prepared and must be approved by the Authorized Officer prior to the development or use of any water resources. This assessment shall identify the groundwater basin(s) and the surface water basin(s) related to water delivery and supply, as well as the aquifer(s) contained within them. An assessment of the geothermal reservoir is expressly required. A water budget for each aquifer identified shall be established based on the best available data and practices for the identified basin(s). This water budget shall classify and describe all water inflow and outflow to the identified basin(s) or system using the following basic hydrologic formula or a derivation: $P - R - E - T - G = \Delta S$, where P is precipitation and groundwater inflow, R is surface runoff or outflow, E is evaporation, T is transpiration, G is groundwater outflow, and ΔS is the change in storage. The volumes involved in this calculation shall be in units of acre-feet per year. Safe Yield is defined as that amount, such that $P - R - E - T - G$ is greater than or equal to zero.

h) A Water Monitoring, Management, and Mitigation Plan shall be prepared and must be approved by the Authorizing Officer prior to the development or use of any water resources. The quality and quantity of all surface water and groundwater used for the project shall be monitored using this plan. The plan shall detail the management and use of all project-related water resources. The plan shall also detail any mitigation measures that may be required as a result of the project.

i) Any wastewater generated in association with temporary, portable sanitary facilities shall be periodically removed by a licensed hauler and disposed into an existing municipal sewage treatment facility.

j) Temporary, portable sanitary facilities provided for construction crews should be adequate to support expected onsite personnel and should be removed at completion of construction activities.

k) Lessee shall comply with local requirements for permanent, domestic water use and wastewater treatment.

l) Lessee shall identify the source(s) of project water, and provide analysis proving that adequate quantity and quality of water are available from identified source(s) for the life of the geothermal project.

Exception: An exception to this stipulation may be granted by the Authorized Officer if the operator submits a plan that demonstrates that impacts from the proposed action are minimal or can be adequately mitigated.

Modification: This stipulation will only be granted a modification by the Authorized Officer under extraordinary circumstances.

Waiver: This stipulation will only be granted a waiver by the Authorized Officer under extraordinary circumstances.

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APPENDIX L

CONTEXTUAL MAPPING

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APPENDIX L

CONTEXTUAL MAPPING

This appendix provides supplemental figures discussed in Chapter 1 and Chapter 2 of this DSEIS. Figure L-4 has been revised to reflect the land allocations identified in the DRECP LUPA (BLM 2016). All others are identical to those contained in Chapter 2 and Chapter 3 of the DEIS (BLM 2012), and are provided for reference.

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FIGURE L-1 Regional Setting with Vicinity Projects

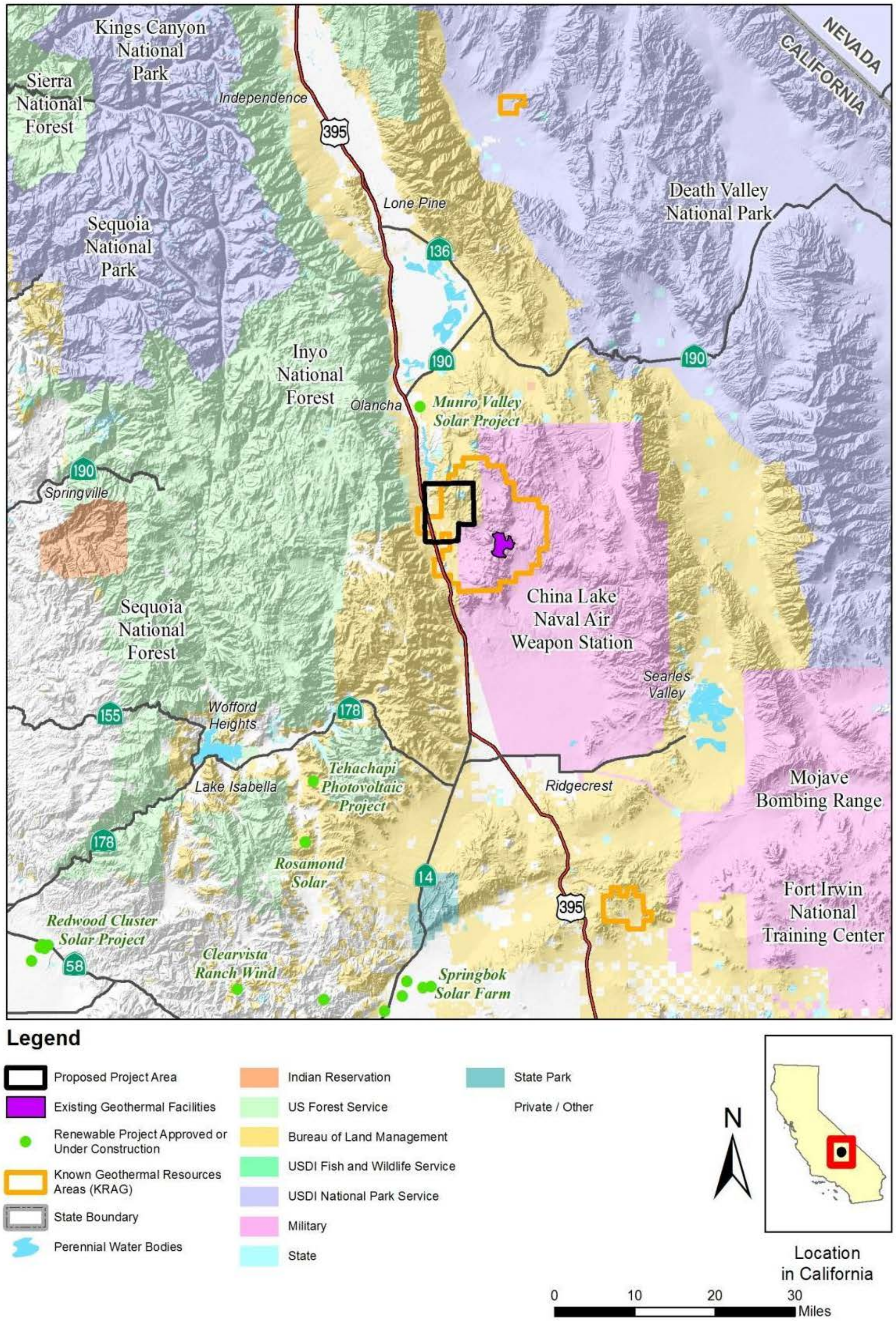


Figure L-2 Aerial View

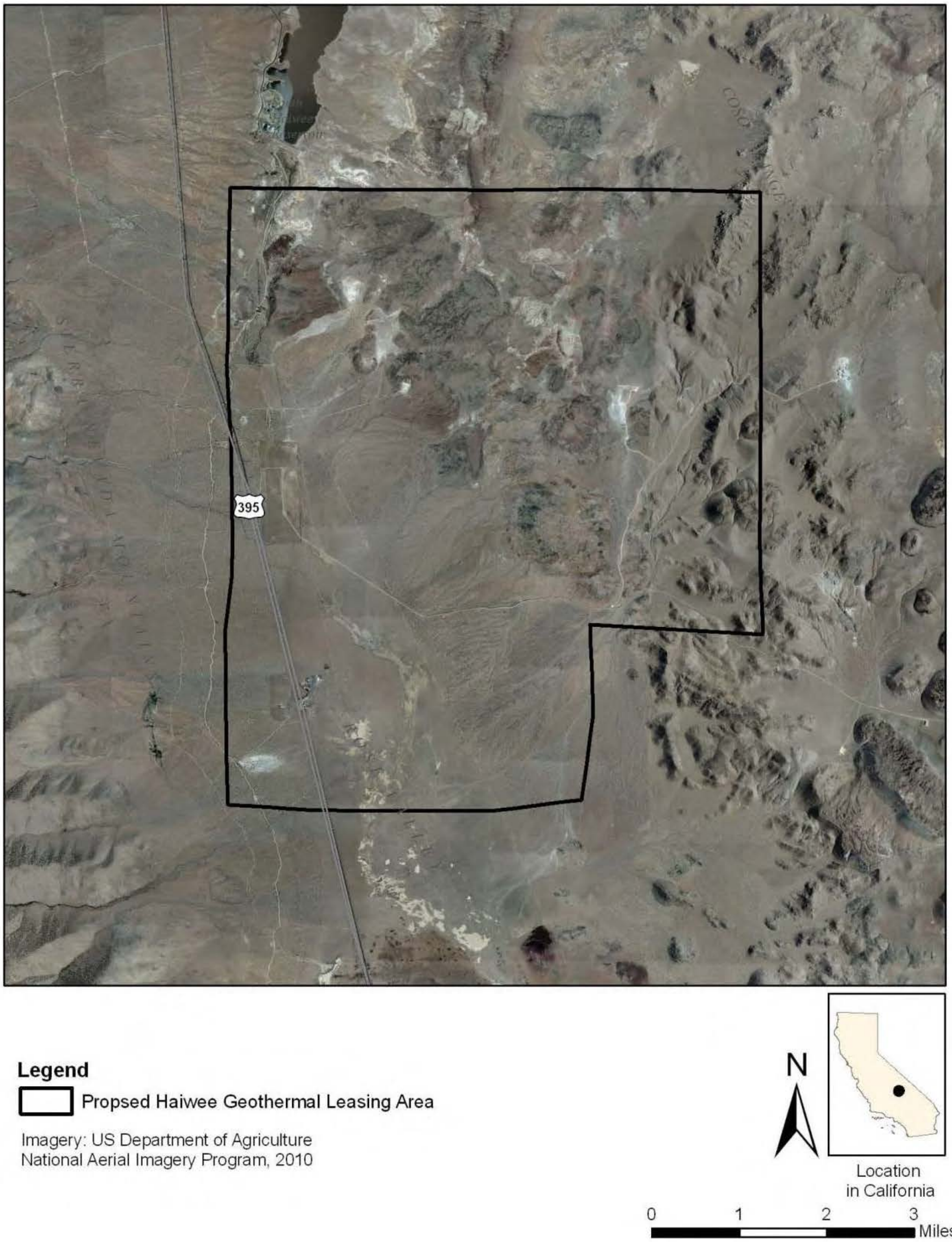


FIGURE L-3 Designated Routes and Pending Geothermal Lease Applications

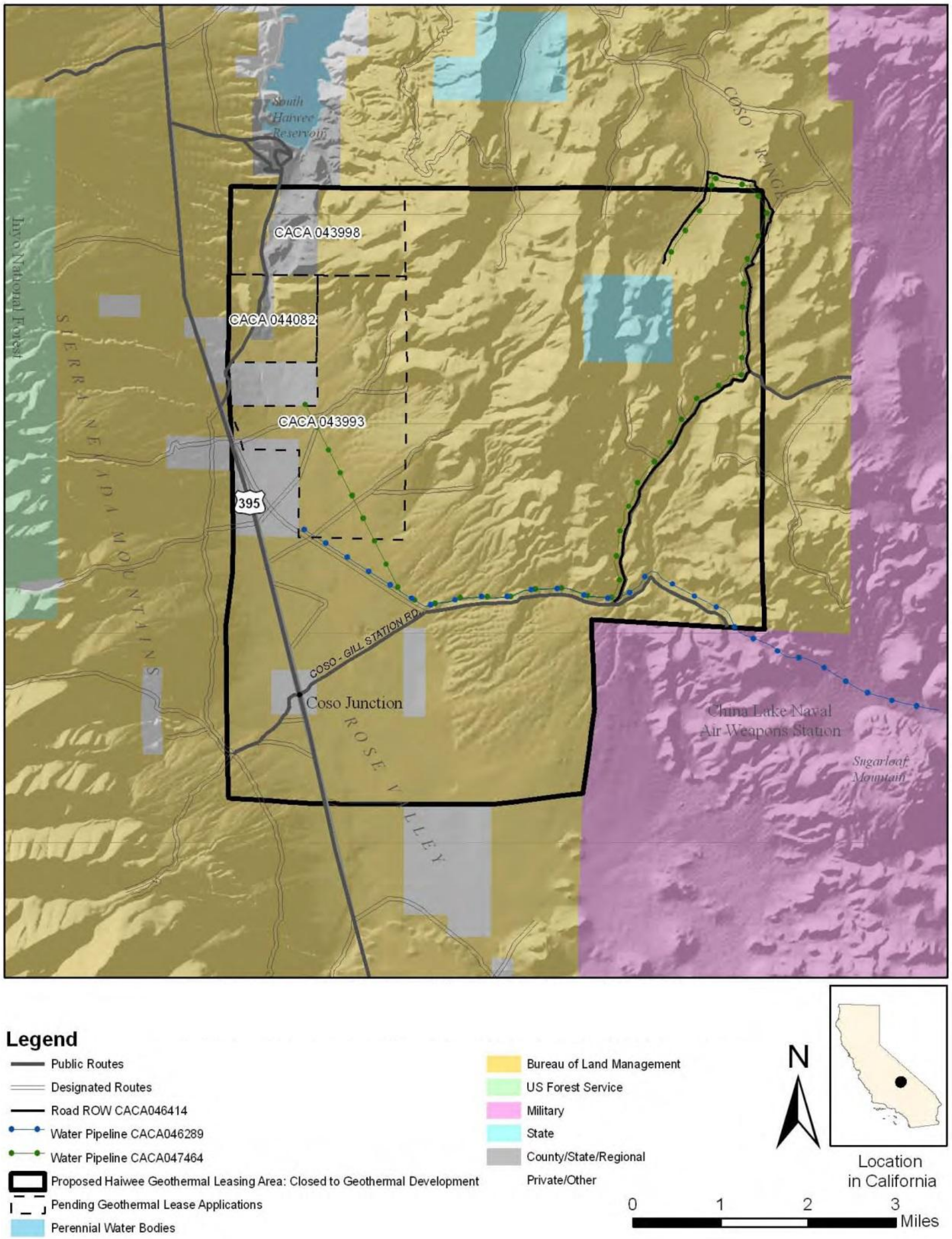


Figure L-4 Land Status

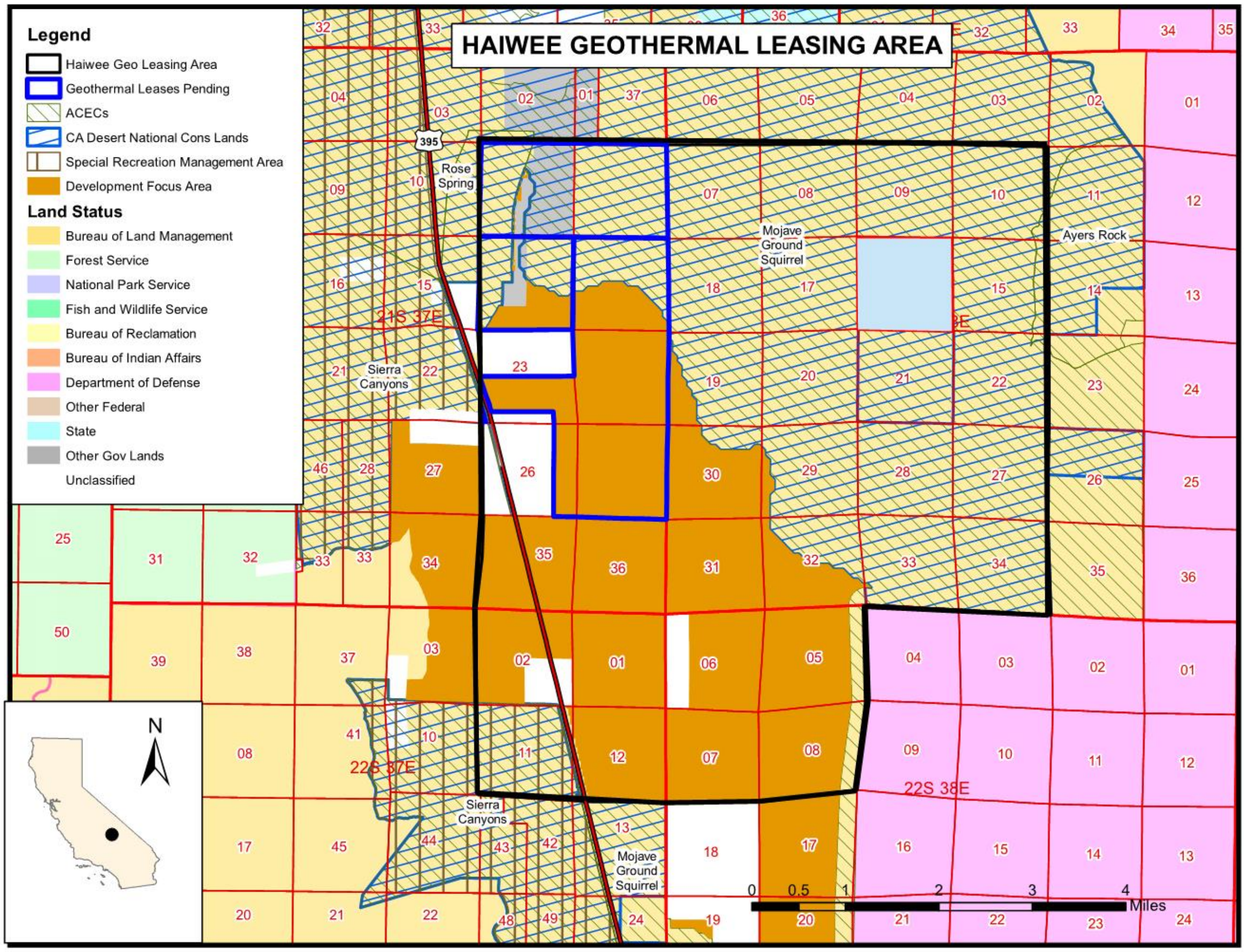
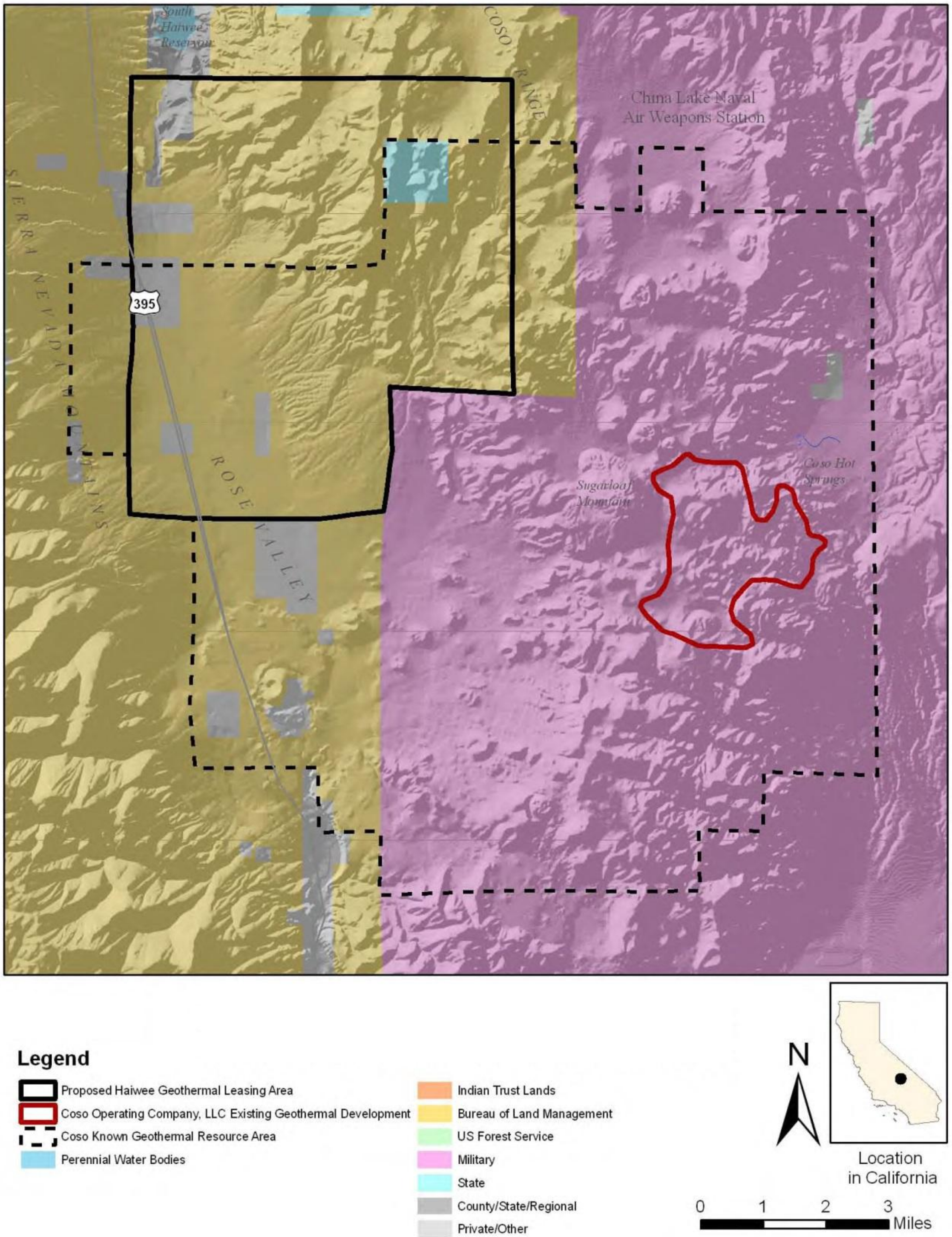


Figure L-5 The Haiwee Geothermal Leasing Area (HGLA) and the Coso Known Geothermal Resources Area (KGRA)



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APPENDIX M

ALTERNATIVES MAPPING

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APPENDIX M

ALTERNATIVES MAPPING

This appendix provides supplemental figures discussed in Chapter 2 of this FSEIS and throughout the document. These figures show the alternatives analyzed in detail in Chapters 3 and 4 and have been revised from the DEIS (BLM 2012) to reflect the land allocations identified in the DRECP LUPA (BLM 2016).

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FIGURE M-1 Alternative A (Preferred Alternative)

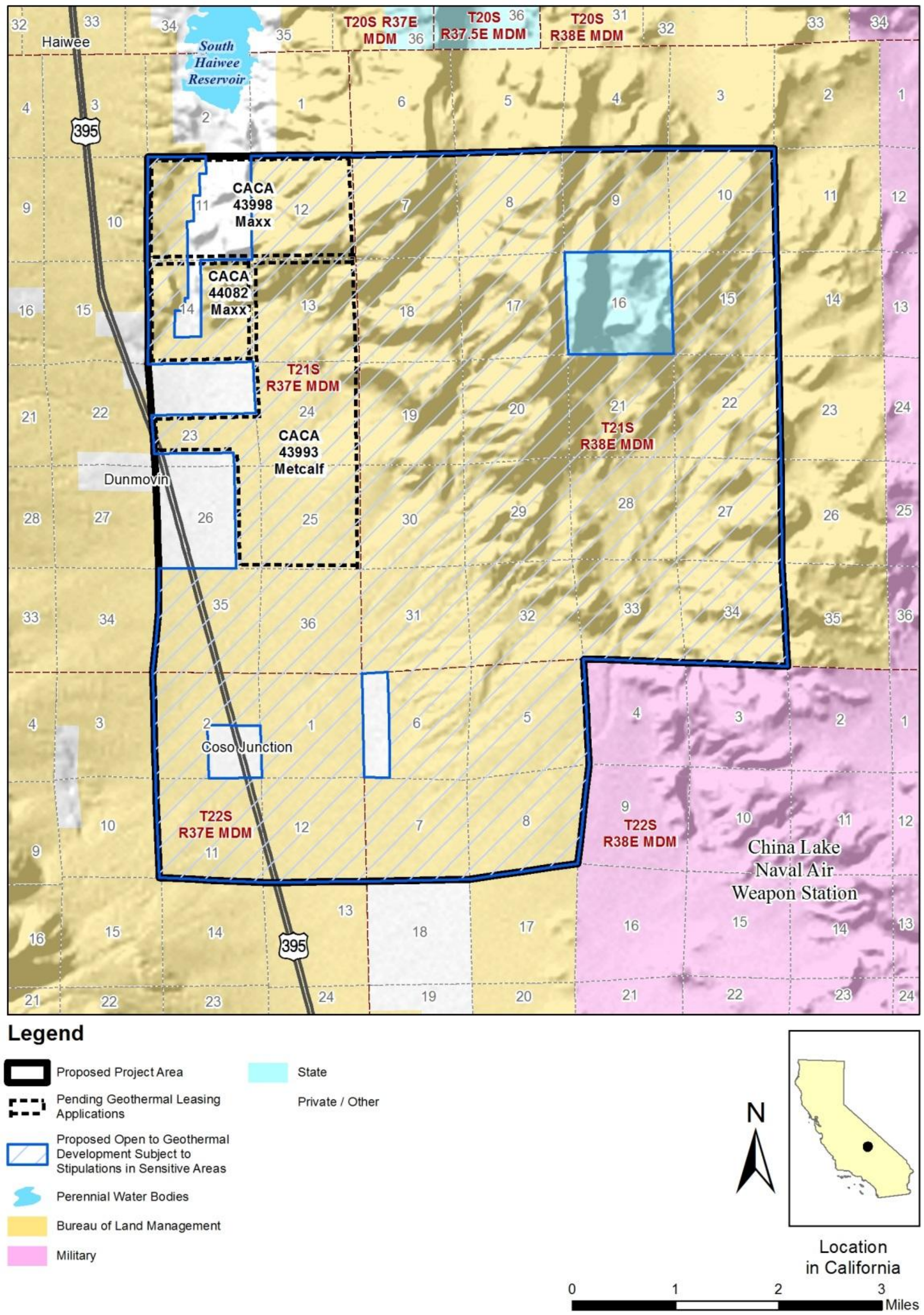


Figure M-2 Alternative B

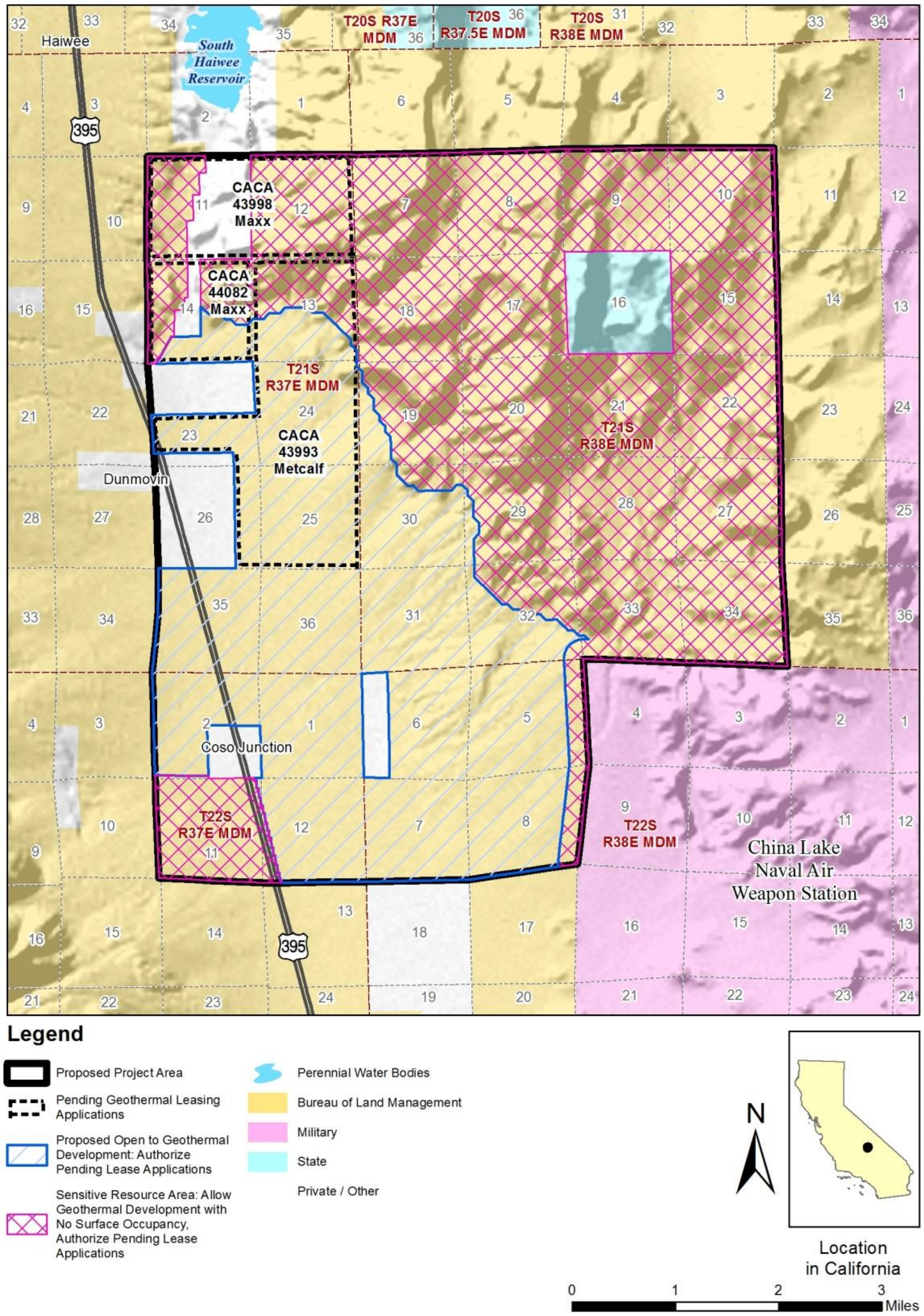


FIGURE M-3 Alternative C

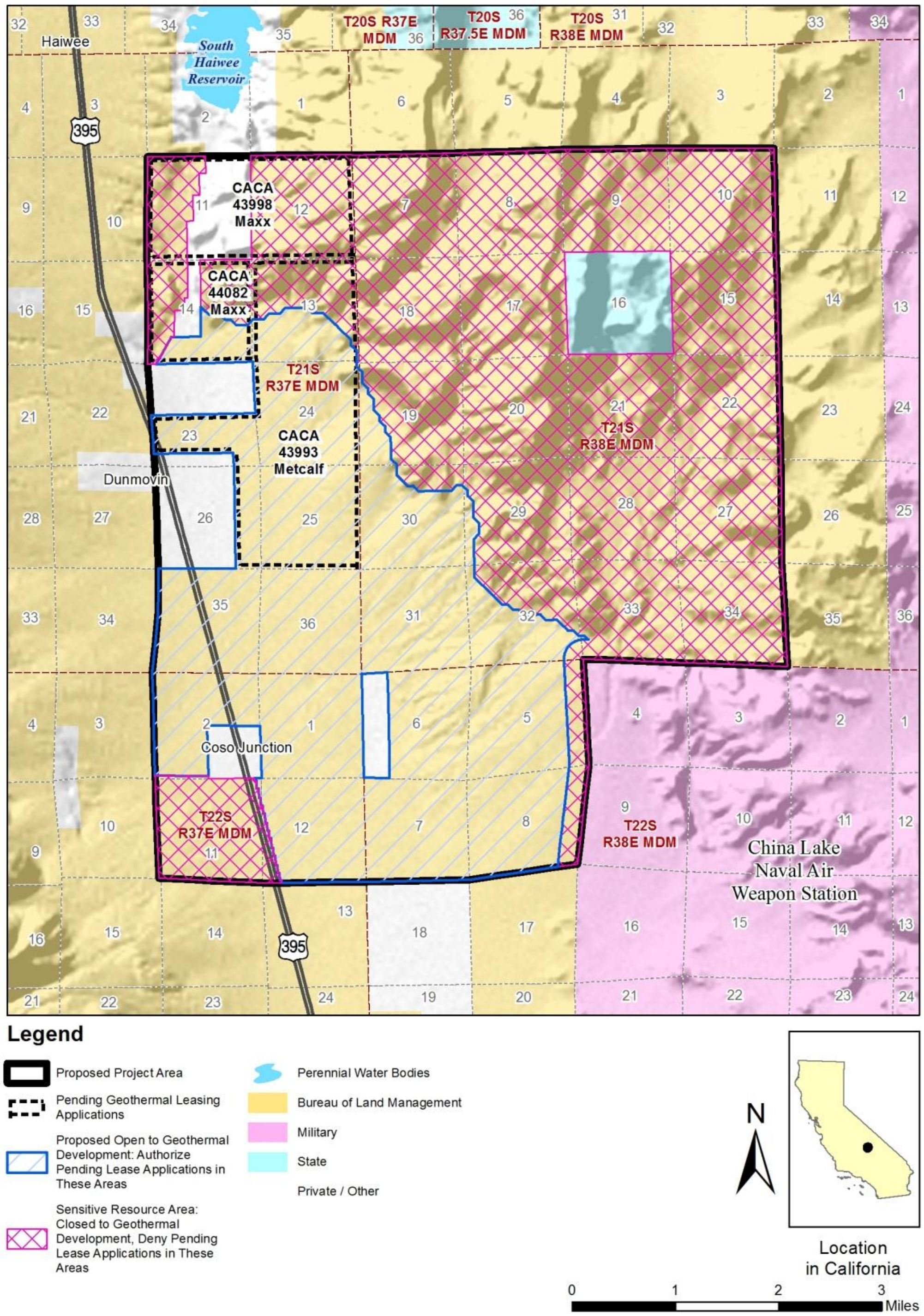
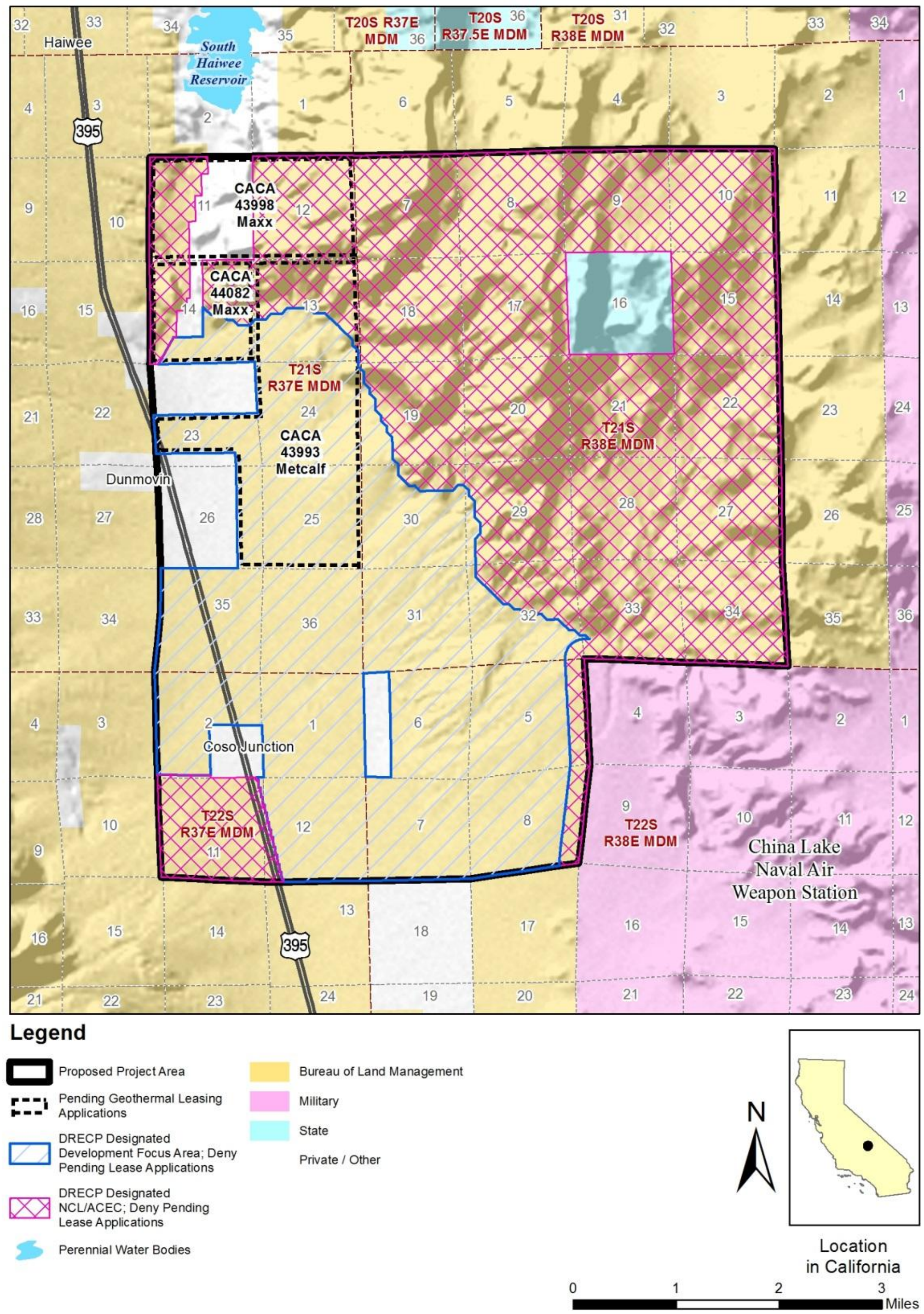


FIGURE M-4 Alternative D



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APPENDIX N

SUPPLEMENTAL AIR QUALITY DATA

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This appendix provides supplemental tables as discussed in Section 3.2 and Section 4.2 of this FSEIS that have changed from the DEIS (BLM 2012). Also refer to Section 3.2, Section 4.2 and Appendix F of the DEIS.

Table N-1 Monthly Average Temperatures and Precipitation – Haiwee Meteorological Station

MONTH	TEMPERATURE, FAHRENHEIT (ºF)				PRECIPITATION, INCHES	
	Maximum	Standard Deviation	Minimum	Standard Deviation	Measurement	Standard Deviation
January	52.0	5.09	29.1	4.38	1.08	1.44
February	56.7	4.44	32.7	3.78	1.30	1.51
March	63.1	4.74	37.2	3.26	0.86	1.07
April	70.5	4.45	51.4	4.08	0.34	0.52
May	79.6	4.56	51.4	3.68	0.22	0.36
June	89.1	3.74	59.2	3.19	0.09	0.21
July	95.6	2.99	65.8	3.40	0.23	0.49
August	93.9	2.97	63.9	2.99	0.29	0.56
September	87.2	3.07	57.3	3.45	0.27	0.53
October	75.8	4.04	47.2	3.27	0.29	0.72
November	62.0	3.85	36.0	3.06	0.5	0.97
December	52.7	3.95	30.1	2.98	0.99	1.14
Annual	**73.2**	**1.86**	**46.1**	**2.10**	**6.5**	**3.55**

Source: http://www.wrcc.dri.edu/CLIMATEDATA.html.

Table N-2 Representative Air Quality Data for the HGLA (2012-2016)

AIR QUALITY INDICATOR	2012	2013	2014	2015	2016
Ozone (O_3)[(1)]					
Peak 1-hour value (ppm)	0.082	0.08	0.08	0.076	0.085
Days above state standard (0.09 ppm)	0	0	0	0	0
Peak 8-hour value (ppm)	0.077	0.074	0.075	0.073	0.078
Days above state standard (0.070 ppm)	7	3	3	3	5
Days above federal standard (0.070 ppm)[(2, 6)]	7	3	3	3	5
Particulate matter less than or equal to 10 µm in diameter (PM_{10})[(3)]					
Peak 24-hour value (µg/m³)	485	276	309	384.6	530.8
Days above state standard (50 µg/m³)	*	*	*	*	*
Days above federal standard (150 µg/m³)	3	6	3	3	4
Annual Average value (ppm)	18.5	19.7	20.6	19.1	24.4
Particulate matter less than or equal to 10 µm in diameter (PM_{10})[(7)]					
Peak 24-hour value (µg/m³)	173	162	673	122.2	266.7
Days above state standard (50 µg/m³)	*	*	*	*	*
Days above federal standard (150 µg/m³)	1	2	3	0	1
Annual Average value (ppm)	15.5	18.8	30	16.7	18.5
Particulate matter less than or equal to 2.5 µm in diameter ($PM_{2.5}$)[(4)]					
Peak 24-hour value (µg/m³) [(5)]	99	93.6	161	130.2	56.8
Days above federal standard (35 µg/m³)	4	8	7	3	4
Annual Average value (ppm)	6.6	7.8	7.8	6.7	6.1
Hydrogen Sulfide (H_2S)[(7)]					
Peak 1-hour value (ppm)	0.008	0.005	0.004	0.006	0.004
Days above state standard (0.03 ppm)	0	0	0	0	0

Source: CARB 2016a. ADAM Air Quality Data Statistics. http://www.arb.ca.gov/adam/topfour/topfourdisplay.php
Notes: [(1)] Data from the Death Valley monitoring station, 55 miles from the project area.
[(2)] The federal ozone standard was revised downward in 2015 to 0.070 ppm.
[(3)] Data from the Olancha monitoring station.
[(4)] Data from the Keeler monitoring station.
[(5)] The federal $PM_{2.5}$ standard was revised downward in 2007 to 35 ⌠g/m³.
[(6)] The federal eight-hour ozone standard was previously defined as 0.08 ppm (1 significant digit). Measurements were rounded up or down to determine compliance with the standard; therefore a measurement of 0.084 ppm is rounded to 0.08 ppm. The 8-hour ozone ambient air quality standards are met at an ambient air quality monitoring site when the average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to the standard.
[(7)] Data from the Coso Junction monitoring station.
ppm = parts per million; ⌠g/m³ = micrograms per cubic meter; * = not available

APPENDIX O

SUPPLEMENTAL WATER RESOURCES DATA

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This appendix provides a supplemental table as discussed in Section 3.6 of this FSEIS that has changed from the DEIS (BLM 2012). Also refer to Section 3.6, Section 4.6, Appendix C, and Appendix G of the DEIS.

Table O-1 Baseline, Estimated Average November 2007, and Average September 2017 Groundwater Elevations

GROUNDWATER ELEVATION, FEET amsl(5)				
Well	**Baseline Groundwater Elevation (1)**	**November 2007 (2)**	**November 2009 (3)**	**September 2017 (4)**
Enchanted Village	-	NM	3,755.5	3,754.8
LADWP 816	-	3,435.2	3,430.8	3,445.1
Dunmovin	-	NM	3,253.0	NM
Cal Pumice	-	3,266.0	3,265.4	3,263.0
Hay Ranch North	-	3,245.0	3,245.3(3)	NM
HR-1A	-	NM	3,244.3	3,233.0
HR-1B	-	NM	3,243.1	3,220.5
HR-1C	-	NM	3,245.6	3,226.0
HR-2A	3,240.9	NM	3,241.1	3,231.8
HR-2B	-	NM	3,238.5	3,221.0
HR-2C	-	NM	3,242.6	3,227.5
Hay Ranch South	-	3,240.9	3,241.8	NM
Coso Junction Ranch	3,230.7	3,232.7	3,232.2	3,227.7
Coso Junction Store #1	3.227.6	3,229.3	3,229.8	3,225.5
Red Hill	3,200.7	NM	3,200.8	3,199.8
Lego	3,199.2	3,200.5	3,200.6	3,198.2
G-36	3,198.4	3,199.6	3,200.0	3,197.3
Cinder Road	3,186.9	NM	3,187.0	3,185.9
18-28 GTH	3.187.7	3,188.2	3,188.5	3,187.7
Fossil Falls	-	NM	3,175.6	3,174.8
Little Lake Ranch North	3,158.9	3,158.95	3,158.9	3,158.1
Little Lake Ranch Dock	-	NM	3,147.9	3,147.3
Little Lake Surface	-	NM	3,147.4	3,146.5
Little Lake Ranch Hotel	-	NM	3,138.3	3,138.0

Source: Geologica 2010.
Notes: NM = not measured; amsl = above mean sea level
(1) Baseline groundwater elevations set January 2010 and March 2011 and approved by Inyo County Water Department.
(2) MHA (2008) Table 3.2-2
(3) Average November 2009 groundwater elevation estimated by Geologica from groundwater elevation hydrographs presented at the Inyo County Water Department's Hay Ranch Monitoring Website, http://www.inyowater.org/coso/default.html accessed December 4, 2009.
(4) Average September 2017 groundwater elevation estimated by Geologica from groundwater elevation hydrographs presented at the Inyo County Water Department's Hay Ranch Monitoring Website,http://www.inyowater.org/projects/groundwater/coso-hay-ranch-project/ accessed November 17, 2017
(5) amsl=above mean sea level.

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APPENDIX P

SUPPLEMENTAL VISUAL RESOURCES DATA

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This appendix provides supplemental tables and figures as discussed in Section 3.10 and Section 4.10 of this FSEIS that have changed from the DEIS (BLM 2012). Also refer to Section 3.10 and Section 4.10 of the DEIS.

Table P-1 Sensitive Viewpoints

VIEWPOINT	USER TYPE/ATTITUDE	DURATION OF VIEW	USE VOLUME	VISUAL SENSITIVITY	COMMENTS
Communities*	High	Long	Moderate	High	Includes Olancha, Haiwee, Dunmovin, Coso Junction and Little Lake
Travel Corridors					
US 395	High	Short	High	High	State Identified Eligible Scenic Highway*
Coso-Gill Station Road	Moderate/Low	Short	Low	Low	
Unimproved/4WD Roads	Moderate/Low	Short	Low	Low	
Mine Haul Roads	Low	Short	Low	Low	
Recreation and Preservation Viewpoints					
Little Lake Overlook*	High	Long	Low	High	California Watchable Wildlife Site
Fossil Falls*	High	Long	Low	High	One of the Ridgecrest Field Office's 'Top 10 Points of Interest'; campground and trail at site.
Sacatar Trail Wilderness*	High	Long	Low	High	Access from the east is via the Sacatar Trail.
Coso Range Wilderness*	High	Long	Low	High	
South Sierra Wilderness*	High	Long	Low	High	
Haiwee Trail*	High	Long	Low	High	Trail accesses Kern River Wild and Scenic River and South Sierra Wilderness.

VIEWPOINT	USER TYPE/ATTITUDE	DURATION OF VIEW	USE VOLUME	VISUAL SENSITIVITY	COMMENTS
Pacific Crest Trail*	High	Long	Low	High	
Kennedy Meadows Campground*	High	Long	Low	High	Campground provides access to the Pacific Crest Trail.
Kern River Wild and Scenic River	High	Long	Low	High	
South Haiwee Reservoir	N/A	N/A	N/A	N/A	The reservoir has been closed to public access.
Cultural Resource Viewpoints					
Ayers Rock Petroglyph Site	Moderate	Long	Low	Moderate	
Coso Hot Springs*	High	Long	Low	High	
Fossil Falls Archeological District*					See Recreation and Preservation Viewpoints
Ayers Rock ACEC	Moderate/Low	Long	Low	Low	Designated for important and irreplaceable cultural resources, especially archaeological.
Sierra Canyons ACEC	Moderate/Low	Long	Low	Low	Designated for important and irreplaceable cultural resources, Including archaeological.
Rose Spring ACEC	Moderate/Low	Long	Low	Low	Designated for important and irreplaceable cultural resources, especially archaeological.

*High sensitivity viewpoints included in the visibility analysis.

Table P-2 Contrast Levels and VRM Class Conformance

VRM CLASS	VISUAL CONTRAST		
	Strong	**Moderate**	**Weak**
Class I*	N/A	N/A	N/A
Class II	No	No	Yes
Class III	Yes	Yes	Yes
Class IV*	N/A	N/A	N/A

*Indicates VRM Classes that are not present within the HGLA, and therefore not analyzed for visual contrast.

Figure P-1 HGLA VRM Classes and Scenic Quality Rating Units

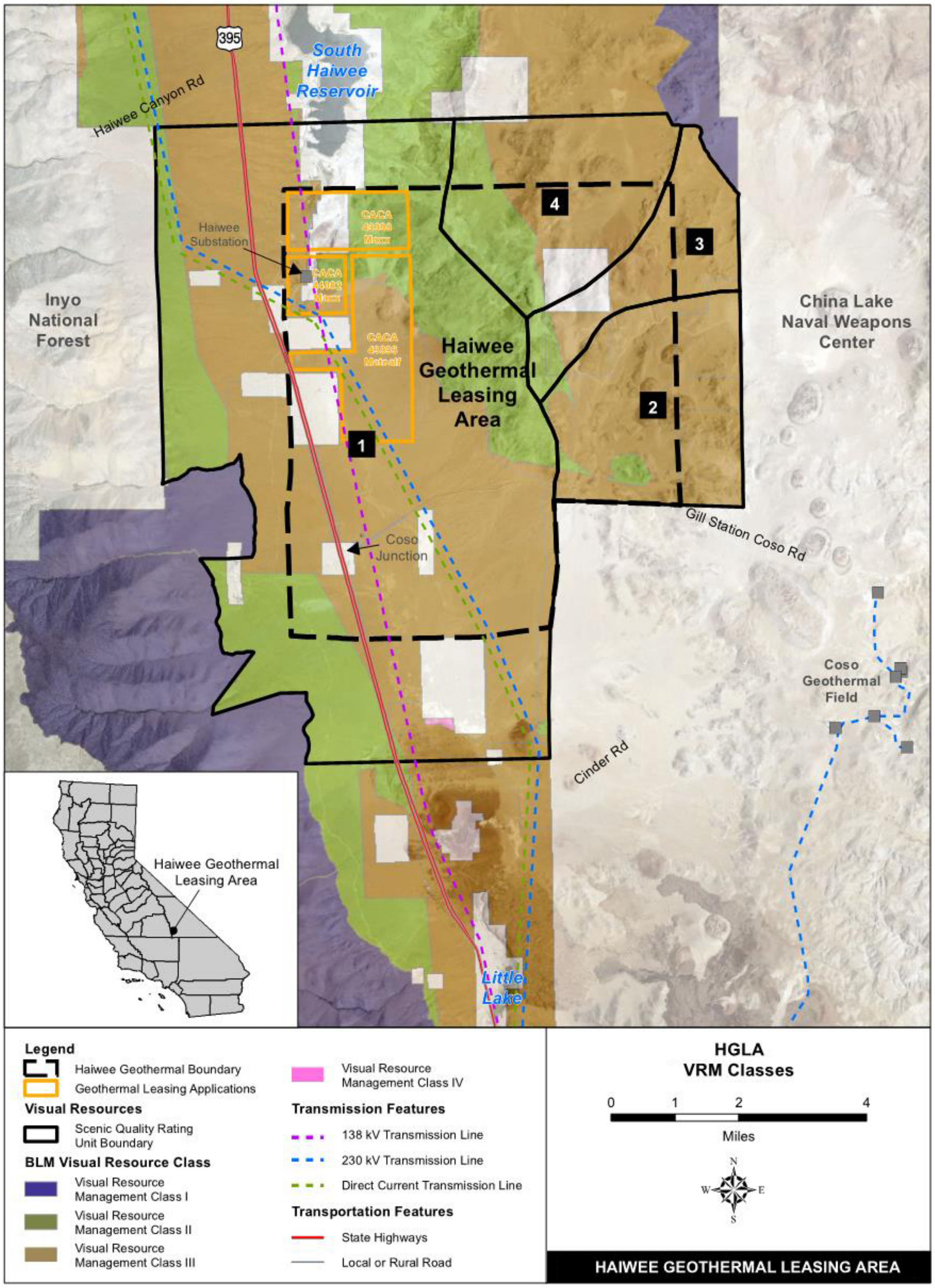
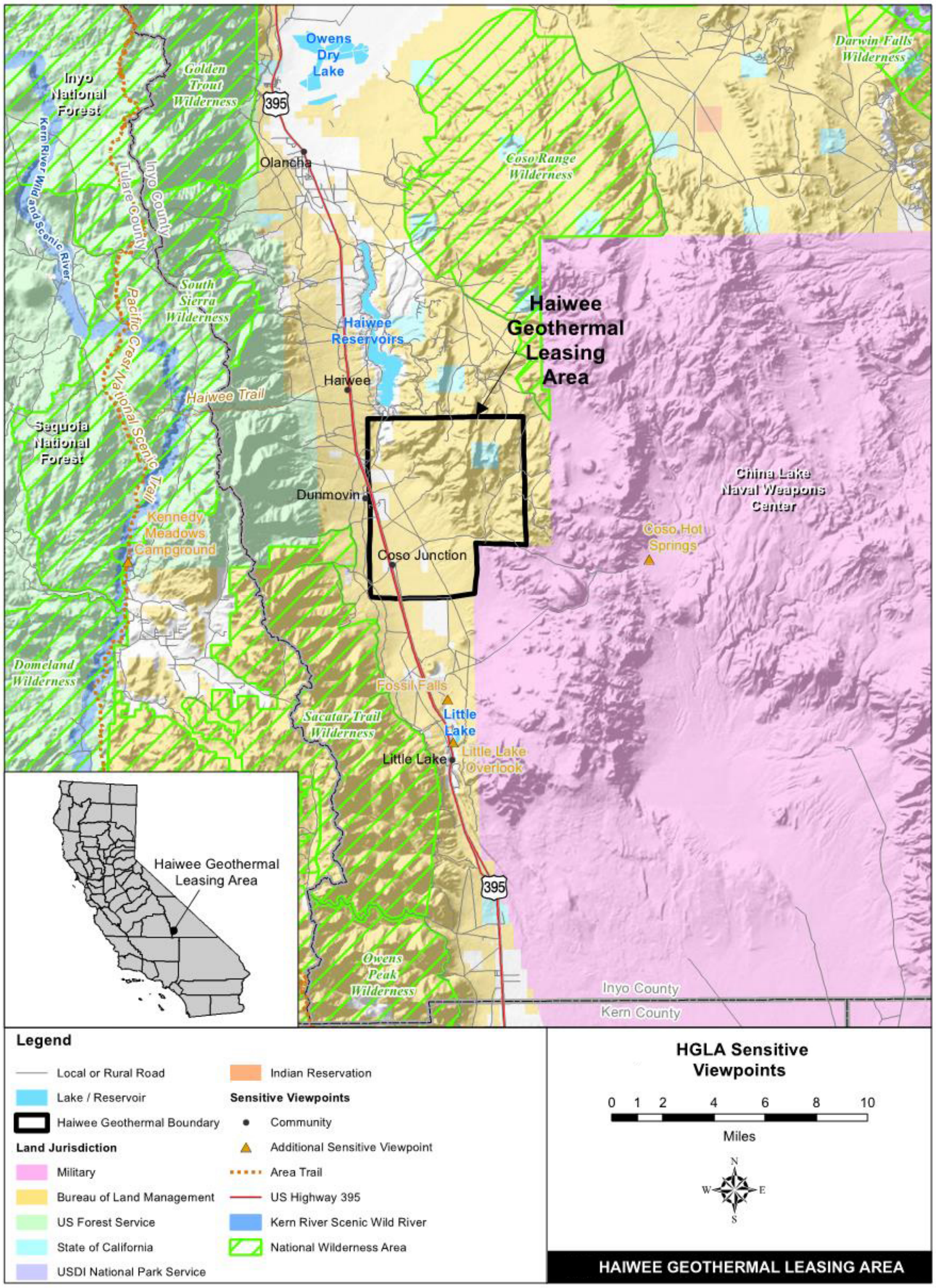


Figure P-2 HGLA Sensitive View Points



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APPENDIX Q

SUPPLEMENT LAND AND REALTY DATA

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This appendix provides a supplemental table as discussed in Section 3.11 of this FSEIS that has changed from the DEIS (BLM 2012). Also refer to Section 3.11 and Section 4.11 of the DEIS.

Table Q-1 Current Land Use Authorizations within the HGLA

HOLDER	SERIAL#	DESCRIPTION
Coso Energy Developers	CACA 13510	Power Transmission Line – 50 feet
Coso Energy Developers	CACA 18885	Telephone Line – 10 feet
Southern California Edison	CACA 21596	115 kV Power Transmission Line – 80 feet
Southern California Edison	CACA 26242	12 kV Power Transmission Line – 10 feet
Verizon California LLC	CACA 26398	Fiber Optic Line – 10 feet
Coso Operating Co.	CACA 46289	Pipeline
Deep Rose, LLC	CACA 47464	Water Pipeline
Maxx Management Corp	CACA 43998	Pending Geothermal Lease
Maxx Management Corp	CACA 44082	Pending Geothermal Lease
Terry K Metcalf	CACA 43993	Pending Geothermal Lease
CA Dept. of Public Works	CALA 0 88333	Material Sites
LADWP	CALA 0 88876	500 kV Power Transmission Line – 250 feet
CA Dept. of Public Works	CALA 0 93471	Federal Highway
Verizon California Inc.	CALA 0 125334	Fiber Optic Line – Variable Widths
City of Los Angeles	CALA 0 155168	34.5 kV Power Transmission Line – 50 feet
CA Dept. of Public Works	CALA 0 164238	Material Site
LADWP	CARI 231	Aqueduct – 100 feet
CA Dept. of Public Works	CARI 2641	Federal Highway
Southern California Edison	CARI 2861	12 kV Power Transmission Line – 25 feet
Southern California Edison	CARI 4354	12 kV Power Transmission Line – 25 feet

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APPENDIX R

SUPPLEMENTAL CULTURAL DATA

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As noted in Section 3.8.3.10 of this FSEIS, there are 23 prehistoric archeological sites and four archaeological sites with historic-era components within the HGLA study area as listed below.

Prehistoric archaeological sites: There are 23 prehistoric archeological sites within the HGLA study area. These are listed in Appendix S of this DSEIS.

- CA-INY-134 Ayer's Rock (NRHP #03000116)
- CA-INY-1791 (BLM #250)
- P14-1792 (BLM #251)
- CA-INY-1799 (BLM #254)
- CA-INY-1897 (BLM #311)
- P14-1910 (BLM #327)
- CA-INY-1993 (BLM #355)
- P14-2137 (BLM #355)
- CA-INY-2246
- CA-INY-2248 (BLM #261, also listed in CRHR)
- CA-INY-2284 (BLM #390)
- CA-INY-2323 (BLM #63, also listed in CRHR)
- CA-INY-2333 (BLM #306)
- CA-INY-2334
- CA-INY-3002 (also eligible CRHR)
- P14-3665 (BLM #286)
- CA-INY-3669
- CA-INY-3618 (also listed in CRHR)
- BLM #8884
- BLM #8885
- BLM #9112
- Fossil Falls Archaeological District (NRHP #80004492)
- Coso Rock Art District (NRHP #99001178)

Archaeological sites with Historic-era Components:

P14-372 (BLM #372, the Rose Spring Site)

- CA-INY-1806 (BLM #265, 366)
- CA-INY-2329 (determined eligible for NRHP as part of a District, also listed in CRHR)
- Coso Hot Springs (NRHP #78000674)

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APPENDIX S

SUPPLEMENTAL ENERGY AND MINERAL RESOURCES DATA

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As of December 2017, there are 23 active mining claims recorded with the BLM within the HGLA. Table S-1 below was revised from the DEIS (BLM 2012) and summarizes all active and recorded mining claims.

Table S-1 Active Recorded Mining Claims within the HGLA

CLAIM NAME	TYPE	DATE RECORDED	DATE OF LOCATION	DATE OF LATEST ASSESSMENT	SERIAL# (FULL)
MAKAYLA PUMICE NO 1	PLACER	08/21/2000	06/26/2000	8/17/2009	CAMC277668
MAKAYLA PUMICE NO 2	PLACER	08/21/2000	06/26/2000	8/17/2009	CAMC277669
MARGIE 1	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277670
MARGIE 2	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277671
MARGIE 3	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277672
MARGID 4	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277673
MARGIE 5	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277674
MARGIE 6	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277675
MARGIE 7	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277676
MARGIE 8	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277677
MARGIE 9	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277678
MARGIE 10	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277679
MARGIE 11	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277680
MARGIE 12	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277681
MORIAH 1	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277682
MORIAH 2	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277683
MORIAH 3	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277684
MORIAH 4	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277685
MORIAH 5	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277686
MORIAH 6	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277687
MORIAH 7	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277688
MORIAH 8	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277689
MORIAH 9	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277690
MORIAH 10	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277691
MORIAH 11	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277692
MORIAH 12	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277693
MORIAH 13	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277694
MORIAH 14	PLACER	08/21/2000	06/21/2000	07/07/2014	CAMC277695
DB 197	LODE	11/27/2007	09/08/2007	8/27/2009	CAMC291086
DB 198	LODE	11/27/2007	09/08/2007	8/27/2009	CAMC291087
DB	LODE	11/27/2007	09/08/2007	8/27/2009	CAMC291088

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APPENDIX T

SUPPLEMENTAL RECREATION DATA

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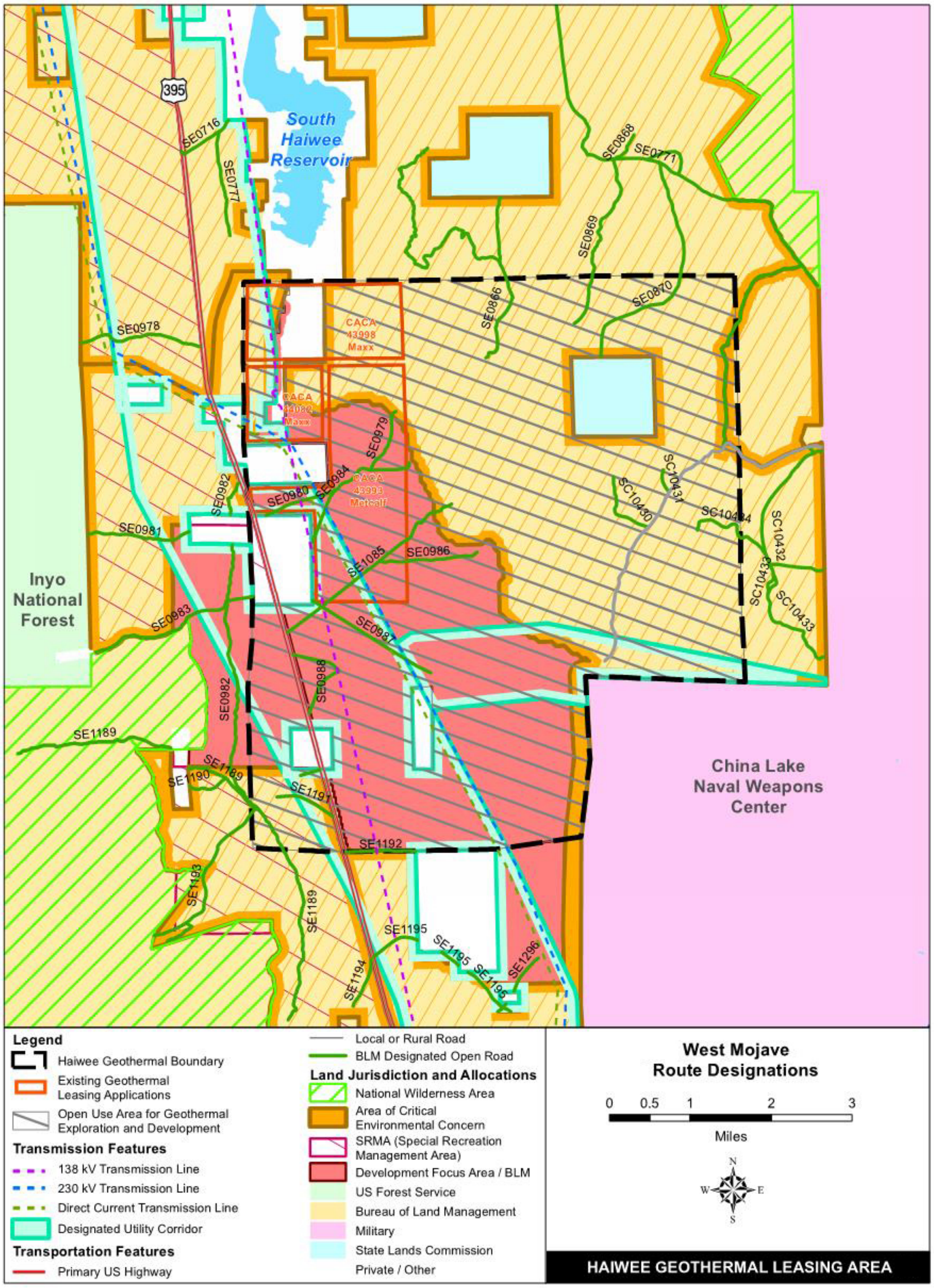
This appendix provides supplemental figures and tables as discussed in Section 3.16 and Section 4.16 of this FSEIS that have changed from the DEIS (BLM 2012). Also refer to Section 3.16 and Section 4.16 of the DEIS. Recreational uses and visitation rates to the Ridgecrest SRMA between October 1, 2016 and September 30, 2017 are summarized in Table T-1 below and reference in Section 3.16.3 of this DSEIS.

Table T-1 Ridgecrest Special Recreation Management Area: Recreational Use and Visitation

ACTIVITY	NUMBER OF PARTICIPANTS	VISITOR DAYS
Ridgecrest SRMA, ID: LLCAD05000-01 Site: Dispersed-Ridgecrest, ID: 00000.000		
Bicycling - Mountain	8,240	1,373
Camping	4,464	8,689
Driving for Pleasure	28,898	7,249
Hiking/Walking/Running	12,360	2,060
Horseback Riding	8,240	1,373
Hunting – Upland Bird	6,180	2,060
Nature Study	6,180	1,030
OHV - ATV	4,120	1,030
OHV – Cars/Trucks/SUVs	29,019	4,926
OHV - Motorcycle	12,360	2,060
Photography	6,180	515
Racing – Horse Endurance	352	381
Rockhounding/Mineral Collection	4,120	1,030
Target Practice	4,120	687
Viewing - Wildlife	4,120	1,373
Viewing – Scenery/Landscapes	58	10

Source: BLM 2017.

Figure T-1 **West Mojave Route Designation Program Map**



APPENDIX U

SUPPLEMENTAL TRAFFIC/TRANSPORTATION DATA

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This appendix provides supplemental tables as discussed in Section 3.18 and Section 4.18 of this FSEIS that have changed from the DEIS (BLM 2012). Also refer to Section 3.18 and Section 4.18 of the DEIS.

Historic and recent traffic volumes were revised as noted in Section 3.18.2.2 of this FSEIS. Data for 2016 is provided in Table U-1 and Historic data from 2007 to 2015 is provided in Table U-2.

Table U-1 2016 Traffic Volumes at the US 395-SR 190 East Junction

LOCATION	ANNUAL AVERAGE DAILY TRAFFIC (AADT)	PEAK MONTH	PEAK HOUR
Along US 395 at SR 190	6,700	8,800	1,150
Along SR 190 East at US 395	240	300	50

Source: Caltrans 2016.

Table U-2 Historic Annual Average Daily Traffic Volumes at the US 395-SR 190 East Junction

LOCATION	2007	2008	2009	2010	2011	2012	2013	2014	2015
Along US 395 at SR 190	5,900	5,600	5,900	5,900	5,600	5,300	5,500	5,500	5,800
Along SR 190 East at US 395	330	300	300	300	230	240	240	240	240

Source: Caltrans 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, and 2015.

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APPENDIX V

SUPPLEMENTAL LANDS WITH WILDERNESS CHARACTERISTICS DATA

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Lands with wilderness characteristics (LWC) were not analyzed in the DEIS (BLM 2012). The affected environment and potential impacts to LWC as a result of the alternatives are discussed in Section 3.20 and Section 4.20 of the FSEIS.

As discussed in Section 3.20.2, Wilderness Inventory Unit #CDCA131 contained three subunits that were evaluated for wilderness characteristics. Table V-1 below summarizes the finding of the evaluation in each subunit.

Table V-1 WIU #CDCA 131 (Coso) Subunits.

Unit #/Name	Sufficient Size (acres)	Natural Condition? Yes/No (Y/N)	Outstanding Solitude? Y/N	Outstanding Primitive & Unconfined Recreation? Y/N	Supplemental Values? Y/N
WIU #CDCA **131-1**	**Y** 21,322.5	**Y**	**Y**	**Y**	**Y**
WIU #CDCA **131-2**	**Y** 2,560 acres but contiguous to existing wilderness	**N**	N/A	N/A	N/A
WIU #CDCA **131-3**	**N** 4,481	**N**	N/A	N/A	N/A

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APPENDIX X

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APPENDIX Y

ABBREVIATIONS AND ACRONYMS

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Abbreviations and Acronyms

AAGR	annual average growth rate
AB	Administrative Bill
ACEC	Area of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
ac-ft/yr	acre feet per year
AGD	allowable ground disturbance
AICUZ	Air Installation Compatible Use Zone
AIRFA	American Indian Religious Freedom Act
AML	Abandoned Mine Lands
AMP	Allotment Management Plans
amsl	above mean sea level
APCD	Air Pollution Control District
APE	Area of Potential Effects
APLIC	Avian Power Line Interaction Committee
AQCMM	Air Quality Control Mitigation Measures
ARB	Air Resources Board
ARPA	Archaeological Resources Protection Act
ASTM	American Society for Testing and Materials
AUM	Animal Unit Months
BGEPA	Bald and Golden Eagle Protection Act
bgs	below ground surface
BLM	Bureau of Land Management
BMP	Best Management Practices
°C	degrees Celsius
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal-IPC	California Invasive Plant Council
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCD	Census County Division
CDCA	California Desert Conservation Area
CDD	California Desert District
CDFG	California Department of Fish and Game (now CDFW)
CDFW	California Department of Fish and Wildlife (formerly CDFG)
CDNCL	California Desert National Conservation Lands
CDOF	California Department of Finance
CDP	Census Designated Place
CDPA	California Desert Protection Act
CDWR	California Department of Water Resources
CEC	California Energy Commission
CEDD	California Employment Development Department
CEQ	Council on Environmental Quality

CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CHL	California Historical Landmarks
CHRIS	California Historical Resource Information System
CHSR	California High-Speed Rail
CJPL	Coso Junction Planning Area
CMA	Conservation Management Actions
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	CO_2 equivalent
COC	Coso Operating Company
COM Plan	Construction, Operation, and Maintenance Plan
Coso	Coso Hay Ranch LLC
CPUC	California Public Utilities Commission
CRHR	California Register of Historical Resources
CRMP	Cultural Resource Management Plan
CRUP	Cultural Resource Use Permit
CSLC	California State Lands Commission
CSU	Controlled Surface Water
CUP	Conditional Use Permit
CWA	Clean Water Act
dB	decibels
dB(A)	A-weighted decibels
DC	Direct Current
DEIS	Draft Environmental Impact Statement
DFA	Development Focus Area
DOGGR	California Department of Conservation, Division of Oil, Gas & Geothermal Resources
DOI	United States Department of the Interior
DRECP	Desert Renewable Energy Conservation Plan
DSEIS	Draft Supplemental Environmental Impact Statement
DSCF	dry standard cubic feet
DWMA	Desert Wildlife Management Area
EA	Environmental Assessment
EIC	Eastern Information Center
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMF	Electromagnetic Field
EO	Executive Order
EPCRA	Emergency Planning and Community Right-to-Know Act

Epsilon	Epsilon Systems Solutions, Inc.
ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act
ºF	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy and Management Act
FOIA	Freedom of Information Act
FR	Federal Register
FEIS	Final Environmental Impact Statement
ft^2/day	square feet per day
GBUAPCD	Great Basin Unified Air Pollution Control District
GBVAB	Great Basin Valleys Air Basin
GDP	Geothermal Drilling Permit
G-E-M	Geology-Energy-Minerals
GHG	Green House Gas
GIS	geographic information system
gpd/ft^2	gallons per day/square foot
GRDA	geothermal resources development account
GSA	Groundwater Sustainability Agency
GWP	global warming potential
HCP	habitat conservation plan
HGLA	Haiwee Geothermal Leasing Area
HMA	Herd Management Areas
HMMP	Hydrologic Monitoring and Mitigation Plan
hp	horsepower
HPTP	Historic Properties Treatment Plan
HUC	hydrologic unit code
H_2S	hydrogen sulfide
ICC	Inyo County Code
IM	Instruction Memorandum
IS	Induced Seismicity
Kf	water erosion factor
KGRA	known geothermal resource area
km	kilometer
KOP	key observation point
kph	kilometers per hour
kV	kilovolt
LADPW	Los Angeles County Department of Public Works
LADWP	Los Angeles Department of Water and Power (City of Los Angeles)

L-C-M	Lacy-Cactus-McCloud
L_{dn}	day-night average noise level
L_{eq}	equivalent, average sound level
LORS	Laws, Ordinances, Regulations and Standards
LOS	Level of Service
LRWQCB	Lahontan Office of the Regional Water Quality Control Board
LUPA	Land Use Plan Amendment
LWC	Lands with Wilderness Characteristics
M	Magnitude
MBTA	Migratory Bird Treaty Act
MDM	Mt. Diablo Meridian
MEQ	micro-earthquake
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
MGSCA	Mojave Ground Squirrel Conservation Area
MOA	Memorandum of Agreement
mph	miles per hour
MUC	multiple use class
MW	megawatts
N_2O	nitrous oxide
N/A	not applicable
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection Act
NAHC	Native American Heritage Commission
NAWS	Naval Air Weapons Station
NCEC	Northern California Earthquake Center
NCL	National Conservation Lands
NCG	non-condensable gases
ND	No Date
NEMO	Northern and Eastern Mojave
NEPA	National Environmental Policy Act
NFS	National Forest Service
NHL	National Historic Landmark
NHPA	National Historic Preservation Act of 1966
NLCS	National Landscape Conservation System
NO_2	nitrogen dioxide
NOI	Notice of Intent
NOTS	Naval Ordnance Test Station
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places

NSO	No Surface Occupancy
O_3	ozone
OEHHA	California Office of Environmental Health Hazard Assessment
OHP	Office of Historic Preservation *(in the California Department of Parks and Recreation)*
OHV	off-highway vehicles
Omnibus Act	Omnibus Public Land Management Act of 2009
PA	Plan Amendment
Pb	lead
PEIS	Programmatic Environmental Impact Statement
PFYC	Potential Fossil Yield Classification
PL	Public Law
PM_{10}	suspended particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$	fine particulate matter less than or equal to 2.5 microns in diameter
POD	Plan of Development
POO	Plan of Operations
ppb	parts per billion
ppm	parts per million
PRPA	Paleontological Resource Preservation Act
REAT	Renewable Energy Action Team
REIS	Regional Economic Information System
RFD	reasonably foreseeable development
RFO	Ridgecrest Field Office
RMP	Resource Management Plan
ROD	Record of Decision
ROG	reactive organic gases
ROW	right-of-way
RPS	Renewable Portfolio Standard
RV	recreational vehicle
RWQCB	Regional Water Quality Control Board
SAA	Streambed Alteration Agreement
SB	Senate Bill
SCAB	South Coast Air Basin
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCEC	Southern California Earthquake Center
SDG&E	San Diego Gas and Electric
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	sulfur dioxide
SPER	Statewide Portable Equipment Registrations
SQRU	Scenic Quality Rating Units

SR	State Route
SRMA	Special Recreation Management Area
SSA	socioeconomic study area
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	toxic air contaminants
TCP	traditional cultural properties
TDS	Total Dissolved Solids
TGA	Taylor Grazing Act
TL	timing limitations
TWRA	Tehachapi Wind Resources Area
µm	microns
$\mu g/m^3$	micrograms per cubic meter
U.S.	United States
US 395	United States Highway 395
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFS	United States Department of Agriculture, Forest Service
USFWS	United States Department of the Interior, Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compounds
VPL	Variance Process Lands
VRI	Visual Resource Inventory
VRM	Visual Resource Management
WECC	Western Electricity Coordinating Council
WEMO	West Mojave
WIU	Wilderness Inventory Unit
WRCC	Western Regional Climate Center