FES 08-44

FINAL

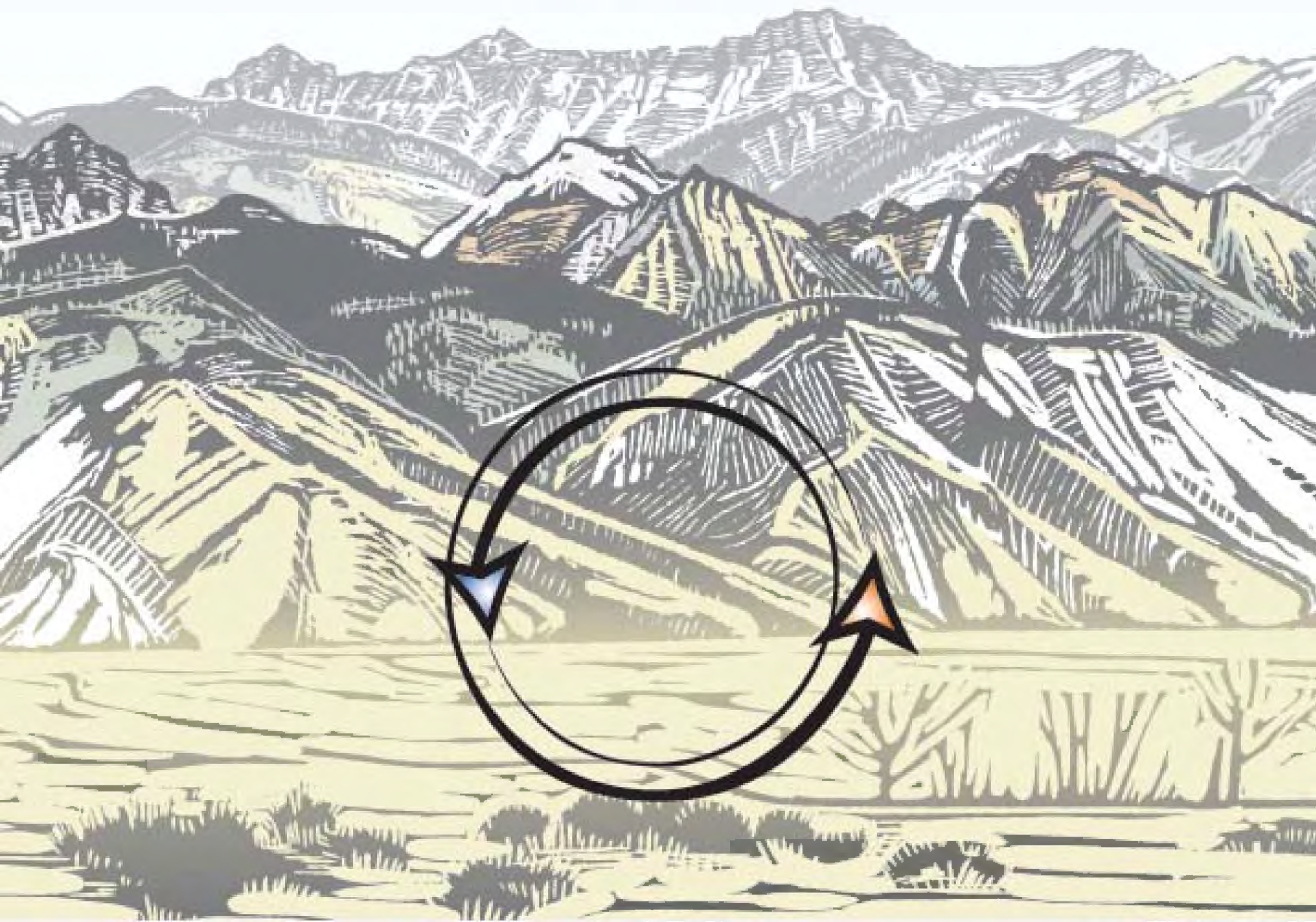
Programmatic Environmental Impact Statement for

Geothermal Leasing

in the Western United States

Volume III: Appendices

October 2008



FES 08-44

FINAL

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR

GEOTHERMAL LEASING IN THE WESTERN UNITED STATES

VOLUME III: APPENDICES

OCTOBER 2008

US DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

US DEPARTMENT OF AGRICULTURE
UNITED STATES FOREST SERVICE

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VOLUME III: APPENDICES

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List of Acronyms

ACEC - Area of Critical Environmental Concern

ADR - Alternative Dispute Resolution

ANCSA - Alaska Native Claims Settlement Act

ANILCA - Alaska National Interest Lands Conservation Act

APD - Application for Permit to Drill

AUM - Animal Unit Month

BLM - United States Department of the Interior, Bureau of Land Management

BMPs - Best Management Practices

C - Celsius

CA - Conservation Agreement

CERCLA - Comprehensive Environmental Response, Compensation and Liability Act

CEQ - Council on Environmental Quality

CFR - Code of Federal Regulations

COAs - Conditions of Approval

CS - Conservation Strategy

CSU - Controlled Surface Use

CX (or CE) - Categorical Exclusion

DM - Departmental Manual

DNA - Documentation of Land Use Plan Conformance and National Environmental Policy Act (NEPA) Adequacy

DOI - Department of the Interior

DR - Decision Record (for an EA)

EA - Environmental Assessment

EFH - Essential Fish Habitat

EIS - Environmental Impact Statement

EPAct of 2005 - Energy Policy Act of 2005 (Public Law 109-58, August 8, 2005)

ESA - Endangered Species Act

F - Fahrenheit

FACA - Federal Advisory Committee Act

FLPMA - Federal Land Policy and Management Act of 1976 (43 United States Code 1701 et seq.)

FONSI - Finding of No Significant Impact

FS - United States Department of Agriculture, Forest Service

FWS - Fish and Wildlife Service

GIS - Geographic Information System

IBLA - Interior Board of Land Appeals

ITAs - Indian Trust Assets

IMP - Interim Management Policy

KGRAs - Known Geothermal Resource Areas

LAC - Limits of Acceptable Change

LUP - Land Use Plan

MFP - Management Framework Plan

MOU - Memorandum of Understanding

NEPA - National Environmental Policy Act of 1969

NFMA - National Forest Management Act of 1976

NFS - National Forest System

NGD - No Ground Disturbance

NHPA - National Historic Preservation Act

NLCS- BLM's National Landscape Conservation System

NMFS - National Marine Fisheries Service

NOA - Notice of Availability

NOAA - National Oceanographic and Atmospheric Administration

NOI - Notice of Intent

NPS - National Park Service

NRCS – National Resources Conservation Service

NREL - US DOE National Renewable Energy Laboratory National Renewable Energy Laboratory

NRHP - National Register of Historic Places

NSO - No Surface Occupancy

OSHA - Occupational Safety and Health Administration

OHV - Off-Highway Vehicle

PAC - Provincial Advisory Council

PEIS - Programmatic Environmental Impact Statement

PFYC – Potential Fossil Yield Classification

PM10 - Particulate Matter Less than 10 Micrometers in Diameter

PM2.5 - Particulate Matter Less than 2.5 Micrometers in Diameter

POD - Plan of Operation and Development

Ppm - Parts per Million

RAC - Resource Advisory Council

RFD - Reasonably Foreseeable Development

RMP - Resource Management Plan

RNA - Research and Natural Area

ROD - Record of Decision (for an EIS)

ROS - Recreation Opportunity Spectrum

ROW- Right of Way

SMS - Scenery Management System

T&E - Threatened and Endangered

TL - Timing Limitation

TMDL -Total Maximum Daily Load

US - United States

USC - United States Code

USDA - United States Department of Agriculture

US DOE - United States Department of Energy

US DOI - United States Department of the Interior

US EPA - United States Environmental Protection Agency

USGS - United States Geological Survey

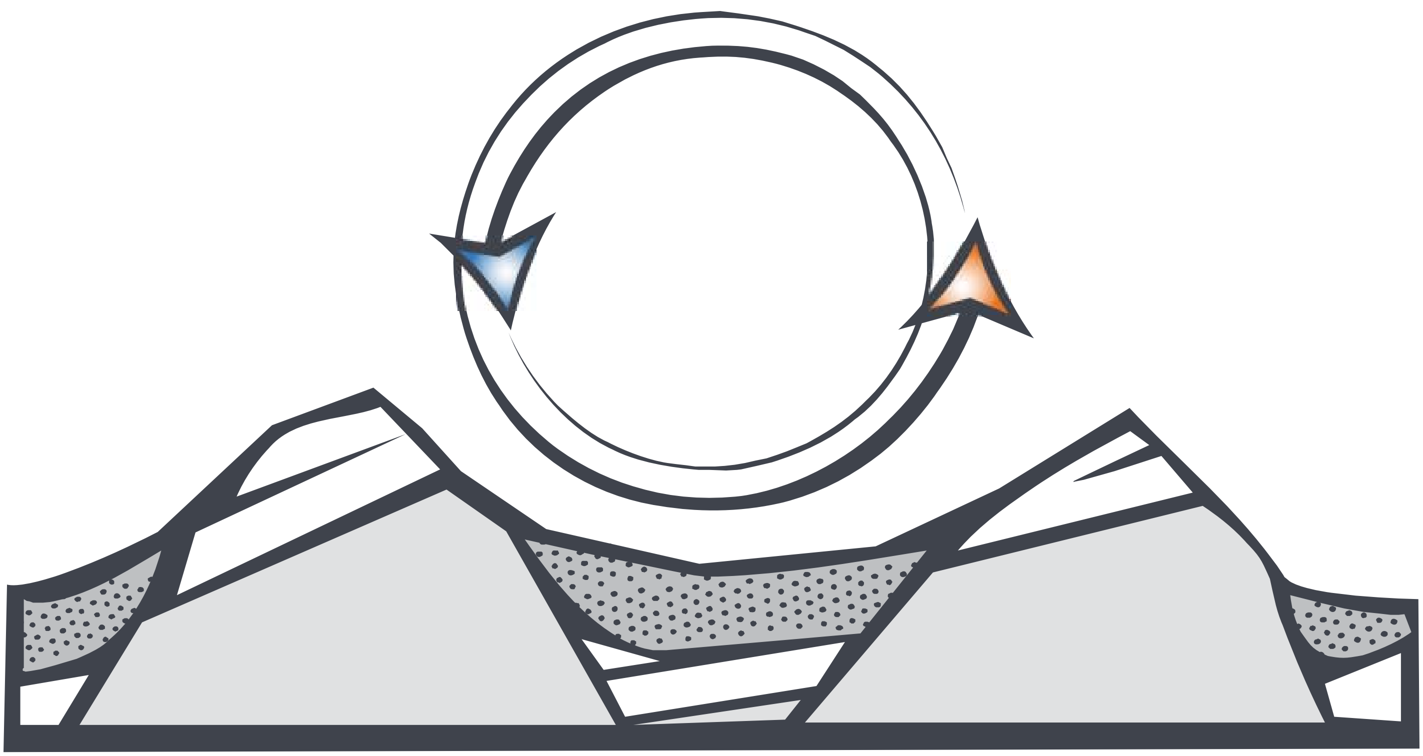
USFWS - United States Department of Interior, Fish and Wildlife Service

VRM - Visual Resource Management

WGA - Western Governors Association

WSR - Wild and Scenic River

WSA - Wilderness Study Area



Appendix A

Status of US Geothermal Energy and Permitting in the Western States and Tribal Lands

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Status of US Geothermal Energy and Permitting in the Western States and Tribal Lands

www.blm.gov

www.fs.fed.us

www.EMPSi.com

Status of US Geothermal Energy and Permitting in the Western States and Tribal Lands

October 2008

prepared
by

Environmental Management and Planning Solutions Inc.

Western States Summary

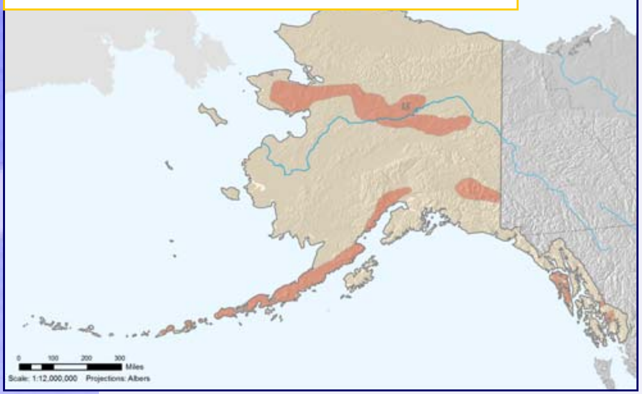
Introduction

This report details the current status of geothermal resources and development for each of the 12 western states covered in this PEIS: Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. The report contains focused information on resource geography, current and proposed geothermal utilization, technical capabilities in the form or public and private research and investment, a look at geothermal resources on tribal lands within each state, and state geothermal regulations and the agencies responsible for the oversight of geothermal resources. Additional requirements and considerations for pursuing geothermal resource development on tribal lands follow the state status section.

The Western States

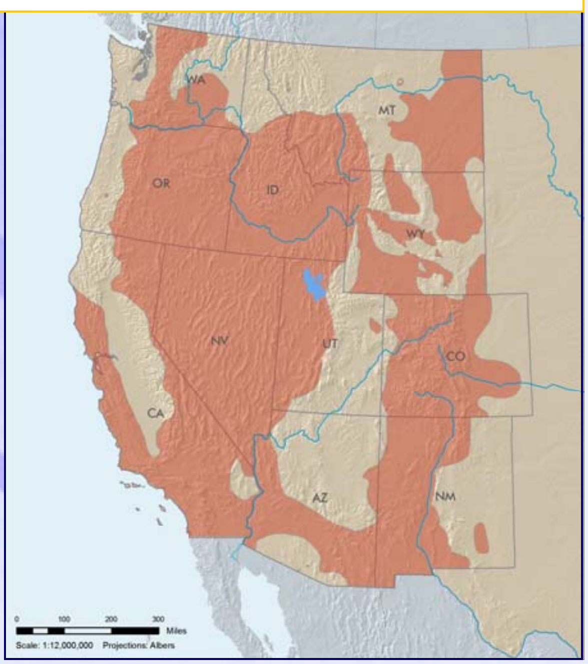
- Alaska
- Arizona
- California
- Colorado
- Idaho
- Montana
- Nevada
- New Mexico
- Oregon
- Utah
- Washington
- Wyoming

Areas of Geothermal Potential in Alaska



In total, about 530 million acres in the 12 western states, including Alaska, are identified as having geothermal potential for indirect or direct applications, with about 480 million acres providing potential for electrical production. The hottest resources and where commercial electrical generation would most likely occur, are generally within central and northern Nevada, western Utah, southern and central Idaho, southern and northeastern California, southeast Oregon, and along the Cascade mountain range.

Areas of Geothermal Potential in the Western States



Estimates of short term (2015) and long term (2025) electrical power generated from geothermal resources provided in this report are derived primarily from the Western Governors' Task Force Report (WGA 2006), with input from state geothermal programs and others in the geothermal industry. Thirty year estimates of potential electrical generation capacity from identified geothermal resources come from the United States Geologic Survey (USGS) report, released October 2008 tilted *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States.*

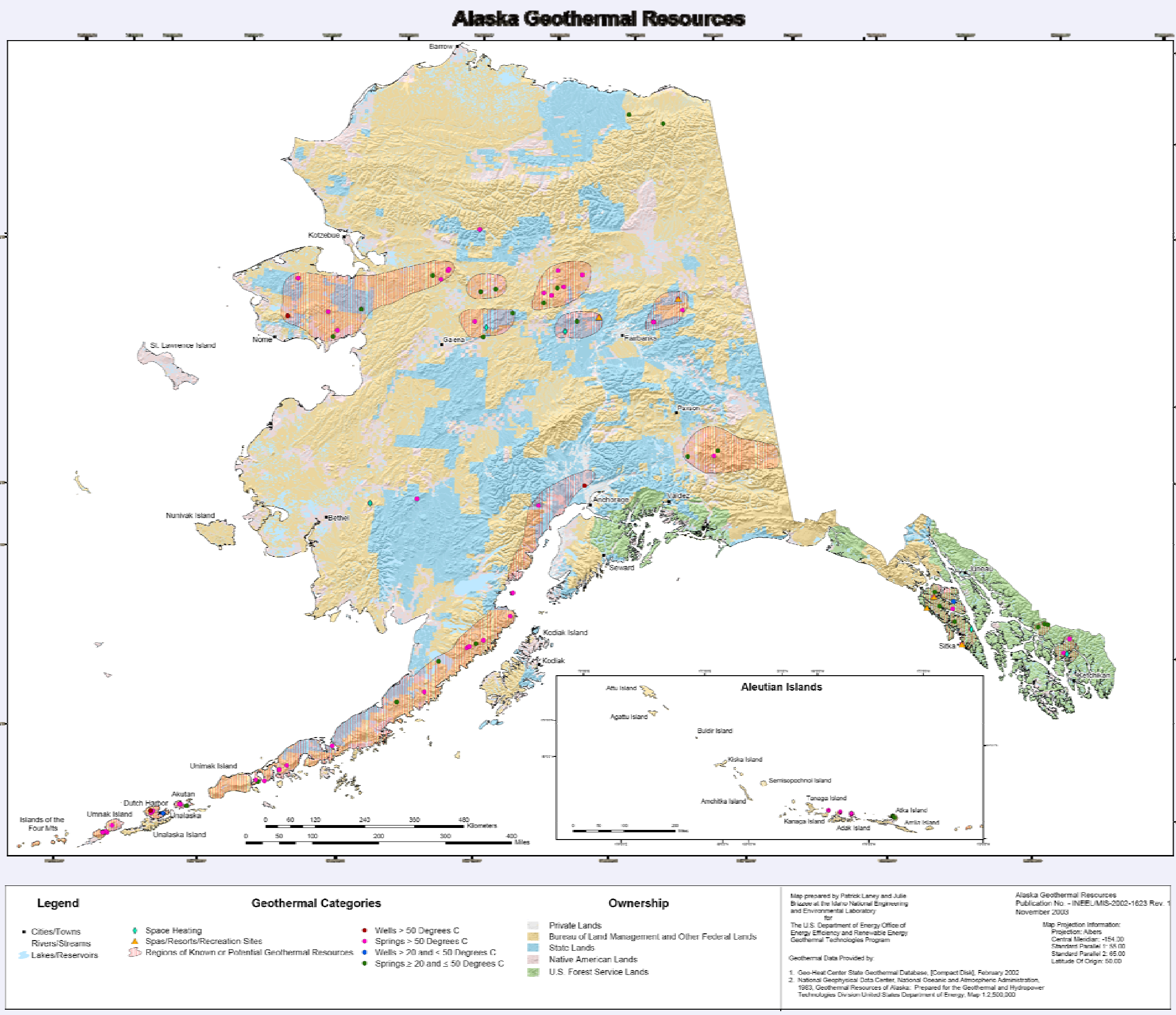
ESTIMATED CAPACITY

The USGS (2008) estimates 8,876 megawatts (MW) of electrical power could be generated from identified geothermal resources in the Western United States. The mean estimated power production resources from undiscovered resources is 27,598 MW, bringing the total estimated mean capacity for electrical power production from geothermal to 34,474 MW. Additionally, estimated potential for new technologies range from 345,100 to 727,900 MW.

Alaska

Resource Geography

Alaska has four distinct geothermal resource regions: The Aleutian Volcanic Arc (which includes the Aleutian Islands as well as the Alaska Peninsula and Cook Inlet volcanoes), The Central Alaskan Hot Springs Belt (CAHSB), The Wrangell Volcanic Cluster, and The Alaskan Panhandle (Kolker 2007). The CAHSB has low to moderate temperature resources while the Aleutian Volcanic Arc holds high-temperature geothermal systems (Crimp 2006). The Wrangell Volcanic Cluster may have the potential for geothermal energy development: The Eastern Copper River Basin (ECRB), close to the western part of the Wrangell volcanoes, has been the subject of geothermal exploration because it contains mud volcanoes, unusual features associated with pressurized groundwater and/or hydrothermal aquifers. Little is known of the potential of the Alaskan Panhandle as no exploration of sites (beyond temperature measurements and aquatic geochemical surveys) has been performed.



Laney, 2003a, http://geothermal.id.doe.gov/maps/ak.pdf

Alaska

Utilization

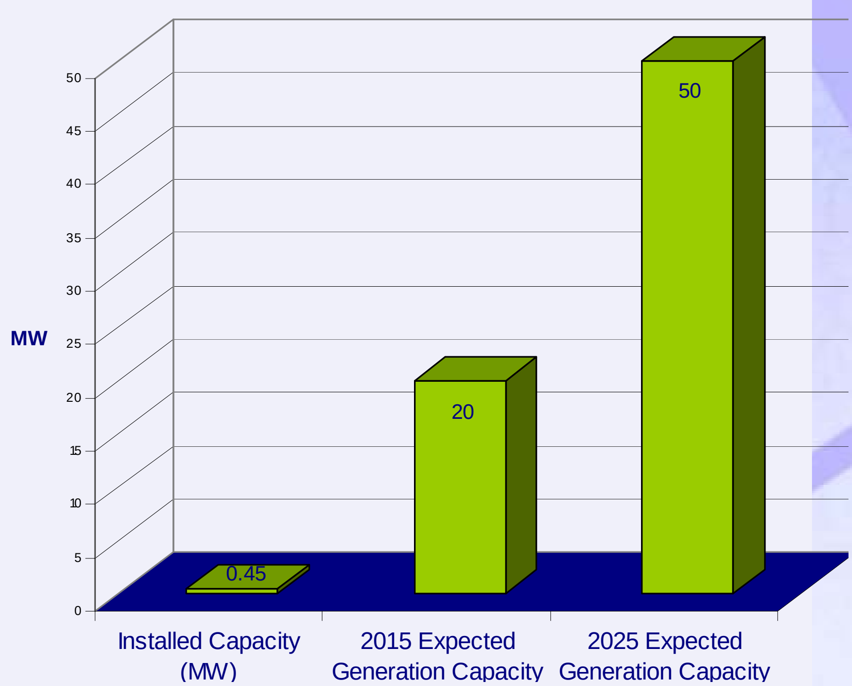
Initial exploration efforts occurred during the 1970s and 80's to help define resource locations but inadequate funding stalled more substantive development. Currently field investigations are on-going to characterize and further identify geothermal areas, particularly near the Chena Hot Springs Resort, where the state's only current geothermal power plant (a two-unit binary system) came on-line in 2006 providing power to the resort and as a demonstration plant. The Chena Hot Springs plant is unique in that it is capable of producing power from a low-temper-ature aquifer (demonstrating the recent advances made in geothermal technology) (USDOE 2007a).

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Alaska during the next 30 years at 677 MW, with a total low-high range of 236 MW to 1,359 MW.

Geothermal energy is not presently used for large-scale electricity production. Direct-use applications such as building heating are common throughout the state and many surface resources have been developed for recreational purposes. The most difficult challenges facing geothermal power plant development in Alaska are the remote locations of known or potential geothermal resource areas, placing potential generation facilities far from existing transmission lines and resulting in high capital costs to build power plants.. A high-temperature (above 302 degrees Fahrenheit [°F], 150 degrees Celcius [°C]) hydrothermal reservoir identified on Unalaska Island has been considered for the development of a 15 MWe (megawatts electric) power plant to supply the city of Unalaska and Dutch Harbor, one of the nation's most active seaports. In addition, the State of Alaska is proposing approximately 36,057 acres in 16 tracts on the south flank of Mount Spurr for geothermal exploration and development (Mount Spurr Geothermal Lease Sale No. 3). On September 10, 2008, the Mount Spurr lease sale was held. The area lies entirely within the Kenai Peninsula Borough, approximately 40 miles west of the village of Tyonek and about 80 west of Anchorage (Diel, 2008). However, the challenges of transmitting the electricity over the terrain separating the energy source from the city, coupled with subsidies for diesel generation, have necessitated additional feasibility studies to implement geothermal power (USDOE 2007a). Field exploration of the leases would likely start in the summer of 2009 (MacKenzie 2008).

Geothermal Electrical Generation



WGA 2006

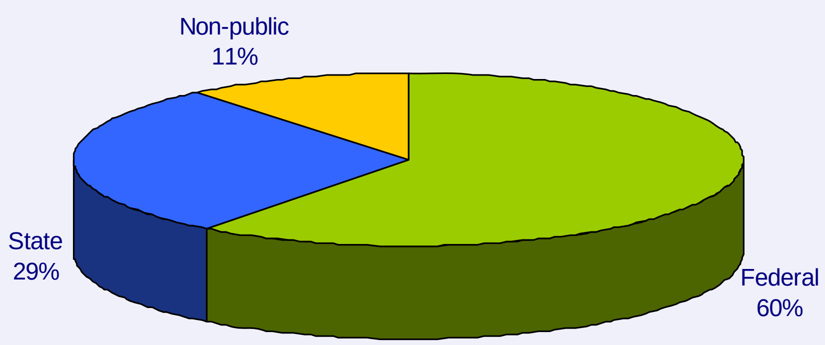
Alaska

Laws and Regulations

Alaska classifies geothermal resources as Mineral (though waters below 120°C are available for appropriation as groundwater and are subject to ground water law statutes), and the state claims ownership of all geothermal resources, including those under private lands. The state gives the landowner preferential right to prospecting permits and/or leases.

The Alaska Department of Natural Resources, Division of Oil and Gas, is responsible for the development of the state's geothermal resources (Battocletti 2005). Alaska has established a Geothermal State Working Group with leadership from the Alaska Energy Authority. The Alaska group brings together state and regional energy professionals to promote the increased utilization of the state's geothermal resources (USDOE 2007a). The state presently has no renewable portfolio standard (RPS) or renewable energy standard (RES) (Richter 2007). Alaska has no state funding allocated specifically for geothermal resource development. The state has not passed greenhouse gas (GHG) reduction legislation but established a Climate Impact Assessment Committee in 2006 to examine and prepare recommendations regarding potential future GHG legislation (Camp 2007). The Alaska State Chamber of Commerce published a document in January 2008 in support of a state-wide energy policy that includes the study and development of Alaska's geothermal resources (ACC 2008).

Land Ownership



NRCM 2008

Alaska

Technical Capabilities

Alaska universities, state agencies, and private firms contribute technical capabilities to the local and national geothermal communities. The University of Alaska has participated in various research and exploration projects throughout Alaska, including the investigation of the Chena Hot Springs area (USDOE 2007a).

Electrical Power Generation and Capacity

Alaska has an installed geothermal electricity production capacity of 0.45 megawatt (MW) with a running capacity of 0.40 MW, all of which comes solely from the Chena plant. Four projects are in development, with a total potential capacity of 45.6-60.6 MW; 20 MW in the short-term (2015), 50 MW in the long-term (2025) (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* provides a mean probability of electrical power generation for identified geothermal resources on all lands in Alaska during the next 30 years at 677 MW, with a total low-high range of 236 MW to 1,359 MW(USGS 2008).

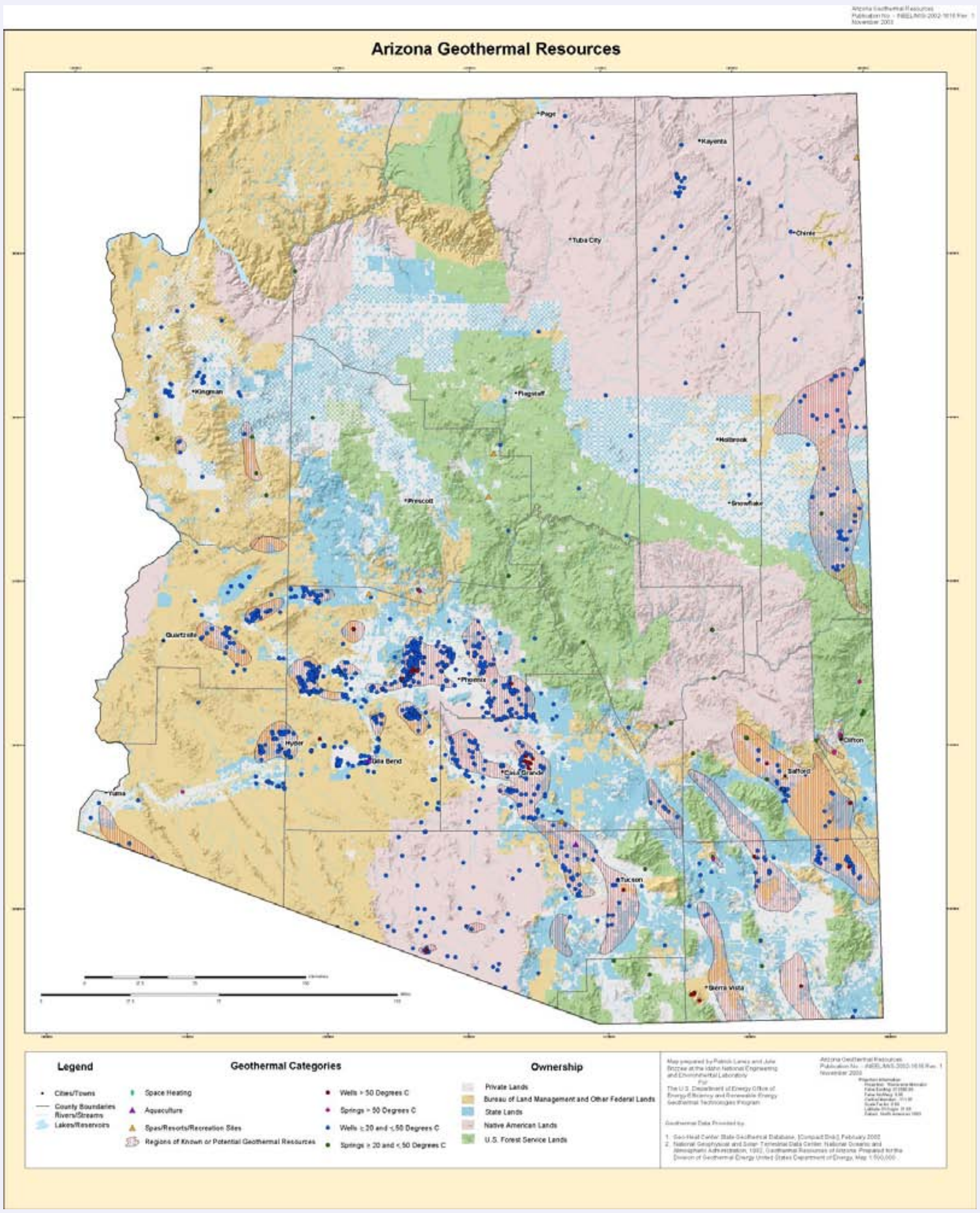
Tribal Lands

The NANA Regional Corporation is currently conducting a Geothermal Assessment Program Feasibility Study to assess potential for power generation on Native Alaska lands in the NANA region (NANA 2007). Source: NANA regional Corp website: http://www.eere.energy.gov/tribalenergy/pdfs/0711review_nana.pdf.

Arizona

Resource Geography

High-temperature geothermal resources have yet to be discovered in Arizona; most known resources of any temperature are located south of the Colorado plateau. Three locations: Buckhorn Baths in Apache Junction, Castle Hot Springs in the Bradshaw Mountains, and Childs on the Verde River exhibit potential for geothermal resources and may warrant exploration (ADC 2008), while geothermal development plans for the counties of Cochise, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz and Yuma were completed in the 1970s (USDOE 2007a).



Laney, 2003a, http://geothermal.id.doe.gov/maps/az.pdf

Arizona

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Arizona during the next 30 years at 26 MW, with a total low-high range of 4 MW to 70 MW.

Utilization

Current development focuses on direct, recreational, and therapeutic use, particularly aquaculture, agriculture and spas. Indirect-use research is on-going: A United States (U.S.) Department of Energy (DOE) grant to drill an exploration well near Clifton Hot Springs in Greenlee County was awarded to the joint groups of Arizona Public Service (APS), Northern Arizona University, Arizona State University, New Mexico University and the Ormond Group (USDOE 2007a). The water temperature ranges from 158-180° F (302-356° C) (ADC 2008). Researchers anticipate this area has the potential to generate 20 MW of electric power (USDOE 2007a). A geothermal power plant has been in planning for several years at this site, but confirmation drilling is required before construction can begin. Northern Arizona University also received US DOE funding to perform geophysical and geochemical testing in the previously unexplored areas of San Francisco Volcanic Field (ADC 2008, Fleischmann 2007).

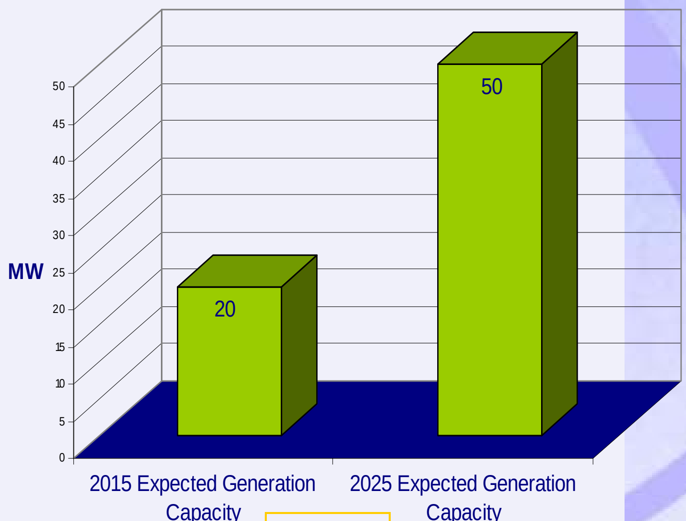
Technical Capabilities

There are several agencies, universities, and private companies assisting in the efforts to further explore Arizona's geothermal capabilities. This collaboration includes: Vulcan Power, Northern Arizona University, Arizona State University, New Mexico University, Arizona Public Service, and the Ormond Group. Northern Arizona University (NAU) is also participating in outreach efforts to educate Arizona's population regarding geothermal resources in addition to it's San Francisco research (USDOE 2007a).

Electrical Power Generation and Capacity

No geothermal plants exist in the state as of present. One project (Clifton Hot Springs) is currently in development, with a projected potential of 2-20 MW, 20 MW short-term and 50 MW long-term (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Arizona during the next 30 years at 26 MW, with a total low-high range of 4 MW to 70 MW (USGS 2008).

Geothermal Electrical Generation



WGA 2006

Tribal Lands

Tribal lands in Arizona make up roughly 27 percent of the state's land. No geothermal direct use facilities are known to be operating on these lands. Those who work with tribes in Arizona assert that continued education and public involvement are essential if tribal leaders will pursue geothermal projects (Fleischmann 2007). Maps and data for geothermal resources on tribal lands in Arizona are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_arizona.html (USDOE 2007b).

Arizona

Tribes with Potential Geothermal Resources in Arizona
Ak Chin Indian Community of the Maricopa Indian Reservation
Cocopah Tribe
Colorado River Indian Tribes of the Colorado River Indian Reservation
Fort Apache Reservation
Fort McDowell Yavapai Nation of the Fort McDowell Indian Reservation
Fort Mojave Indian Tribe
Fort Yuma Indian Reservation
Gila River Indian Community of the Gila River Indian Reservation
Havasupai Tribe of the Havasupai Reservation
Hopi Tribe of Arizona:
San Carlos Apache Tribe of the San Carlos Reservation
Northern lands
Eastern lands
Southwestern lands
Kaibab Indian Reservation
Hualapai Indian Tribe of the Hualapai Indian Reservation:
San Juan Southern Paiute Tribe
Northern lands
Southern lands
Maricopa Indian Community of the Salt River Reservation
Maricopa Indian Reservation
Navajo Nation:
Four Corners Region lands (Northeast Arizona, Northwest New Mexico, and Southeast Utah)
North Central Arizona and Central Utah lands
East Central lands in Arizona
Four Corners Region lands (Northeast Arizona, Northwest New Mexico, and Southeast Utah)
Southeastern lands in Arizona
Southwestern lands in Arizona
Paiute Indians of the Kaibab Indian Reservation
Pascua Yaqui Tribe
Quechan Tribe of the Fort Yuma Indian Reservation
Salt River Pima-Maricopa Indian Community of the Salt River Reservation
Salt River Reservation
Tohono O'odham Nation
Tonto Apache Tribe
White Mountain Apache Tribe of the Fort Apache Reservation
Yavapai-Apache Nation
Yavapai-Prescott Tribe of the Yavapai Reservation

Arizona

Laws and Regulations

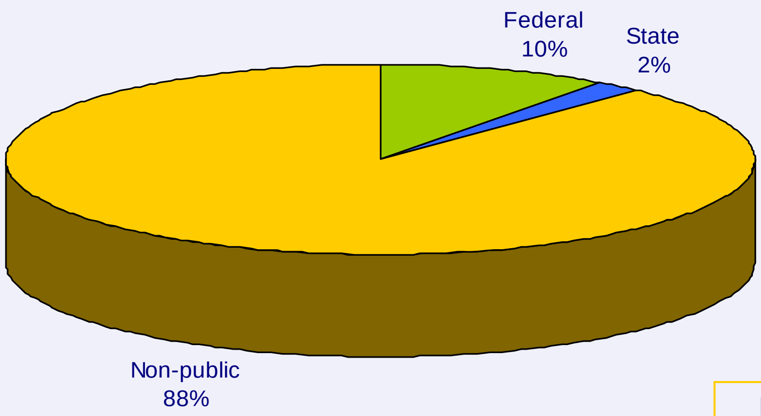
The State of Arizona classifies geothermal resources as *sui generis,* indicating that they are not covered by a 'Use Class' but effectively are in a class of their own. The state claims ownership of all geothermal resources on state lands and reserves the right to lease or withhold these state lands for the purpose of leasing (Battocletti 2005).

Several state agencies are involved with any potential geothermal project. The Arizona Department of Environmental Quality (DEQ) is responsible for the disposal of waters associated with geothermal projects. The State Department of Water resources must be consulted to obtain well construction permits and to secure water rights, and the Department of Commerce Community Planning Office should be contacted regarding planning and zoning issues across the state (Battocletti 2005). Arizona's Geothermal Working Group has established two primary tasks: collecting data on all of the current state geothermal applications and documented resources, and identifying future energy development activities that will be the most beneficial to the state (USDOE 2007a).

Arizona has set a RPS of 7 percent by 2017 and 15 percent by 2025 (60 percent of which will come from solar and 30 percent of which will be distributed energy). The RPS for geothermal electrical and geothermal heat pumps is 15 percent by 2025 (Richter 2007). There is currently no state funding or incentive for geothermal development (USDOE 2007). The state has GHG reduction targets aiming for year 2000 GHG levels by 2020 and 50 percent below 2000 levels by 2040, and is considering legislation to set these targets (Camp 2007).

Land Ownership

(33,328,000 total acres)



NRCM 2008

California

Resource Geography

California has several high-potential geothermal areas, and much of the state, with the exception of the Central Valley and the far northwest corner, displays potential for geothermal resources (USDOE 2007). Twenty-five known geothermal resource areas exist in the state (CEC 2008), including north of Santa Rosa at the Geysers, in the northeastern part of the state, in the Owens Valley and eastern Sierras, in the Mojave Desert, and at the Salton Sea and Imperial Valley in southern California (CDC 2008, CEC 2008, USDOE 2007a).

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in California during the next 30 years at 5,404 MW, with a total low-high range of 2,422 MW to 9,282 MW.

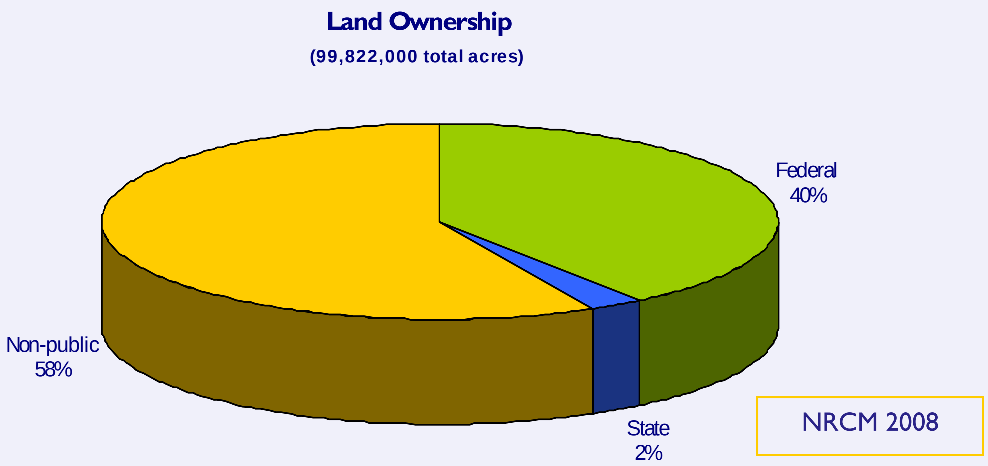
Utilization

California currently leads the nation and world in geothermal electricity generation, with seven percent of the state's total power production output coming from geothermal resources (USDOE 2007a). Six counties produce geothermal resources hot enough for electrical power generation (CDC 2008). The state has over 600 active, high-temperature geothermal wells (with fluids over 212°F, 100°C) and 230 injection wells (CEC 2008).

There are 15 electrical power projects in various stages of development in California (with a total MW potential of 921.3-969.3), and the Western Governor's Association Geothermal Task Force projects up to 2,400 MW of additional power production capacity for potential near-term development (Richter 2007). Direct use of geothermal power in California is expanding and consists of aquaculture, agriculture, recreation, and food dehydration (CDC 2008). The largest concentration of geothermal aquaculture facilities in the US is in the Imperial Valley (Rafferty 1999).

Technical Capabilities

California universities, state agencies, and private firms contribute technical capabilities to the local and national geothermal communities. The California Energy Commission maintains databases of geothermal resource information and produces numerous reports on state resources and development opportunities (USDOE 2007a).



California

California- CDC 2002. ftp://ftp.consrv.ca.gov/pub/oil/maps/Geothermal/MapS-11.pdf

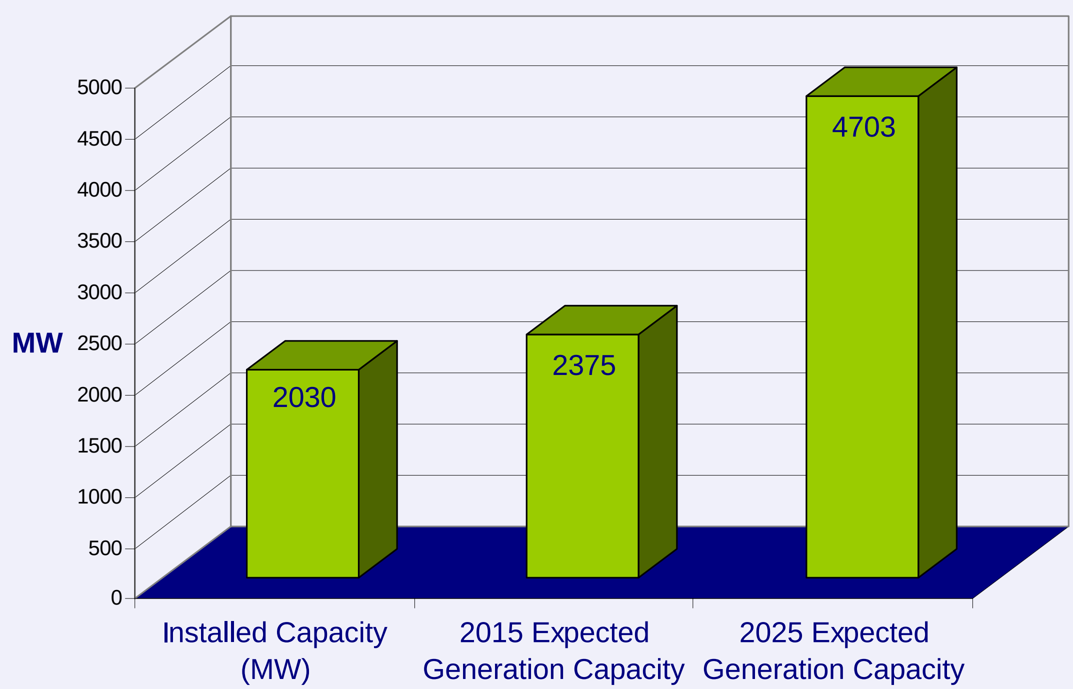
California

Electrical Power Generation and Capacity

Approximately 40 percent of total world-wide geothermal plant production takes place in California, largely due to the presence of the Geysers, a collection of 41 geothermal power plants located north of San Francisco, which is the world's largest producer of geothermal power. Additional plants are located in the Imperial Valley (east of San Diego), at Coso Hot Springs near Ridgecrest, at Amedee/Wineagle near Susanville, and at the Mammoth Lakes area in Long Valley (USDOE 2007a).

California has a literature-cited installed geothermal power capacity of 2,492.10 MW, with a current running capacity of 2030.47 MW. Approximately 14,379 GWh (gigawatt hour) of geothermal energy is produced annually from 49 plants (composed of 67 units total). These plants include binary, dry steam, single flash, double flash, dual flash, hybrid-biomass/geothermal, and dry team-low pressure reaction types (Richter 2007) and include sites at Amedee, Casa Diablo, East Mesa, Glass Mountain, Heber, Honey Lake, and Salton Sea, in addition to those previously mentioned (USDOE 2007a). The same literature cites a short-term projected geothermal electricity generation potential for the state of 2,375 MW, with a long-term potential of 4,703 MW (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in California during the next 30 years at 5,404 MW, with a total low-high range of 2,422 MW to 9,282 MW (USGS 2008). Recently, development has been limited or stalled by transmission issues and delays resulting from federal and state permitting regulations. However, geothermal power production capacity is increasing in California (Fleischmann 2007).

Geothermal Electrical Generation



WGA 2006

California

Tribal Lands

Maps and data for geothermal resources on tribal lands in California are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_california.html (USDOE 2007c). The table on the following two pages indicates which tribes data is available for at the DOE website.

Tribes with Potential Geothermal Resources in California	
Agua Caliente Band of Cahuilla Indians of the Agua Caliente Indian Reservation	Alturas Indian Rancheria of Pit River Indians
Auburn Rancheria	Augustine Band of Cahuilla Mission Indians
Barona Reservation	Bear River Band of the Rohnerville Rancheria
Benton Paiute Reservation	Berry Creek Rancheria of Maidu Indians
Big Lagoon Rancheria of Smith River Indians	Big Pine Band of Owens Valley Paiute Shoshone Indians
Big Sandy Rancheria of Mono Indians	Big Valley Band of Pomo Indians of the Big Valley Rancheria
Bishop Reservation	Blue Lake Rancheria
Bridgeport Paiute Indian Colony	Buena Vista Rancheria of Me-Wuk Indians
Cabazon Band of Cahullia Mission Indians of the Cabazon Reservation	Cahuilla Band of Mission Indians of the Cahuilla Reservation
Cahto Indian Tribe of the Laytonville Rancheria	California Valley Miwok Tribe (formerly the Sheep Ranch Rancheria of Me-Wuk Indians)
Campo Band of Diegueno Mission Indians of the Campo Indian Reservation	Capitan Grande Band of Mission Indians of the Barona Reservation
Capitan Grande Band of Mission Indians of the Viejas Reservation	Cedarville Reservation of Northern Paiute Indians
Chemehuevi Indian Tribe of the Chemehuevi Reservation	Cher-Ae Heights Indian Community of the Trinidad Rancheria
Chicken Ranch Rancheria of Me-Wuk Indians	Chico Rancheria
Cloverdale Rancheria of Pomo Indians	Coast Indian Community of Yurok Indians of the Resighini Rancheria (see Resighini Rancheria)
Cold Springs Rancheria of Mono Indians	Colorado River Indian Tribes of the Colorado River Indian Reservation
Colusa Rancheria	Cortina Indian Rancheria
Coyote Valley Band of Pomo Indians	Cuyapaipe Community of Diegueno Mission Indians of the Cuyapaipe Reservation
Death Valley Timbi-Sha Shoshone Band	Dry Creek Rancheria of Pomo Indians
Elem Indian Colony of Pomo Indians of the Sulphur Bank Rancheria	Elk Valley Rancheria
Enterprise Rancheria of Maidu Indians	Fort Bidwell Indian Community of Paiute Indians
Fort Independence Indian Community of Paiute Indians	Fort Mojave Indian Tribe
Fort Yuma Indian Reservation	Greenville Rancheria of Maidu Indians
Grindstone Creek Rancheria of Wintun-Wailaki Indians	Guidiville Rancheria
Hoopa Valley Tribe	Hopland Band of Pomo Indians of the Hopland Rancheria
Inaja Cosmit Band of Diegueno Mission Indians of the Inaja and Cosmit Reservation	Jackson Rancheria of Me-Wuk Indians
Jamul Band of Mission Indians, Jamul Indian Village	Karuk Tribe
Kashia Band of Pomo Indians of the Stewarts Point Rancheria	La Jolla Band of Luiseno Mission Indians of the La Jolla Reservation
La Posta Band of Diegueno Mission Indians of the La Posta Indian Reservation	Lone Pine Paiute Shoshone Reservation
Los Coyotes Band of Cahuilla Mission Indians of the Los Coyotes Reservation	Lytton Band of Pomo Indians at the Lytton Rancheria
Manchester Band of Pomo Indians of the Manchester-Point Arena Rancheria	Manzanita Band of Diegueno Mission Indians of the Manzanita Reservation

California

Tribes with Potential Geothermal Resources in California (continued)	
Mechoopda Indian Tribe of Chico Rancheria	Mesa Grande Band of Diegueno Mission Indians of the Mesa Grande Reservation
Middletown Rancheria of Pomo Indians	Mooretown Rancheria of Maidu Indians
Morongo Band of Cahuilla Mission Indians of the Morongo Reservation	North Fork Rancheria of Mono Indians
Paiute-Shoshone Indians of the Bishop Community of the Bishop Reservation	Pala Band of Luiseno Mission Indians of the Pala Reservation
Paskenta Band of Nomlaki Indians (see Grindstone Creek Rancheria)	Pauma Band of Luiseno Mission Indians of the Pauma and Yuima Reservation
Pechanga Band of Luiseno Mission Indians of the Pechanga Reservation	Picayune Rancheria of Chukchansi Indians
Pine Community of the Lone Pine Reservation	Pinoleville Band of Pomo Indians
Pit River Tribe: XL Ranch and Likely and Lookout Rancherias Quartz Valley Indian Community of the Quartz Valley Reservation	Big Bend, Montgomery Creek, and Roaring Creek Rancherias
Ramona Band or Village of Cahuilla Mission Indians	Potter Valley Rancheria of Pomo Indians
Redwood Valley Rancheria of Pomo Indians	Quechan Tribe of the Fort Yuma Indian Reservation
Rincon Band of Luiseno Mission Indians of the Rincon Reservation	Redding Rancheria
Rohnerville Rancheria	Resighini Rancheria (formerly known as the Coast Indian Community of Yurok Indians of the Resighini Rancheria)
Rumsey Indian Rancheria of Wintun Indians	Robinson Rancheria of Pomo Indians
San Pasqual Band of Diegueno Mission Indians	Round Valley Indian Tribes of the Round Valley Reservation (formerly known as the Covelo Indian Community)
Santa Rosa Band of Cahuilla Mission Indians of the Santa Rosa Reservation	San Manuel Band of Serrano Mission Indians of the San Manuel Reservation
Santa Ysabel Band of Diegueno Mission Indians of the Santa Ysabel Reservation	Santa Rosa Indian Community of the Santa Rosa Rancheria
Sherwood Valley Rancheria of Pomo Indians	Santa Ynez Band of Chumash Mission Indians of the Santa Ynez Reservation
Smith River Rancheria	Sheep Ranch Rancheria of Me-Wuk Indians (see California Valley Miwok Tribe)
Stewarts Point Rancheria	Shingle Springs Band of Miwok Indians, Shingle Springs Rancheria (Verona Tract)
Sycuan Band of Diegueno Mission Indians	Soboba Band of Luiseno Mission Indians of the Soboba Reservation
Wiyot Tribe Table Bluff Reservation	Susanville Indian Rancheria of Paiute, Maidu, Pit River & Washoe Indians
Torres-Martinez Band of Desert Cahuilla Mission Indians	Trinidad Rancheria
Tuolumne Band of Me-Wuk Indians of the Tuolumne Rancheria	Table Mountain Rancheria
United Auburn Indian Community of the Auburn Rancheria	Tule River Indian Tribe of the Tule River Reservation
Utu Utu Gwaitu Paiute Tribe of the Benton Paiute Reservation	Twenty-Nine Palms Band of Mission Indians (Chemehuevi)
Washoe Tribe of Nevada and California of the Woodfords Community	Upper Lake Rancheria
Viejas Reservation	Yurok Tribe of the Yurok Reservation

California

Laws and Regulations

California classifies geothermal resources as Mineral and claims ownership of these resources where they occur on state-owned land; otherwise, the resource is the property of the owner of the mineral estate. Permits for siting power plants greater than or equal to 50 MW on all lands, including federal lands, are issued by the California Energy Commission. The Division of Oil, Gas, and Geothermal Resources is the lead agency for the environmental review of exploratory wells (excluding Imperial County) and permits the drilling, operation, plugging, and abandonment of all production and injection wells. The local authority is the lead agency for the environmental review of developmental wells, pipelines, and power plants generating less than 50 MW (Battocletti 2005). California has established a Geothermal State Working Group, with leadership from the California Energy Commission. The California group brings together state and regional energy professionals for workshops and other outreach activities. A geothermal industry summit was held in Sacramento in 2004, during which geothermal stakeholders examined opportunities for further development in relation to California's RPS legislation, as well as grid interconnection and industry partnership topics (USDOE 2007a).

The state's RPS requires ten percent renewable energy by 2010, with a minimum of one percent over the previous year for 2004-2010. The RPS mandates geothermal electric growth of one percent over the previous year, at least 20 percent by 2010, and a long-term goal of 33 percent by 2020 (Richter 2007). The state offers supplemental energy payments applicable to geothermal power plants through its RPS, as well as energy efficiency rebates (USDOE 2007a). In 2006 California passed a GHG law setting reduction targets of 1990 levels by 2020 and 80 percent below 1990 levels by 2050. The state requires a performance standard for electricity generation and sales of 1,100 lbs of CO_2 per MWh (Camp 2007).

Colorado

Resource Geography

Expert opinion suggests Colorado has a large geothermal resource base, although development in the state has been limited to direct-use applications (USDOE 2007a). When last inventoried in 1993, Colorado had 59 sites with water temperatures above 95° F (35° C) and 34 geothermal wells (CGS 2007). High-temperature resources exist at greater depth beneath most of the mountainous regions of the state (CGS 2007, CSWG 2007, USDOE 2007a). From preliminary heat flow and geothermal gradient maps, several areas can be identified that have potential for geothermal power generation. These locations include the Mt. Princeton area near Buena Vista, the Waunita Hot Springs area in southeast Gunnison County, the San Luis Basin especially along its margins, the San Juan Mountains near Ouray and Rico, Pagosa Springs, the Raton Basin west of Trinidad, and possibly an area near Somerset. Also, past geothermal and geochemistry studies at hot springs in the Steamboat Springs area indicate geothermal resources at depth may have temperatures above 250° F (121° C). Oil and gas development has also indicated geothermal resource potential in both the Denver and San Juan Basins (CSWG 2007).

Utilization

Geothermal electric power has not historically been considered competitive given low energy prices in the state. Thus further exploration and analysis is needed to characterize known geothermal prospects and determine what would be needed for development. As suggested above, some resources may require deep drilling, while small power units similar to the plant at Chena Hot Springs in Alaska may be applicable in some locations (Fleischmann 2007). Current plans for development continue to focus on direct-use, particularly for recreation, therapeutic properties and aquaculture. Several unique aquaculture-related projects are currently in operation, i.e. alligator farms (Clutter 2001).

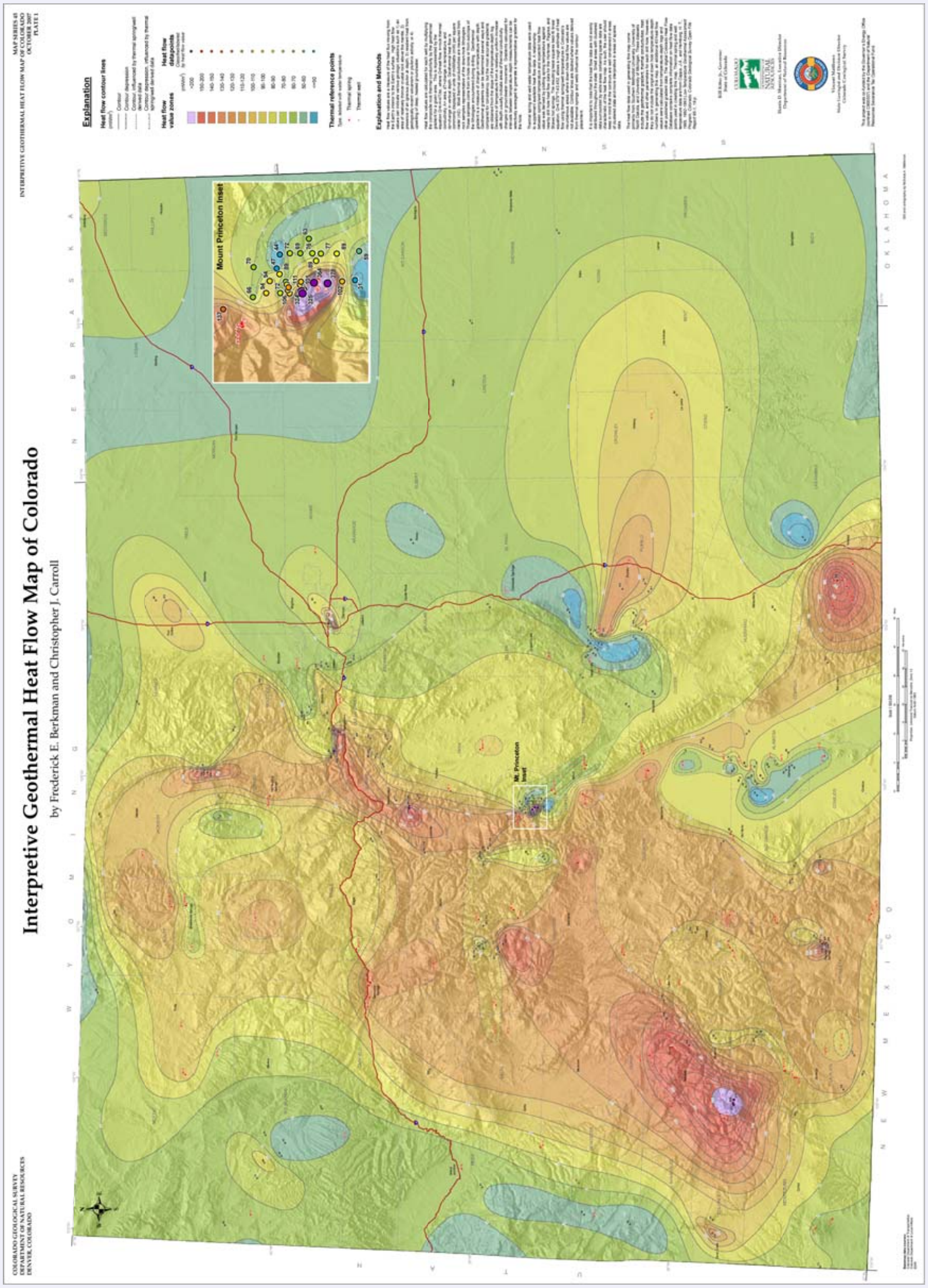
ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Colorado during the next 30 years at 30 MW, with a total low-high range of 8 MW to 67 MW.

Technical Capabilities

Colorado universities, state agencies, and private firms contribute technical capabilities to the local and national geothermal communities. The Colorado Geological Survey has conducted and published various assessments of the state's geothermal resource base, while the National Renewable Energy Laboratory in Golden, Colorado is the nation's leading institution for the research and development of renewable energy technologies, including geothermal energy (USDOE 2007a). Currently the Colorado Geological Survey is compiling a Colorado-specific geothermal database, which will be used to create an updated and more detailed state-wide heat flow map and geothermal gradient map (CSWG 2007).

Colorado



CGS 2007b, http://geosurvey.state.co.us/Default.aspx?tabid=484

Colorado

Technical Capabilities

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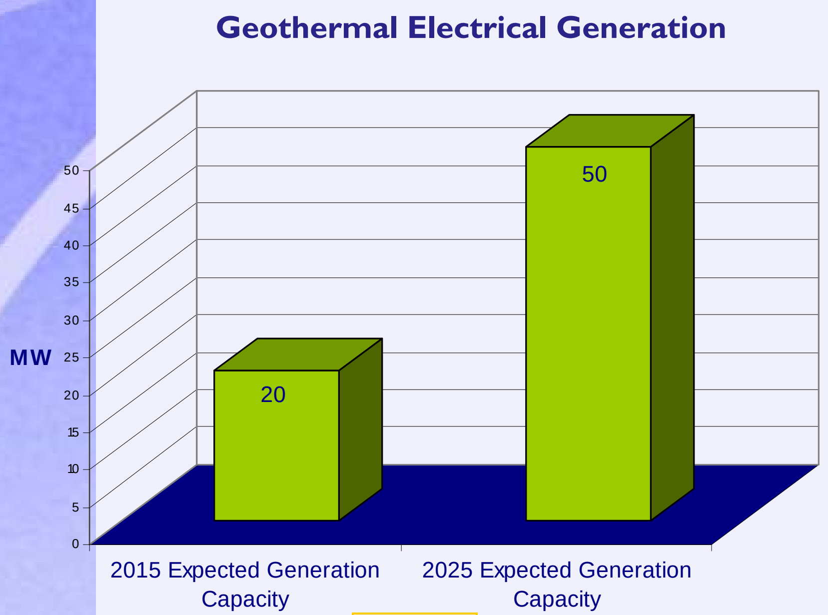
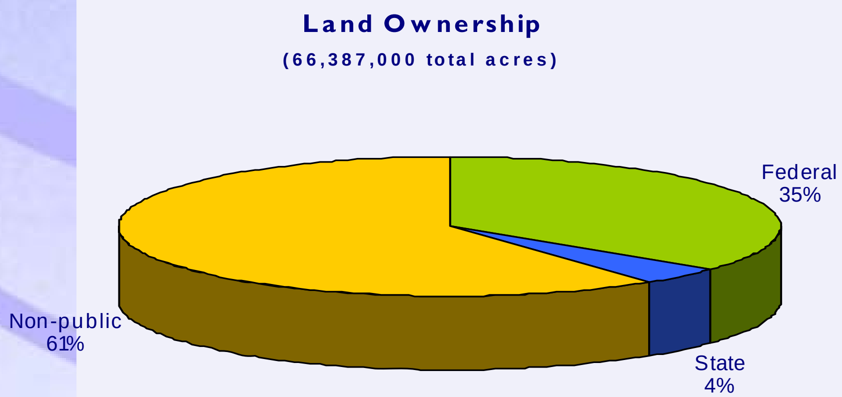


WGA 2006



NRCM 2008

Electrical Power Generation and Capacity

No geothermal power plants are currently proposed for the state, but literature cites a short-term geothermal potential of 20 MW, with a long-term potential of 50 MW (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Colorado during the next 30 years at 30 MW, with a total low-high range of 8 MW to 67 MW (USGS 2008). The Colorado Geological Survey reports that the state displays a number of criteria for geothermal power potential, including quarternary volcanoes and fault lines, and one of the highest high flows in the US. Studies indicate that Colorado may have some of the best high-temperature resources in the country for extraction via "enhanced geothermal system" or "hot dry-rock" technology (CGS 2007). (A hot dry-rock resource is deep, hot crystalline rock that can be used to generate geothermal energy by pumping water down to the rock and thus heating it before it returns to the surface) (Battocletti 2005).

Colorado

Tribal Lands

Maps and data for geothermal resources on tribal lands in Colorado are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_colorado.html (USDOE 2007d). Tribes for which information is available are listed below.

Tribes with Potential Geothermal Resources in Colorado
Southern Ute Indian Tribe of the Southern Ute Reservation: Main tribal lands Western-most tribal lands
Ute Mountain Tribe of the Ute Mountain Reservation

Laws and Regulations

The State of Colorado classifies geothermal resources as Water and stipulates that geothermal resources are publicly-owned. A property right to a hot dry-rock resource is an incidence of the overlaying surface, unless several resources are transferred with the subsurface estate expressly (Battocletti 2005).

The Colorado Division of Water Resources is the lead state agency administering geothermal resource rules and regulations, as well as overseeing the permitting of injection wells. The US Environmental Protection Agency (EPA), Region 8, has primacy however, and oversees the administration of underground fluid injection wells. The state Department of Public Health and Environment's Water Quality Control Division is responsible for administering surface disposal of wastewater, including geothermal fluids (Battocletti 2005). Colorado has established a Geothermal State Working Group with leadership from Delta-Montrose Electric Association. The Colorado group is in the process of bringing together state and regional energy professionals to work together to promote the increased utilization of the state's geothermal resources (USDOE 2007a). Colorado has a RPS of 20 percent by 2020 for investor-owned utilities (IOUs) and ten percent for rural co-ops and municipality utilities (four percent solar for 2007-2010 for IOUs only) (Richter 2007). Outside of the RPS the state offers no incentives for geothermal development and no funding is available at the state level for development (USDOE 2007a). Presently Colorado has no GHG laws or legislation pending, but does participate in the National Climate Registry (Camp 2007).

Idaho

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Idaho during the next 30 years at 333 MW, with a total low-high range of 81 MW to 760 MW.

Resource Geography

Idaho has both low-temperature geothermal sources for potential direct-use and high-temperature sites (concentrated in the southern part of the state) that may provide opportunities for electricity production (Crimp 2006).

Utilization

Current development focuses on community heating though construction of the state's first geothermal power generation facility, a 10-MW plant at Raft River (approximately 200 miles southeast of Boise) that was completed in January 2008 (USDOE 2007a, USGI 2008).

Past exploration and development efforts have been limited, as low energy costs and the small size of the state's population did not necessitate new sources of electric power. Thus, further exploration and characterization of Idaho's geothermal resources is needed to better define the state's resource potential (Fleischmann 2007). In addition to Raft River, three other sites are being investigated for potential electricity generation: the China Cap site in Caribou County (with a literature-estimated capacity of 100 MW), an area near Willow Springs (with a literature-estimated capacity of 100 MW) (USDOE 2007a), and a site at Crane Creek in western Idaho (with a literature-estimated value of 100-179 MW) (Neely 2007).

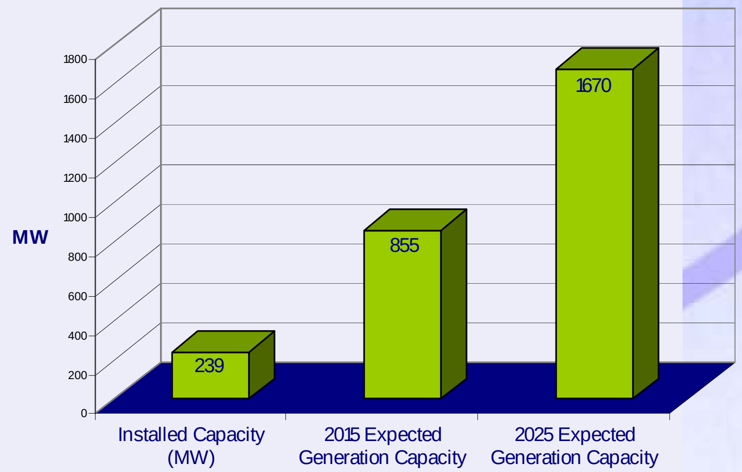
Technical Capabilities

The Idaho National Laboratory houses national expertise in the research and development of geothermal energy resources. The laboratory maintains databases of geological characteristics to aid in the characterization and development of geothermal reservoirs nationwide. Additionally, the Energy Division of the Idaho Department of Water Resources provides technical support for geothermal projects in the state and conducts educational outreach activities to promote further geothermal development (USDOE 2007a).

Electric Power Generation and Capacity

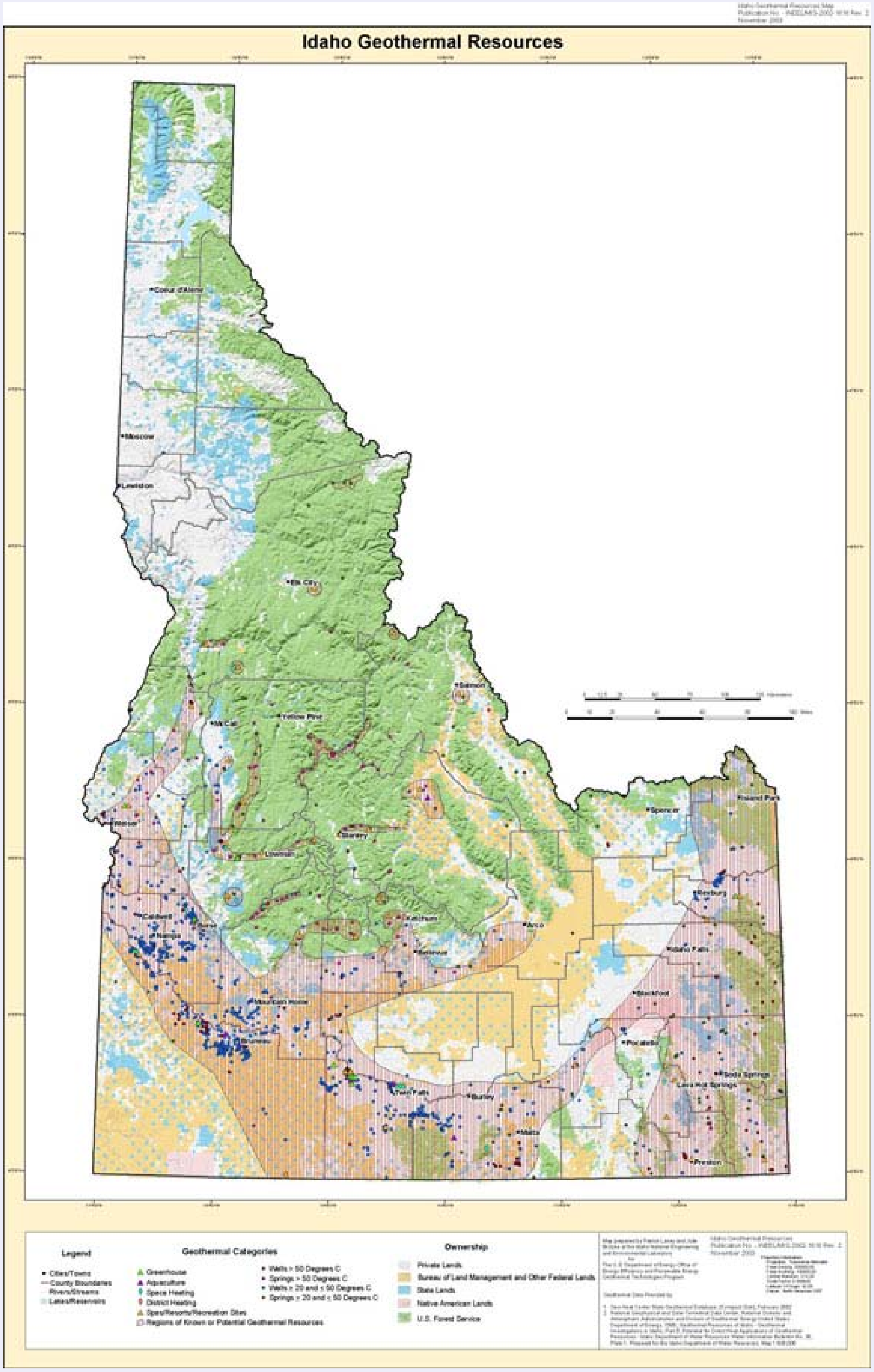
Four projects are in development, with a total literature-estimated MW potential of 39-239. Literature-cited potential energy production from geothermal resources places estimates at 855 MW short-term and 1,670 long-term (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Idaho during the next 30 years at 333 MW, with a total low-high range of 81 MW to 760 MW (USGS 2008).

Geothermal Electrical Generation



WGA 2006

Idaho



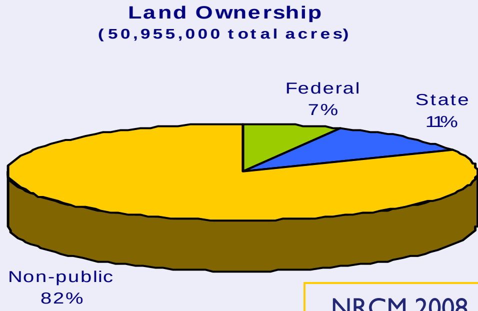
Laney, 2003c, http://geothermal.id.doe.gov/maps/id.pdf

Idaho

Tribal Lands

Tribal lands in Idaho make up roughly 1.1 percent of the state's land. The largest reservation is the Fort Hall Reservation north of Pocatello, where potential for geothermal resource development has been suggested by research in the area (Fleischmann 2007). Maps and data for geothermal resources on tribal lands in Idaho are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_idaho.html (USDOE 2007e). Tribes for which information is available are listed below.

- Coeur D'Alene Tribe of the Coeur D'Alene Reservation
- Duck Valley Reservation
- Fort Hall Reservation
- Kootenai Tribe
- Nez Perce Tribe
- Shoshone-Bannock Tribes of the Fort Hall Reservation
- Shoshone-Paiute Tribes of the Duck Valley Reservation



NRCM 2008

Laws and Regulations

Idaho classifies geothermal resources as *sui generis* and Water. Groundwater with a temperature greater than or equal to 212°F at the well bottom fall under the category of *sui generis* and is further classified as a "geothermal resource." Groundwater between 85-212°F at the well bottom is classified as a "low temperature geothermal resource." The state claims ownership of all geothermal resources underlying state and school lands and holds the right to regulate development and use of all of the state's geothermal resources (Battocletti 2005).

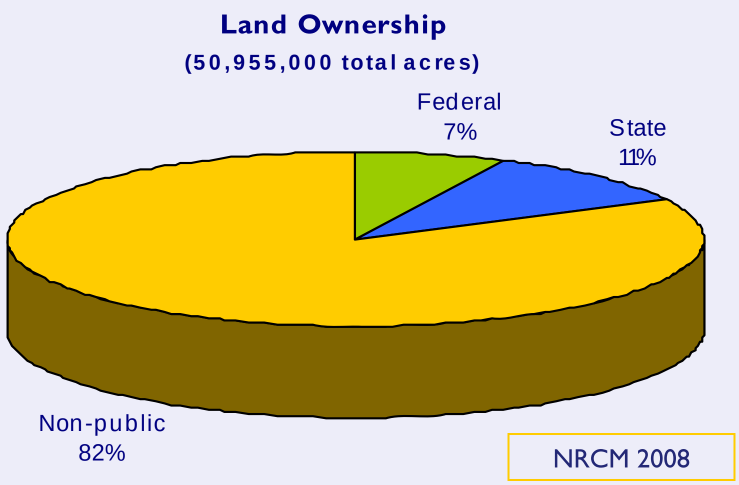
The Idaho Department of Water Resources issues water rights, well-drilling permits, and injection well permits. The state's DEQ Water Quality Division is responsible for administering surface disposal of wastewater, including geothermal fluids. The Idaho Department of Lands has a process that includes permitting, bonding, and royalties. The state does not have comprehensive environmental review statutes and does not coordinate permitting at the state level. Developers must obtain permits from state and local boards and agencies. The use of "geothermal resources" (as classified by the state) does not require a permit to appropriate water unless it will decrease groundwater in any aquifer or other groundwater resource, or measurably decrease groundwater available from prior water rights. The use of "low-temperature geothermal resources" requires a permit to appropriate water (Battocletti 2005). Idaho has established a Geothermal State Working Group, with leadership from the Idaho Energy Division. The group organizes workshops to promote the increased utilization of the state's geothermal resources (USDOE 2007a).

Idaho currently has no RES or RPS (Richter 2007) but does offer incentives for geothermal development, including low-interest loans and sales tax exemption for equipment used in construction of geothermal plants. Minimal state funding is allocated for geothermal development (most previous research has been federally funded) (USDOE 2007a). The state has no GHG laws or pending legislation. As of May 2007, the Director of the Idaho Department of Environmental Quality is, by executive order, to develop GHG reduction strategies (Camp 2007).

Montana

Resource Geography

The state of Montana has more than 50 geothermal areas and at least 15 high-temperature sites. There are seven locations with surface temperatures above 149° F (65°C), plus 20 locations with temperatures above 110°F (43° C). Low- and moderate-temperature wells and springs can be found in nearly all areas of Montana (MDEQ 2008).



The US DOE and Montana state government have joined together to organize a database of locations where geothermal resources have been identified. Records show at least 15 high-temperature sites, several with estimated deep reservoir temperatures exceeding 176.7°C. Some of these sites are located in the vicinity of Helena, Bozeman, Ennis, Butte, Boulder, and White Sulphur Springs (Fleischmann 2007, MDEQ 2008).

Utilization

While there are many areas in Montana with the potential to support geothermal electrical generation, development has thus far been limited to direct-use applications due to the proximity of previously proposed plans to Yellowstone National Park, an issue that created controversy and concern. Geothermal electrical development has also been overlooked in the past due to the state's low fossil fuel prices, small population, and lack of transmission access to remote locations (Fleischmann 2007). Current development focuses on direct-use (mostly recreational and therapeutic). One private company is currently exploring the possibility of installing a small binary plant near an existing spa (Battocletti 2005).

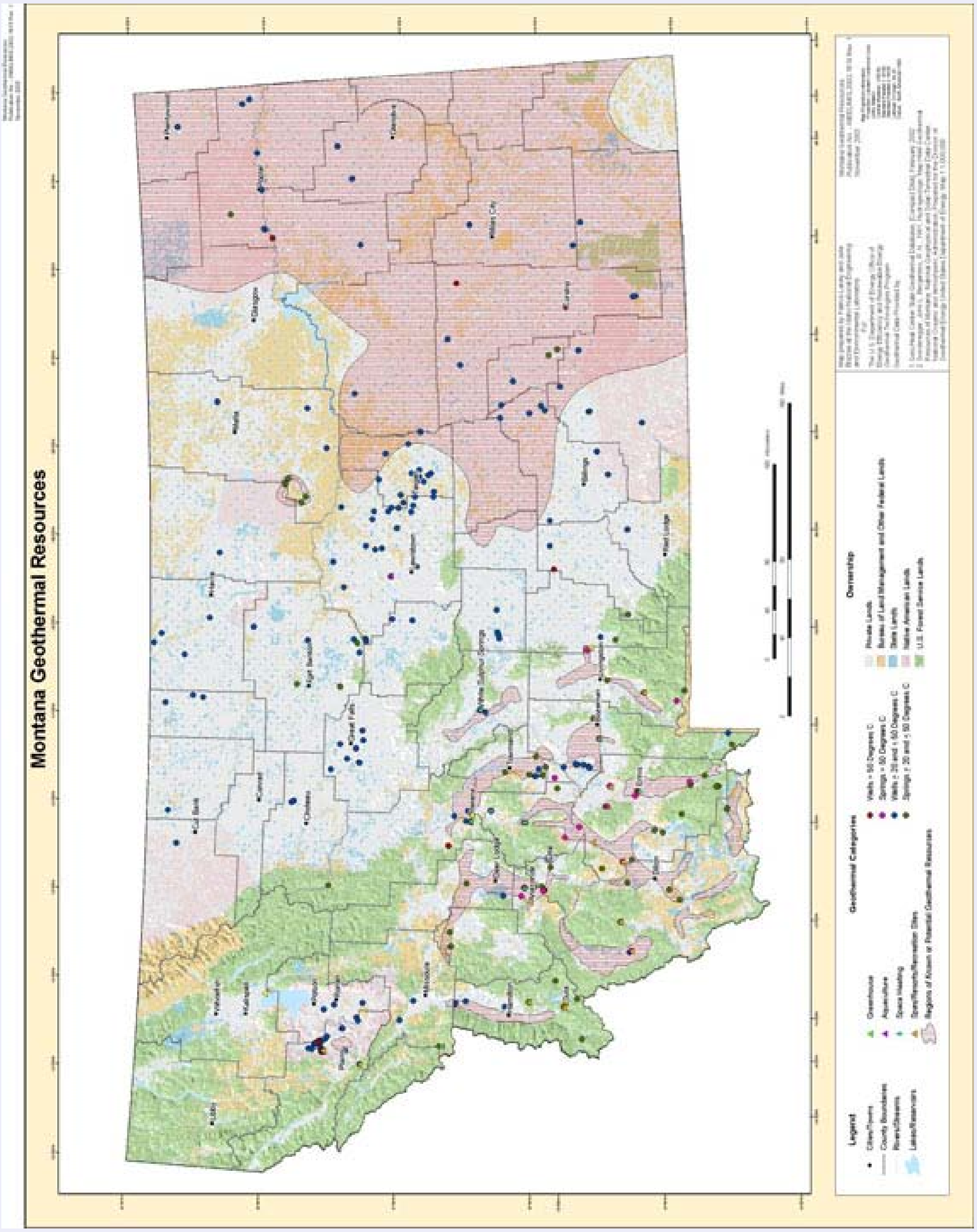
Electrical Power Generation and Capacity

There is presently no installed geothermal electric capacity in the state. The Western Governors' Association report did not identify geothermal resource potential for electrical generation in Montana, however, input for state and industry acknowledge that new technologies and undiscovered resources may yield geothermal resources that are viable for electrical generation in the future. A recent study regarding deep oil wells at Poplar Dome Oil Field (located on the Fort Peck Indian Reservation in northeast Montana) indicated potential for generating one MW from producing oil wells or three MW by deepening and hydrofracturing unused wells. This area currently produces 20,000 barrels per day of water at 130°C and there is interest in the possibility of the area supporting small geothermal power plants (USDOE 2007a). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Montana during the next 30 years at 59 MW, with a total low-high range of 15 MW to 130 MW (USGS 2008).

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Montana during the next 30 years at 59 MW, with a total low-high range of 15 MW to 130 MW.

Montana



Laney, 2003d, http://geothermal.id.doe.gov/maps.mt.pdf

Montana

Maps and data for geothermal resources on tribal lands in Montana are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_montatna.html

Tribes with Potential Geothermal Resources in Montana
Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation: Eastern lands Western lands
Blackfeet Tribe of the Blackfeet Indian Reservation
Chippewa-Cree Indians of the Rocky Boy's Reservation
Confederated Salish & Kootenai Tribes of the Flathead Reservation
Crow Tribe: Main tribal lands Easternmost lands
Flathead Reservation
Fort Belknap Reservation
Fort Peck Indian Reservation: Eastern lands Western lands
Gros Ventre & Assiniboine Tribes of the Fort Belknap Reservation
Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation
Rocky Boy's Reservation

Laws and Regulations

The state of Montana classifies geothermal resources as *sui generis* and claims ownership to geothermal resources on state lands. State water laws apply to all geothermal development involving production and diversion of geothermal fluids. Groundwater is defined by the state as a public reserve that must be appropriated (Battocletti 2005).

The Montana Department of Natural Resources and Conservation is responsible for issuing water rights and well construction permits. The US EPA, Region 8, oversees the administration of underground fluid injection. The Montana Department of Environmental Quality (DEQ) is responsible for administering surface disposal of wastewater, including geothermal fluids (Battocletti 2005). A state Geothermal Working Group is planned for Montana (USDOE 2007). The state currently has a RPS that requires IOUs to obtain 5 percent of their energy from renewable sources for years 2008-2009, 10 percent for 2010-2014, and 15 percent for 2015 and each year after (Richter 2007). Geothermal power plants are eligible for RPS incentives as well as tax credits, grants, and loans; however, no state funding is currently available specifically for geothermal development (USDOE 2007a). In May 2007, Montana passed GHG legislation prohibiting the approval of new coal generating units unless 50 percent of CO_2 emitted is captured and sequestered (Camp 2007).

Nevada

Resource Geography

High-temperature (>150°C) resources suitable for electric power production are located primarily in the northwest portion of the state, while direct-use occurs state-wide, particularly in regard to food processing plants. There are several geothermal research facilities in the state, and field investigations are ongoing to further characterize geothermal resources (NCMR 2008, USDOE 2007a).

Utilization

Nevada is second to California in levels of geothermal electricity production. Direct-use in the state consists primarily of agriculture drying and industrial applications such as mining (Lund 2003).

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Nevada during the next 30 years at 1,391 MW, with a total low-high range of 515 MW to 2,551 MW.

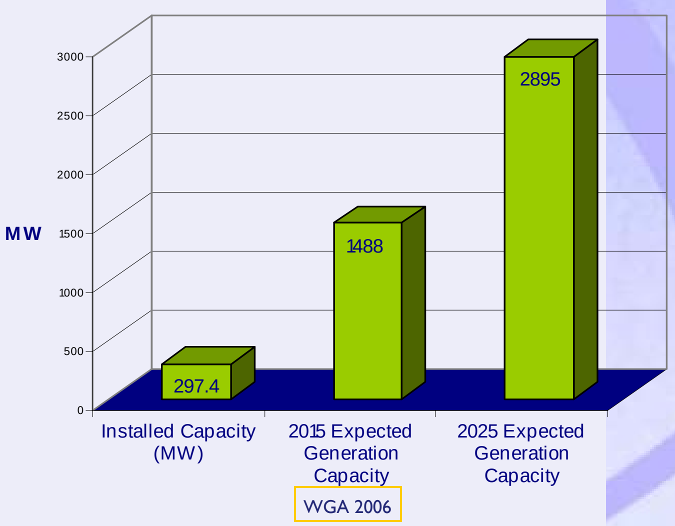
Technical Capabilities

Nevada universities, state agencies, and private firms contribute technical capabilities to the local and national geothermal communities. The Great Basin Center for Geothermal Energy, part of the University of Nevada at Reno (UNR), conducts geologic research and has produced a database of Nevada's geothermal resources to accelerate projects in the Great Basin region. Additionally, the UNR Redfield branch campus will feature a Renewable Energy Center for research and education in renewable energy systems (USDOE 2007a).

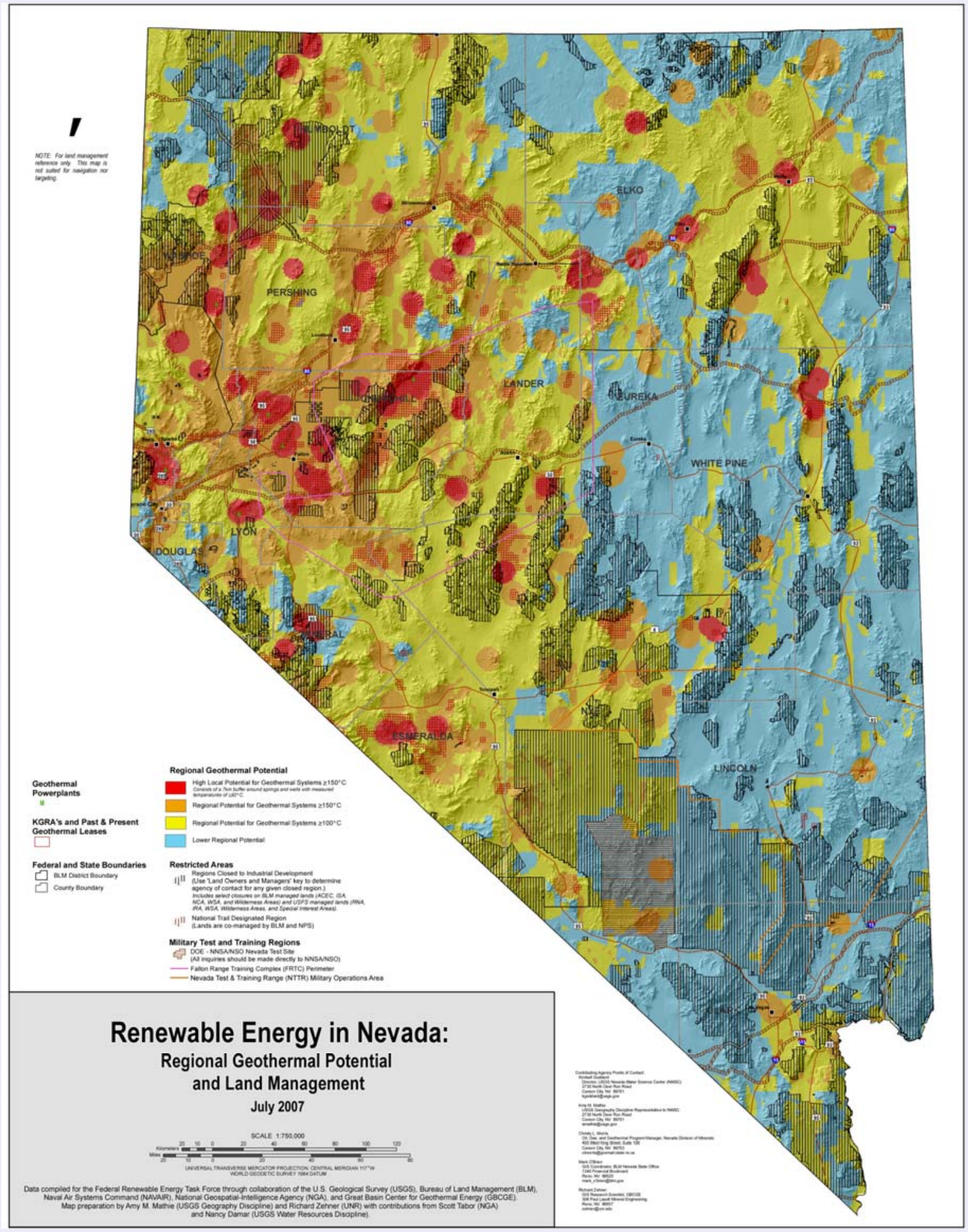
Electrical Power Generation and Capacity

There are 15 geothermal plants (totaling 40 units) in operation in the state (NCMR 2008). A 20-MW capacity plant was commissioned at Steamboat in November 2005, the first in response to the state's RPS. Literature-cited potential energy production from geothermal resources places estimates at 1,488 MW short-term and 2,895 long-term (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Nevada during the next 30 years at 1,391 MW, with a total low-high range of 515 MW to 2,551 MW (USGS 2008). Future plans include power generation in the Pumpernickel Valley, Stillwater, and Salt Wells areas and within Washoe, Churchill, Humboldt, and Elko Counties. Power purchase contracts have already been established with local utilities for proposed power plant construction at some locations (USDOE 2007a). Additionally, on August 5, 2008, a BLM lease sale for geothermal resources was held for lands in Churchill, Elko, Esmeralda, Humboldt, Lander, Mineral, Nye and Pershing Counties. The manner in which Nevada has combined federal and state efforts to develop geothermal resources has been very effective and could serve as a model for other states (Battocletti 2005).

Geothermal Electrical Generation



Nevada



UNR 2007, http://www.unr.edu/Geothermal/pdffiles/NV_GEOTHERM.pdf)

Nevada

Tribal Lands

Tribal lands in Nevada make up roughly 1.7 percent of the state's land. There are three tribal reservations of particular interest for geothermal development opportunities. One is the Pyramid Lake Paiute Reservation located 50 miles north of Reno, where extensive exploration has been performed and development is likely within the next few years. The others are in the Walker River Paiute Reservation and the Fallon Reservation and Colony of the Paiute-Shoshone tribe. Developers have expressed interest in geothermal projects in both reservations, although no projects have yet been proposed. However, the Fallon Reservation and Colony abuts existing geothermal power facilities at Stillwater, and tribal leaders are involved in the process for the new facility being developed there (Fleischmann 2007). Maps and data for geothermal resources on tribal lands in Nevada are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_nevada.html (USDOE 2007g). Tribes for which information is available are listed below.

Tribes with Potential Geothermal Resources in Nevada
Confederated Tribes of the Goshute Reservation
Duck Valley Reservation
Duckwater Shoshone Tribe of the Duckwater Reservation
Ely Shoshone Tribe
Fallon Reservation and Colony
Fort McDermitt Paiute and Shoshone Tribes of the Fort McDermitt Indian Reservation
Fort Mojave Indian Tribe
Goshute Reservation
Las Vegas Tribe of Paiute Indians of the Las Vegas Indian Colony
Lovelock Paiute Tribe of the Lovelock Indian Colony-
Moapa Band of Paiute Indians of the Moapa River Indian Reservation
Paiute-Shoshone Tribe of the Fallon Reservation and Colony
Pyramid Lake Paiute Tribe of the Pyramid Lake Reservation
Reno-Sparks Indian Colony
Shoshone-Paiute Tribes of the Duck Valley Reservation
Summit Lake Paiute Tribe
Te-Moak Tribes of Western Shoshone Indians: Battle Mountain Band South Fork Band Elko Band Wells Band
Walker River Paiute Tribe of the Walker River Reservation
Winnemucca Indian Colony
Yerington Paiute Tribe of the Yerington Colony and Campbell Ranch
Yomba Shoshone Tribe of the Yomba Reservation
Washoe Tribe of Nevada and California: Carson Colony Dresslerville Community Stewart Community

Nevada

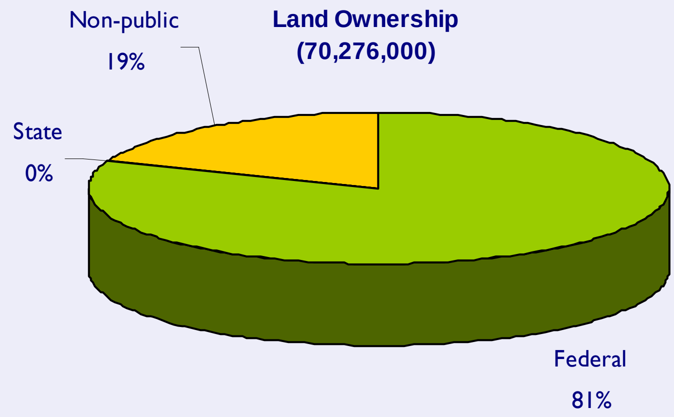
Laws and Regulations

Nevada classifies geothermal resources as both Mineral and Water. Resources in the state belong to the owner of the surface estate unless they have been reserved by or conveyed to another individual (NCMR 2006, Battocletti 2005).

The state's lead geothermal regulatory agency is the Division of Minerals Commission on Mineral Resources, which issues permits to drill or operate geothermal wells. The length of the permitting process varies depending on well type, location, and the agencies involved. Permitting for a commercial or industrial well could take 45 days whether on private or federal lands. Permitting for wells on federal land by a federal agency takes a minimum of three months; however, periods of a year or more are typical. Unlike California, Idaho, and the Pacific Northwest, where a number of the best geothermal prospects are located on USFS land, most of Nevada's promising resources are on federal land managed by the BLM (Battocletti 2005).

The Nevada Department of Conservation and Natural Resources Division of Water Resources are responsible for issuing water rights. The state Department of Conservation and Natural Resources Bureau of Water Pollution Control oversees the administration of underground fluid injection wells as well as the administration of surface disposal of wastewater, including geothermal fluids. The Nevada Department of Environmental Protection administers the Clean Water and Clean Air Acts (Battocletti 2005). Nevada has established a Geothermal State Working Group, with leadership from the Nevada Division of Minerals-Oil, Gas and Geothermal Program. The Nevada group brings together state and regional energy professionals to promote the increased utilization of the state's geothermal resources (USDOE 2007a).

The state's RPS stipulates a requirement of 20 percent renewable energy by 2015 (solar being 5 percent of annual and 1 percent of total generation). The RPS for geothermal electric and hot water district heating systems recommends an increase of up to 20 percent by 2015 (Richter 2007). Nevada's geothermal development is primarily federally funded; however, the state offers the incentive of property-tax exemption for geothermal power plants (USDOE 2007a). The state has no GHG reduction targets but is considering GHG legislation (SB422) that would require power plant emissions to be below 2006 levels for 2011-2014, below 2005 levels in 2015, one percent below each of the previous years for 2016-2019, and one and a half percent below 2019 levels for 2020 (Camp 2007).



NRCM 2008

New Mexico

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in New Mexico during the next 30 years at 170 MW, with a total low-high range of 53 MW to 343 MW.

Resource Geography

New Mexico contains abundant geothermal resources throughout a large temperature gradient (USDOE 2007a). In a recent update of the geothermal database for New Mexico, 359 discrete thermal wells and springs were identified (NMEMNRD 2007). Resources suitable for most development are concentrated in the west and north-central regions of the state, with high-temperature gradients ranging from 1.6°F to 2.5°F per 100 feet of depth (NMEM 2006). There are no geothermal power plants currently operating; however, direct-use applications are ongoing. The northwest region contains volcanic activity from the Valles Caldera in the Jemez Mountain Range (west of Los Alamos), where the only known high-temperature geothermal system in the state occurs (base temperatures in this system exceed 500°F, 260°C) (USDOE 2007a). During the 1970s and 1980s a large geothermal power project was under development in the Valles Caldera; however, regulatory and resource issues led to the cancellation of the project (demonstration projects revealed inconsistent reservoir permeability and low productivity, though drilling and testing indicated a viable potential of 20 MW) (Fleischmann 2007).

While other potential geothermal resource areas exist, limited research has been done and most areas are without apparent surface manifestations. These areas are high risk, and developers in the state may need government funding to aid with early exploration and to reduce the high investment risk associated with their development. Sites in eight counties (Doña Ana, Grant, Hidalgo, McKinley, Rio Arriba, San Miguel, Sandoval, and Valencia), have been identified as potential geothermal resources (NMEMNRD 2007). The Rio Grande Rift area, specifically near Las Cruces, also needs to be explored in greater detail (Fleischmann 2007).

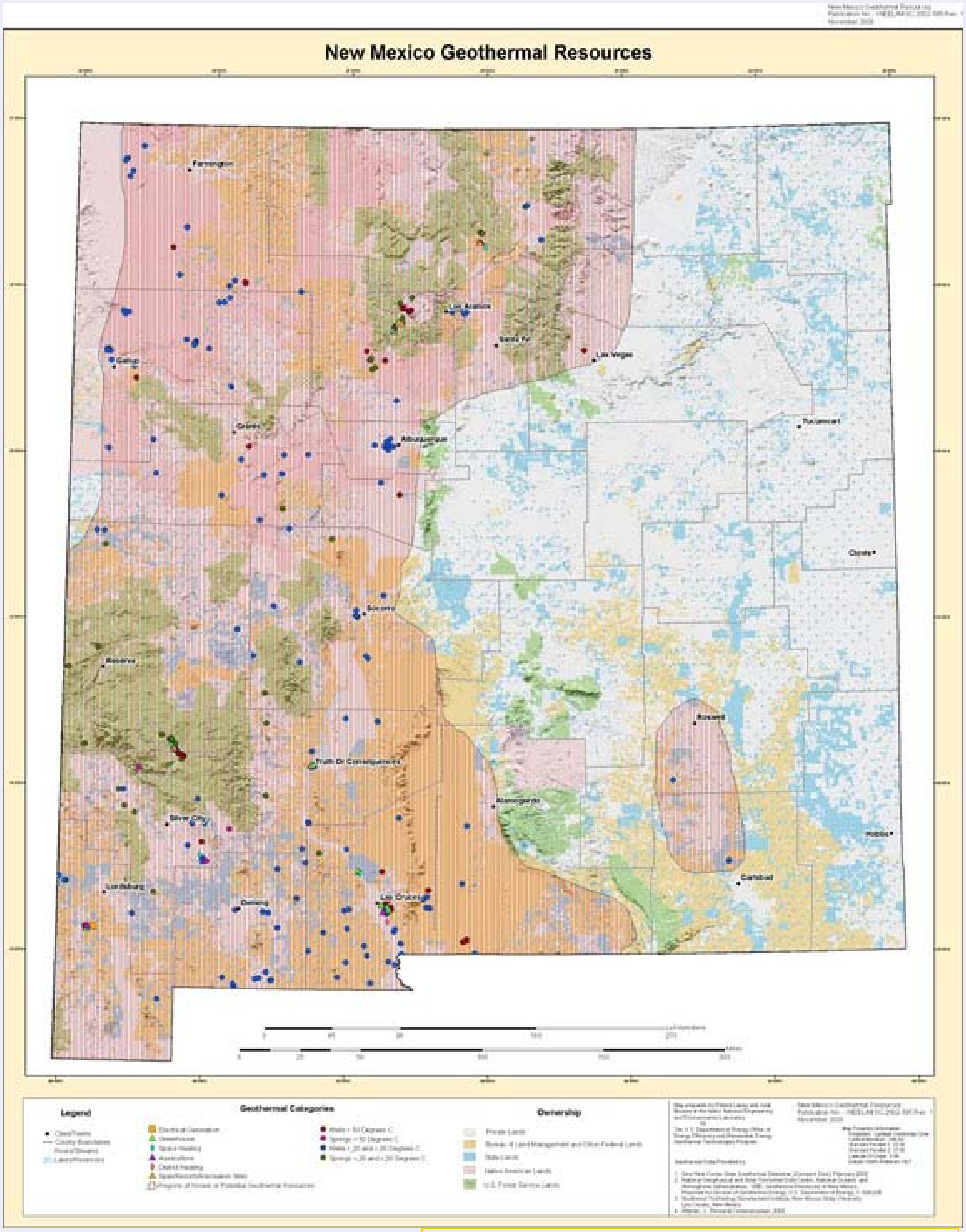
Utilization

There are no geothermal power plants operating; however, current development has included electric power production. An attempt to introduce geothermal electricity production occurred in the southwest at the Burgett Geothermal Greenhouses (near Cotton City) but was suspended due to design problems (NMEM 2006, USDOE 2007a). Drilling has occurred at two locations where small power units will be installed to provide electricity for an aquaculture facility and greenhouse. Other direct-use applications are ongoing (USDOE 2007a).

Technical Capabilities

New Mexico universities, state agencies, and private firms contribute technical capabilities to the local and national geothermal communities. New Mexico State University (NMSU) at Las Cruces conducted geothermal research that resulted in the development of a geothermal space-heating system that at one point heated up to 30 campus buildings such as dorms and athletic facilities. Sandia National Laboratory in Albuquerque is one of the three main national laboratories working on geothermal research and development (USDOE 2007a).

New Mexico

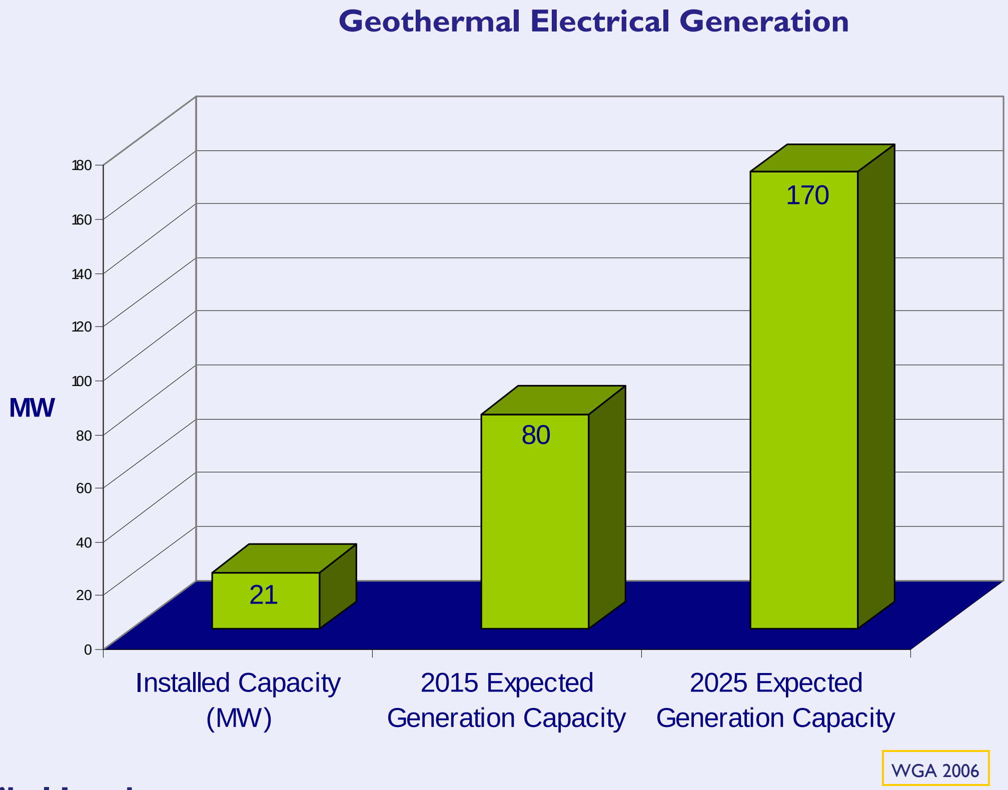


Lacey, 2003e, http://geothermal.id.doe.gov/maps/nm.pdf

New Mexico

Electrical Power Generation and Capacity

In the near term, development is likely for small-scale power. The state has two projects in development, with a total estimated potential of 21 MW. Literature estimates cite a short-term geothermal electricity generation potential of 80 MW and a long-term potential of 170 MW (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in New Mexico during the next 30 years at 170 MW, with a total low-high range of 53 MW to 343 MW (USGS 2008).



Tribal Lands

Tribal lands in New Mexico make up roughly 8.4 percent of its total acreage, and several locations on tribal reservations have been identified as having potential for geothermal development. This includes tribal lands in the San Juan Basin of northwest New Mexico, where considerable oil and gas drilling has occurred and intermediate-temperature fluid has been encountered. Another potential area is in the Jemez Mountains (in the vicinity of Valles Caldera). From 2002-2004, the Pueblo of Jemez worked with USDOE, who cost-shared a feasibility study to install a geothermal direct-use heating facility. The study concluded that there were business opportunities related to geothermal resources, but further drilling is needed before these applications can be developed on the site (Fleischmann 2007). Maps and data for geothermal resources on tribal lands in New Mexico are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_newmexico.html (USDOE 2007h). Tribes for which information is available are listed on the following page.

New Mexico

Tribes with Potential Geothermal Resources in New Mexico
Jicarilla Apache Tribe of the Jicarilla Apache Indian Reservation
Mescalero Apache
Navajo Nation: Northwestern lands in New Mexico Northeastern lands in New Mexico Southwestern lands in New Mexico Southeastern lands in New Mexico Alamo Navajo Chapter Canoncito (Tohajiileeh) Chapter Ramah Navajo Chapter
Pueblo of Acoma
Pueblo of Cochiti
Pueblo of Isleta
Pueblo of Jemez
Pueblo of Laguna
Pueblo of Nambe
Pueblo of Picuris
Pueblo of Pojoaque
Pueblo of San Felipe
Pueblo of San Ildefonso
Pueblo of San Juan
Pueblo of Sandia
Pueblo of Santa Ana
Pueblo of Santa Clara
Pueblo of Santo Domingo
Pueblo of Taos
Pueblo of Tesuque
Pueblo of Zia
Pueblo of Zuni
Ute Mountain Tribe of the Ute Mountain Reservation

New Mexico

Laws and Regulations

New Mexico classifies geothermal resources as Mineral if the fluid produced has a temperature greater than 250°F and as Water if the fluid produced has a temperature less than or equal to 250°F. The state claims ownership of geothermal resources when and where it holds the mineral rights. If the fluid produced is "mineral," the resource is under the primary jurisdiction of the Oil Conservation Division of the New Mexico Energy, Minerals, and Natural Resources Department for drilling. This agency coordinates with the US EPA, Region 8, which has authority over wastewater discharge to surface waters in the state. Both of these latter agencies, in addition to the state Environmental Department, have regulatory authority over geothermal discharge permits. The New Mexico State Land Office leases the lands of the state mineral estate (Battocletti 2005).

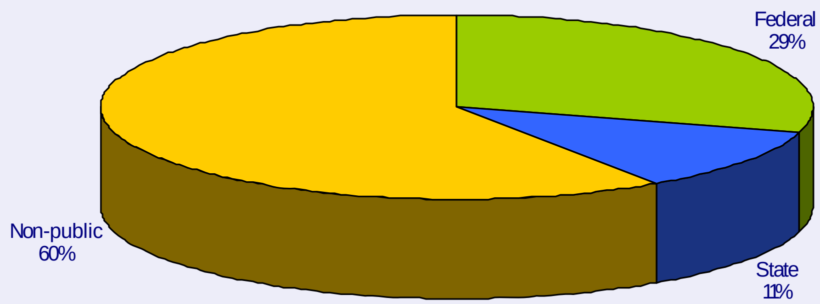
Geothermal fluid under 250°F is considered "water," and the resource is under the primary responsibility of the New Mexico Office of the State Engineer in regards to drilling and permitting. New Mexico does not have comprehensive environmental review statutes.

The state's RPS requires 20 percent renewable energy by 2020 for IOUs, 10 percent for rural co-ops and municipality utilities, with one Kilowatt (KW) of geothermal energy counting as two KW (Richter 2007). In addition to the state's RPS, geothermal resource development qualifies for the US Department of the Interior Energy Efficiency and Renewable Energy's bond program (USDOE 2007). New Mexico has established a Geothermal State Working Group, with leadership from the New Mexico Energy, Minerals, and Natural Resources Department (USDOE 2007a).

New Mexico does not have GHG laws or pending legislation; however, the state has a GHG reduction target that outlines 2000 levels by 2012, 10 percent below 2000 levels by 2020, and 75 percent below 2000 levels by 2050 (Camp 2007). There is no state funding for geothermal development. Most funding has come from the federal level from the US DOE (USDOE 2007a).

Land Ownership

(77,674,000 total acres)



NRCM 2008

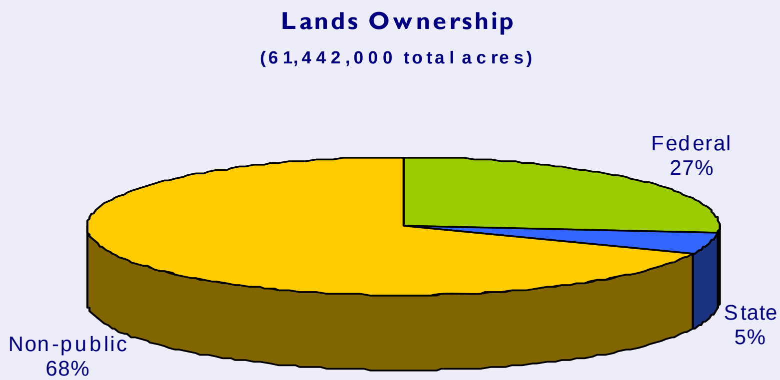
Oregon

Resource Geography

Oregon's geothermal resources are located primarily in the central and eastern regions of the state, with some activity occurring in the Cascade Range and in the southeast basin and range areas (USDOE 2007a). The state's geothermal resource base has been well documented, and numerous direct-use projects have been constructed (primarily street and building heating, and recreational and therapeutic use) (Fleischmann 2007).

Utilization

While a small-scale geothermal power plant ran in south-central Oregon in the mid 1980s, the state currently has no plants in operation (Fleischmann 2007, ODE 2008). Indirect use is being pursued, and several promising resource sites have been identified. Resources that may have significant potential for power-plant development on a small scale include Klamath Falls, Lakeview, Summer Lake, Malheur River, and Vale (ODGMI 2003, USDOE 2007a). Researchers in Oregon are experimenting with geothermal heat and power technologies for alternative fuel production, and expansions are planned for several direct-use facilities (Fleischmann 2007).



NRCM 2008

Development has and will continue to focus on direct use and further exploration of potential sites for geothermal electricity generation. While several large-scale geothermal power plants are under development, their success is contingent upon coordinated federal and state efforts to conduct EISs (Fleischmann 2007).

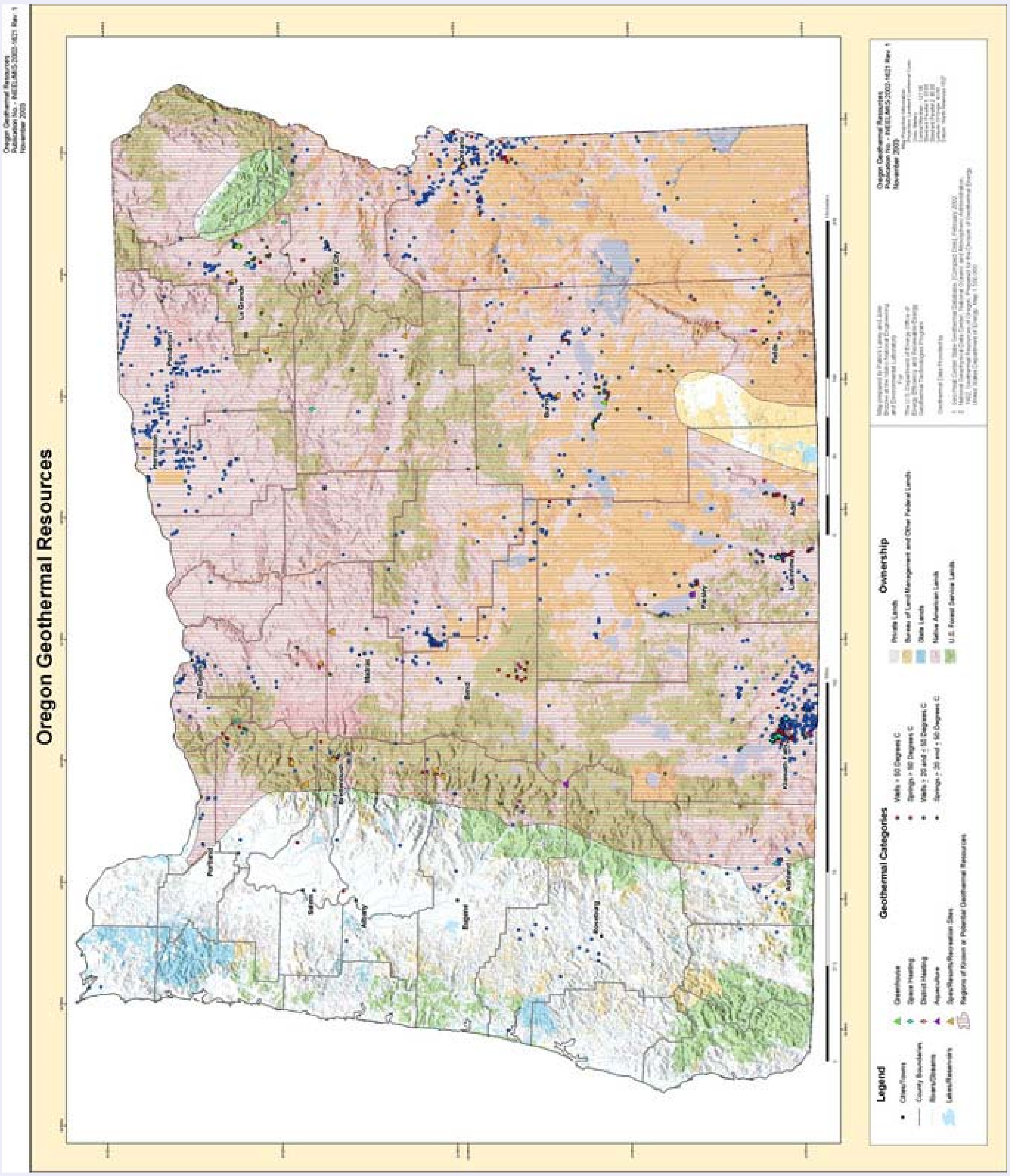
Technical Capabilities

The Oregon Institute of Technology's Klamath Falls campus houses the Geo-Heat Center, a national resource for the research and development of geothermal energy. The Geo-Heat Center aids in the transfer of technical information and provides project development support for geothermal direct-use applications (USDOE 2007a).

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Oregon during the next 30 years at 540 MW, with a total low-high range of 163 MW to 1,107 MW.

Oregon



Laney, 2003f, http://geothermal.id.doe.gov/maps/or.pdf

Oregon

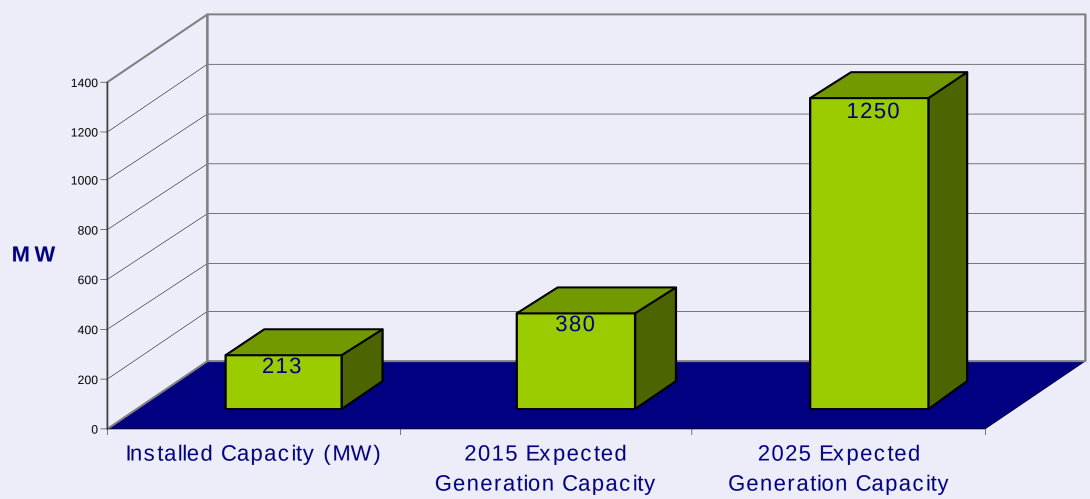
Electrical Power Generation and Capacity

There are four geothermal power plant projects in development in the state, with a total literature-estimated potential of 128.2-213.2 MW. Projected potential for the state is 380 MW in the short term and 1,250 MW in the long term (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Oregon during the next 30 years at 540 MW, with a total low-high range of 163 MW to 1,107 MW (USGS 2008).

Geothermal leases for the Crump Geyser site (in Warner Valley, south-central Oregon) have been secured by a private developer. Data for this site indicate temperatures in excess of 180°C, and the potential for electricity generation has been estimated at 85 MW. Research shows Newberry Volcano (near Bend in central Oregon) holds resources sufficient for a 30-MW plant that is in the initial planning stages (ODGMI 2003, USDOE 2007a). In July 2006, Davenport Power executed a 20-year power sales agreement with Pacific Gas & Electric (PG&E) involving the sale of 60-120 MW of geothermal-produced electricity from the proposed Newberry Site. The first 30-MW phase of this projected is scheduled to begin operation in 2009, with the second 30-MW phase in 2010, and the remaining 60-MW phase in 2011 (USDOE 2007a).

The main difficulties pertaining to development of geothermal power plants in this state have been a lack of transmission access and regulatory hurdles similar to those experienced in California in association with development on federal lands (Fleischmann 2007).

Geothermal Electrical Generation



WGA 2006

Oregon

Laws and Regulations

Oregon classifies geothermal resources as Mineral if the temperature of the bottom hole is greater that 250°F (121°C) and as Water if the temperature of the bottom hole is less than 250°F (121°C). The state claims ownership of all geothermal resources located on state and private land (Battocletti 2005). The Oregon DEQ is the primary agency for the disposal of water in either surface or injection well applications. Geothermal resources classified as “water” are regulated by the state Water Resources Department, while resources classified as “mineral” are regulated by the Oregon Department of Geology and Mineral Industries. The Department of State Lands issues exploration permits and drilling leases for resources on state-owned land. Oregon does not have comprehensive environmental review statutes. A developer must obtain permits directly from local land use boards (Battocletti 2005).

The state Energy Facility Siting Council (EFSC) has jurisdiction over geothermal energy facilities of 38.95 MW or greater (Battocletti 2005). The state has a RPS requiring large utilities to generate 25 percent of their power from renewable energy sources by 2025, with lesser requirements for small utilities (Richter 2007). Oregon has established a Geothermal State Working Group, with leadership from the Oregon Department of Energy, which is shared by the state of Washington (USDOE 2007a).

Incentives for geothermal development include low-interest loans, business energy tax credits, and cash incentives through the Energy Trust of Oregon resources (USDOE 2007a). The state passed GHG legislation in 2007 that requiring GHG levels be 10 percent below 1990 levels by 2020 and 75 percent below 1990 levels by 2050. Oregon has a GHG emission generation performance standard for electric generation and sales of 675 lbs CO_2 per MWh (Camp 2007).

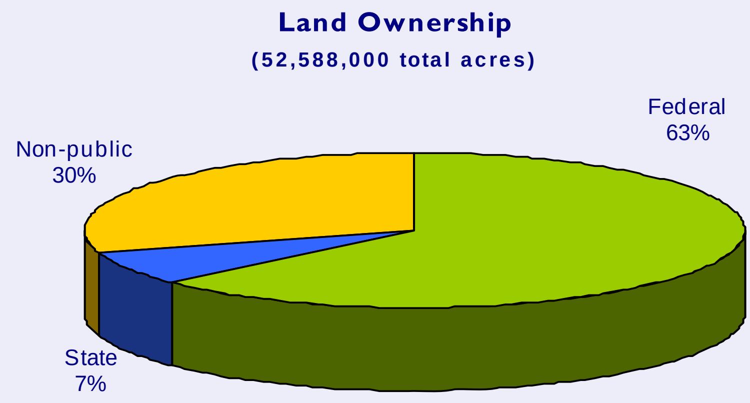
Tribes with Potential Geothermal Resources in Oregon
Burns Paiute Tribe of the Burns Paiute Indian Colony
Celilo Indian Village
Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians
Confederated Tribes of the Grand Ronde Community
Confederated Tribes of the Siletz Reservation
Confederated Tribes of the Umatilla Indian Reservation (Cayuse, Umatilla, and Walla Walla Tribes)
Confederated Tribes of the Warm Springs Reservation
Coquille Tribe
Cow Creek Band of Umpqua Indians
Fort McDermitt Paiute and Shoshone Tribes of the Fort McDermitt Indian Reservation
Grand Ronde Community
Klamath Indian Tribe-
Siletz Reservation
Umatilla Indian Reservation (Cayuse, Umatilla, and Walla Walla Tribes)
Warm Springs Reservation
Warm Springs Tribe of the Celilo Indian Village

Utah

Resource Geography

The majority of the state's renewable energy comes from geothermal sources (Nielsen 2002), which are abundant in the western and central parts of the state (UGS 2008). Geothermal resources range from low to high temperature (above 150°C). The majority of the systems suitable for power production are located within the Sevier thermal area, a region of southwest Utah covering a portion of the eastern Basin and Range Physiographic Province, and part of the Basin and Range-Colorado Plateau transition zone (Harja 2007, UGS 2008).

Research indicates that geothermal resources underlie much of the Wasatch Front, where a large portion of the state's population resides (Fleischmann 2007). Known high-temperature systems include the Roosevelt KGRA and the Cove Fort-Sulphuredale KGRA (USGS 2008). Literature from state offices suggests several known resource areas for potential development, including Abraham (Crater Springs) Hot Springs area, the Meadow-Hatton area, Joseph Hot Springs, and the Newcastle, Monroe-Red Hill, and Thermo Hot Springs areas. Other areas with development potential that have been previously investigated but lacked identified resources include the Drum Mountains-Whirlwind Valley area (near the Millard-Juab County line) and the Beryl area in western Iron County. The same office suggests the need for further exploration of the west side of Black Rock Desert in Millard County, where bottom hole temperatures of 380°F (193°C) were measured during exploratory oil and gas well drilling in 1980 (Harja 2007), as well as the Escalante Desert (UGS 2008).



NRCM 2008

Utilization

The potential extent of Utah's geothermal resources is not well understood, and the geology of the resources is complicated in some areas. Lack of transmission capacity may hinder development for indirect use in some areas; however, direct use is diverse and ongoing throughout the state (Fleischmann 2007).

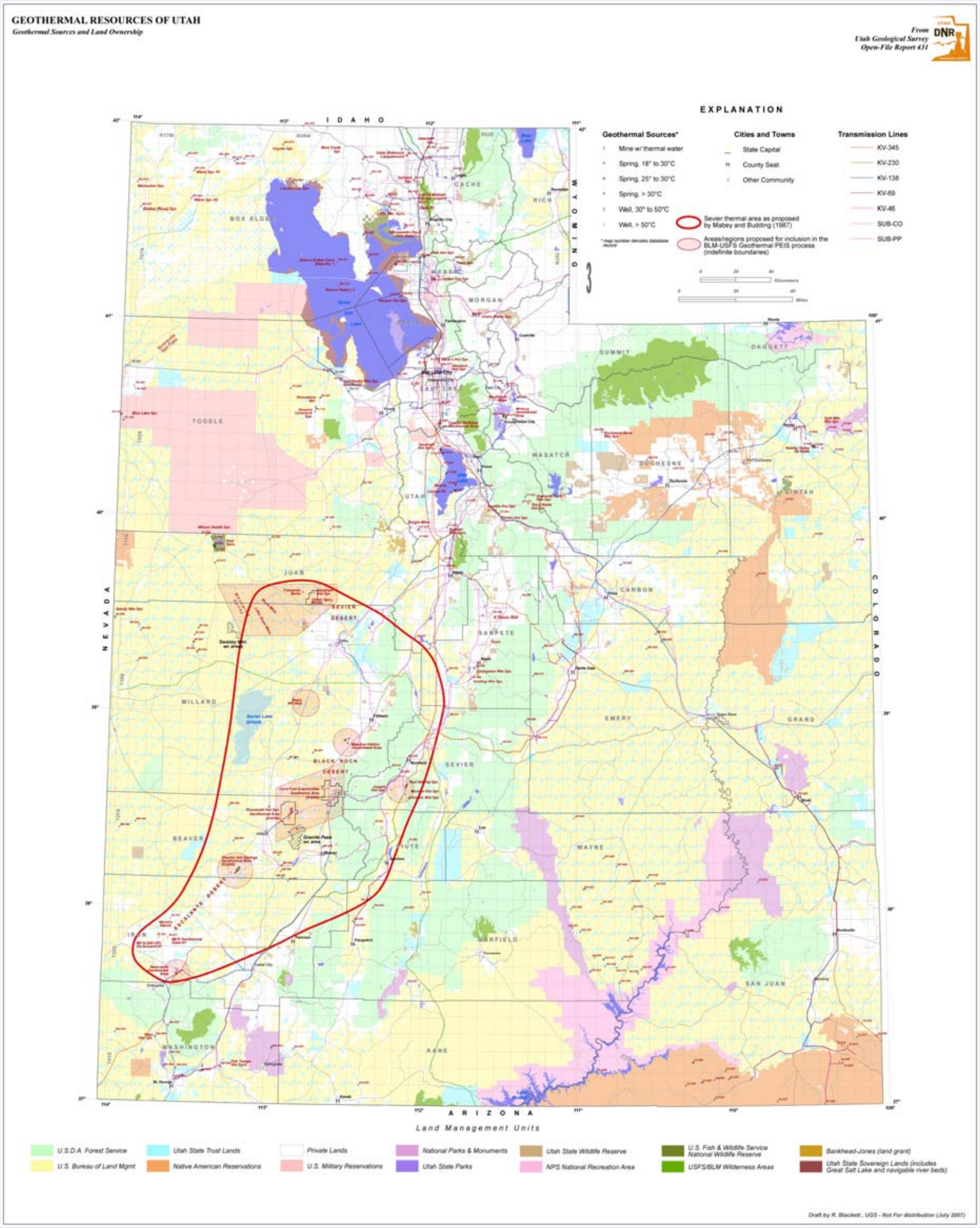
Technical Capabilities

Utah universities, state agencies, and private firms contribute technical capabilities to the local and national geothermal communities. The Utah Geological Survey maintains a database of geothermal resource information to support development projects.

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Utah during the next 30 years at 184 MW, with a total low-high range of 82 MW to 321 MW.

Utah



Mabey, D.R. and K.E. Budding, 1987

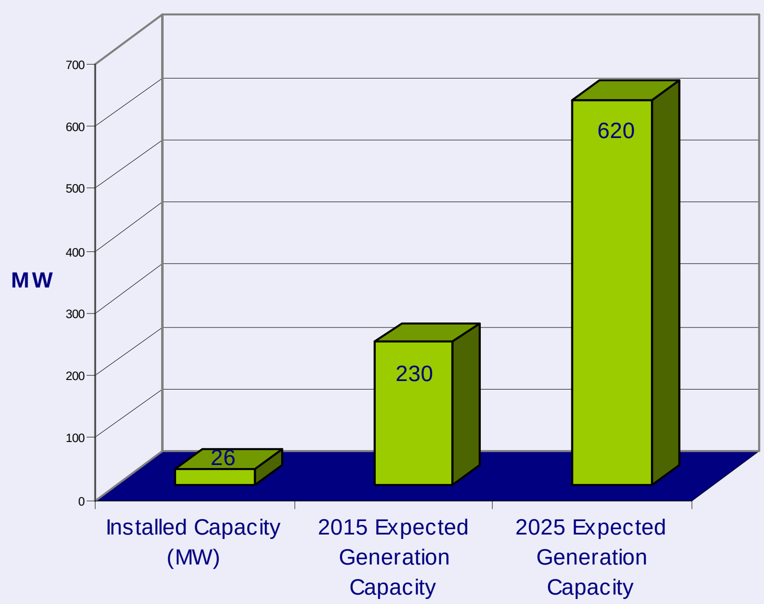
Utah

Electrical Power Generation and Capacity

Utah (along with California and Nevada) is one of the few states in the region to have developed geothermal power plants. The state has three geothermal power plants (one running, two decommissioned). Types of plant include binary, single flash , and dry steam. Current geothermal electrical output is 26 MW, with a literature-projected potential of 48-183 MW (including MW projections for two projects in development). Short-term potential is cited as 230 MW, with 620 MW long term (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Utah during the next 30 years at 184 MW, with a total low-high range of 82 MW to 321 MW (USGS 2008).

The state's first geothermal power plant (the Blundell geothermal plant) came online at Roosevelt Hot Springs (in Beaver County) in 1984 and has remained online since. While it currently produces 26 MW gross power, expansion has been planned that will add approximately 33 MW contingent on the resource. On April 17, 2008 a rig test was conducted and the results were encouraging. Two other facilities were built at Cove Fort-Sulphurdale KGRA (in Beaver County) during the same time period, with a total capacity of 12 MW (UGWG 2005, USDOE 2007a). While these plants were decommissioned in 2003, new owners (ENEL North America) have been successful in obtaining additional federal geothermal leases within the KGRA (Harja 2007).

Geothermal Electrical Generation



WGA 2006

Utah

Tribal Lands

Tribal land covers roughly 4.4 percent of Utah's land. The largest section of this land is located in the southeast, as part of the Navajo nation. Significant geothermal potential has not been indicated in this area; however, there are several Paiute reservations near Cove Fort and Roosevelt Hot Springs, as well as tribal land in southwestern Utah, that may be promising for geothermal development. The site of the Renaissance project is near tribal land, and the developer is working with the Northwestern Shoshoni Tribe on the project (Fleischmann 2007). Maps and data for geothermal resources on tribal lands in Utah are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_Utah.html (USDOE 2007j). Tribes for which information is available are listed below.

Tribes with Potential Geothermal Resources in Utah
Confederated Tribes of the Goshute Reservation
Goshute Reservation
Navajo Nation: Four Corners region lands North central Arizona and central Utah lands
Northern Ute Indian Tribe of the Uintah and Ouray Reservation: Eastern lands Western lands
Northwestern Band of Shosoni Nation
Paiute Indian Tribe of Utah: Lands in central Utah Main reservation in southwestern Utah
Skull Valley Band of Goshute Indians
Ute Mountain Tribe of the Ute Mountain Reservation

Laws and Regulations

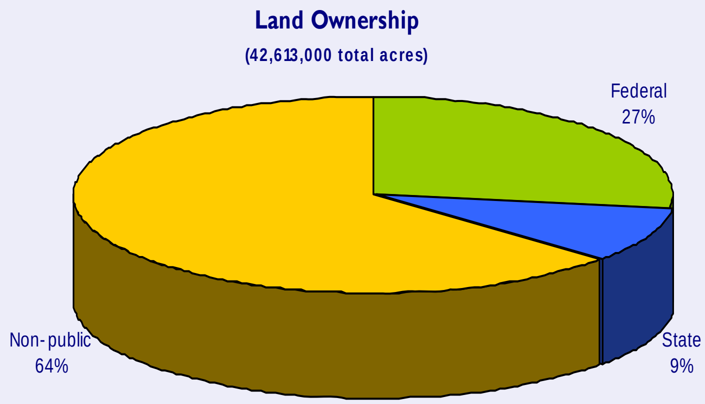
Utah classifies geothermal resources as Water. Ownership is derived from an interest in the land and not from an appropriated right to geothermal fluids. The right to a geothermal resource is based on ownership of the mineral rights or surface rights, which are usually obtained by direct ownership or leasing (Battocletti 2005).

The state Department of Natural Resources Division of Water Rights has jurisdiction and authority over all geothermal resources and issues water rights and well construction permits. The Utah Division of Water Quality oversees fluid disposal plans and permits. State regulations do not apply on tribal land, which makes up 4.4 percent of the state (Battocletti 2005). Utah does not have a comprehensive environmental review statute, nor a RES or RPS (Richter 2007). Utah has established a Geothermal State Working Group, with leadership from the Utah Geological Survey. The state does not have state funding for geothermal research or projects; however, the US DOE funds specific research. Utah offers sales-tax exemption for the purchase of leasing of equipment used to generate energy for geothermal plants resources (USDOE 2007). In August 2007, Utah developed state goals to reduce GHG emissions 15 percent by 2020 as part of its union with the Western Climate Initiative (Camp 2007).

Washington

Resource Geography

While the state has high volcanic activity, only the Cascade Range holds high potential for moderate- to high-temperature geothermal resources, particularly in the Northern Cascade Mountains (Nielsen 2002). The most recent assessment of the state's geothermal potential was completed in 1994 and identified 34 thermal springs (primarily in the Cascade Mountains) and 941 thermal wells (primarily in the Columbia Basin) (USDOE 2007a).



NRCM 2008

Utilization

Geothermal resources in Washington have been virtually undeveloped. There are no district heating systems or large buildings using the resource. There are no commercial developments such as aquaculture or greenhouses and no power plants. Resource use is currently limited to recreational and therapeutic applications (Geo-Heat 2007). Low energy prices and lack of knowledge about the state's resource base have contributed to this status (Fleischmann 2007).

Several exploration leases are pending but are associated with important scenic areas where environmental considerations could prohibit development. There are no near-term plans to develop geothermal resources in the Columbia Basin (USDOE 2007a). Near-term developments of any kind are likely to focus, at least initially, on the expansion of direct-use applications, though literature cites one geothermal power plant project in development, with a potential capacity of 50-100 MW (Richter 2007).

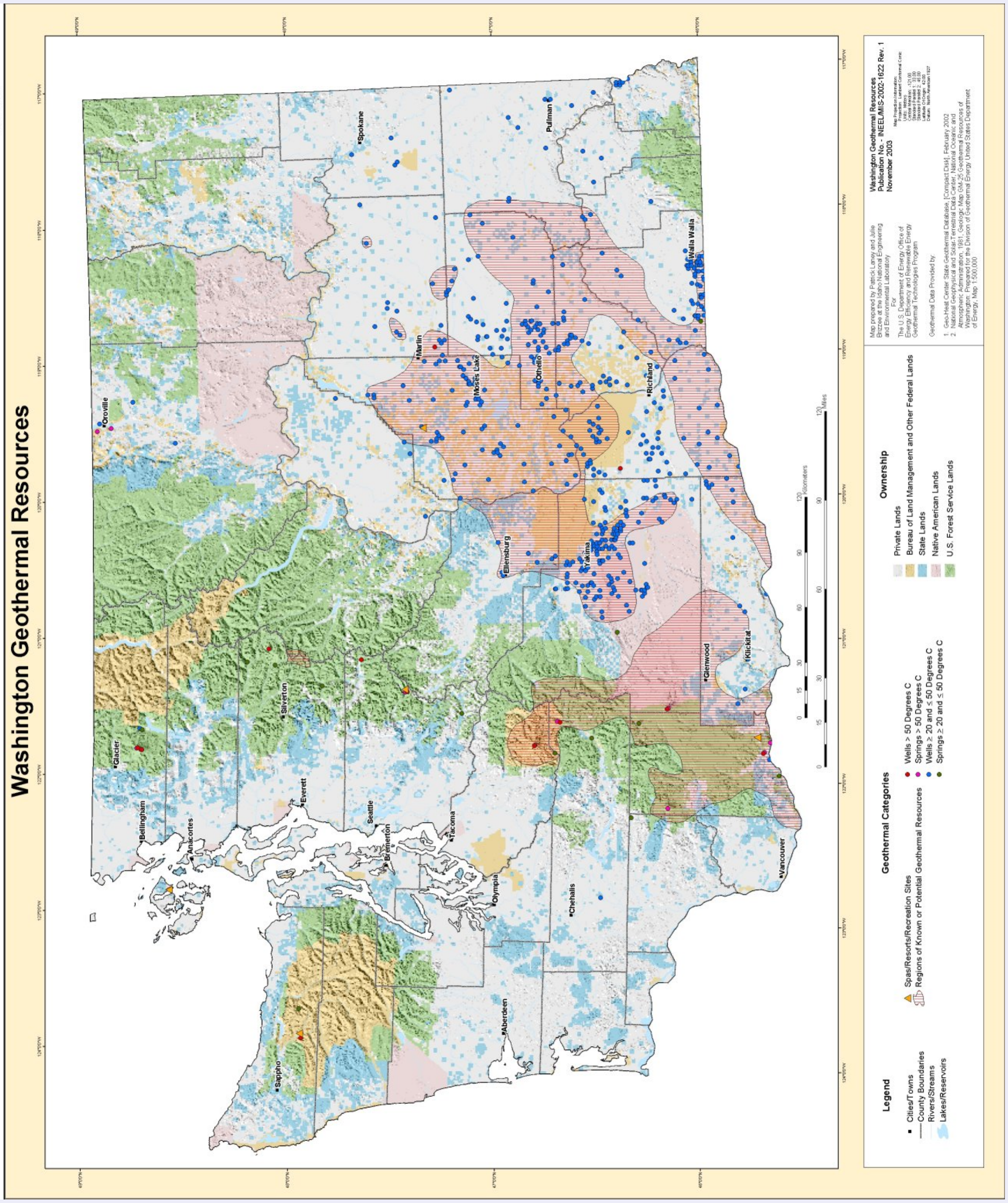
Technical Capabilities

The geothermal experts at the Washington State University Extension Energy Program have world-class expertise in high- and low-temperature geothermal energy. The group has prepared a series of guides on developing geothermal energy and a series of case studies on geothermal heat pumps (USDOE 2007a, WSUEEP 2004).

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Washington during the next 30 years at 23 MW, with a total low-high range of 7 MW to 47 MW.

Washington



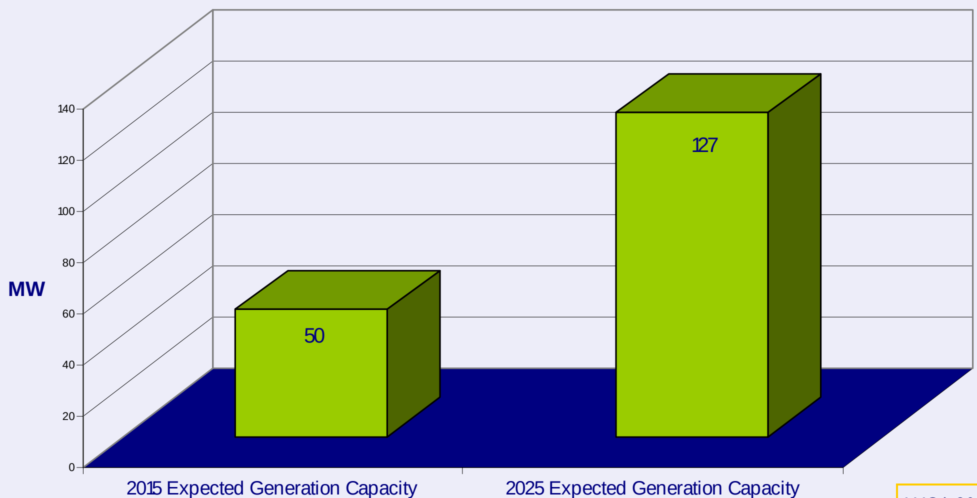
Lacy, 2003g, http://geothermal/id.doe.gov/maps.wa.pdf

Washington

Electrical Power Generation and Capacity

Potential projected geothermal electrical output is undefined, but literature estimates site a short-term projection of 50 MW, with long-term projections of 600 MW for sites at Mount Baker and Wind River in the Cascade Range (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Washington during the next 30 years at 23 MW, with a total low-high range of 7 MW to 47 MW (USGS 2008).

Geothermal Electrical Generation



WGA 2006

Laws and Regulations

Washington classifies geothermal resources capable of generating electricity (no specific temperature is defined) as *sui generis*. All direct-use geothermal resources are considered to be groundwater and regulated as such. The state Department of Ecology is responsible for issuing water rights, well construction permits, and fluid disposal plans, including underground injections. Developers must also secure ownership or lease rights from the Washington Department of Natural Resources Division of Lands. Environmental review is required under Washington's State Environmental Policy Act. The Washington Energy Facility Site Evaluation Council (EFSEC) determinations operate in lieu of state environmental reports and has the authority to issue permits under the Federal Clean Air Act and Clean Water Act (Battocletti 2005, http://www.energy.wsu.edu/documents/renewables/washington.pdf); however, its jurisdiction covers only plants 250 MW and greater. Washington has an RPS that requires 3 percent renewable energy by 2012 and 15 percent by 2020, with less than 5 MW capacity counting as double (Richter 2007). Geothermal development incentives for the state include eligibility under the RES and utility-run incentives. Washington has a combined Geothermal Working Group with the state of Oregon (USDOE 2007a).

In April 2007 the state passed GHG legislation (SSB6001), which mandates that GHG levels be at 1990 levels by 2020, 25 percent below 1990 levels by 2035, and less than 50 percent of 1990 levels (or 70 percent below current projected annual emissions for 2050) by 2050. Washington also has a GHG emission generation performance standard for electric generation and sales of 1,100 lbs of CO_2 per MWh (Camp 2007).

Washington

Tribal Lands

Map and data for geothermal resources on tribal lands in Washington are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_Washington.html (USDOE 2007k). Tribes for which information is available are listed in table A-10 below.

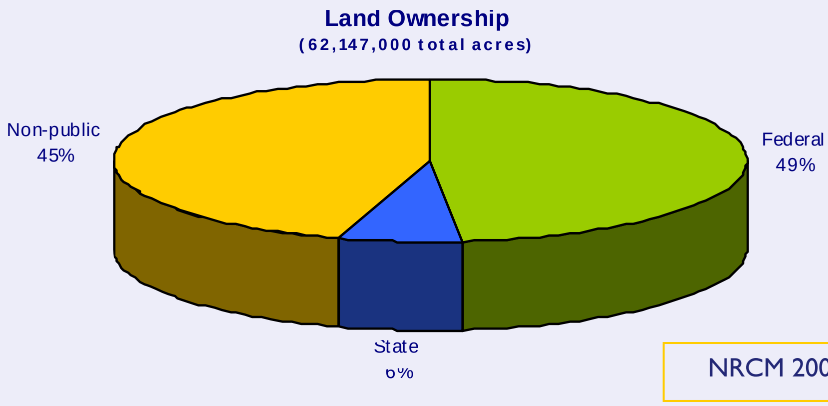
Tribes with Potential Geothermal Resources in Washington	
Colville Reservation	Chehalis Reservation
Confederated Tribes of the Colville Reservation	Confederated Tribes of the Chehalis Reservation
Hoh Indian Tribe of the Hoh Indian Reservation	Confederated Tribes and Bands of the Yakama Indian Nation
Kalispel Indian Community	Jamestown S'Klallam Tribe
Lummi Tribe of the Lummi Reservation	Lower Elwha Klallam Tribal Community
Muckleshoot Indian Tribe	Makah Indian Tribe of the Makah Indian Reservation
Nooksack Indian Tribe	Nisqually Indian Tribe of the Nisqually Reservation
Port Gamble S'Klallam Tribe	Payallup Tribe of the Puyallup Reservation
Quileute Tribe of the Quileute Reservation	Port Madison Reservation
Samish Indian Tribe	Quinault Tribe of the Quinault Reservation
Shoalwater Bay Tribe of the Shoalwater Bay Indian Reservation	Sauk-Suiattle Indian Tribe
Snoqualmie Tribe	Skokomish Indian Tribe of the Skokomish Reservation
Squaxin Island Tribe of the Squaxin Island Reservation	Spokane Tribe of the Spokane Reservation
Suquamish Indian Tribe of the Port Madison Reservation	Stillaguamish Tribe
Tulalip Tribes of the Tulalip Reservation	Swinomish Indians of the Swinomish Reservation
Yakama Indian Nation	Upper Skagit Indian Tribe

Wyoming

Resource Geography

The majority of Wyoming's geothermal resources are concentrated in the state's northwest corner, in and around Yellowstone National Park. Elsewhere, groundwater at elevated temperatures occurs beneath large areas, and research indicates that the state has a substantial geothermal resource base. High-temperature geothermal hotspots outside of environmentally sensitive areas (such as Yellowstone and the protected area of Hot Springs State Park in Thermopolis) could be suitable for electricity generation (USDOE 2007a).

One KGRA near Jackson Hole has been identified and may be capable of yielding high-temperature water (aside from Yellowstone). The possibility of volcanic and magmatic activity exists along the northern end of Jackson Hole, which may indicate geothermal reservoirs. Outside of this area it is likely geothermal development will require very deep drilling analogous to oil and gas exploration (Lyons 2003, USDOE 2007a).



NRCM 2008

Utilization

Geothermal development in the state has so far been limited to direct-use applications, specifically for recreational and therapeutic purposes. Concern and controversy surrounding the development of geothermal resources near Yellowstone National Park has precluded development of resources near Yellowstone (USDOE 2007a). Wyoming's sparse population is also a causal factor associated with limited geothermal development. Finally, most renewable energy efforts in the state have focused primarily on harnessing wind power (Fleischmann 2007).

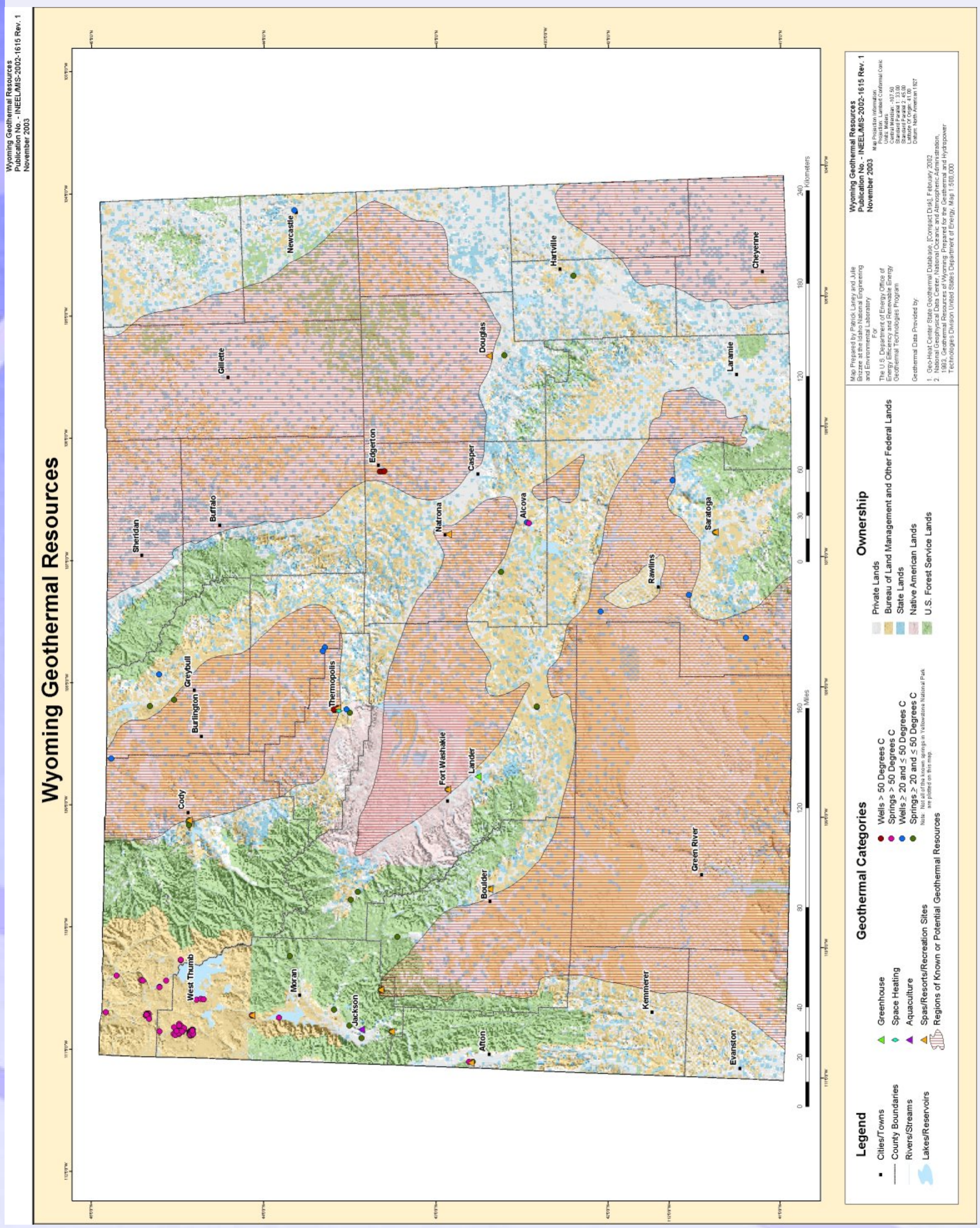
ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in Wyoming during the next 30 years at 39 MW, with a total low-high range of 5 MW to 100 MW.

Technical Capabilities

Wyoming's coal resources are among the richest in the world, and the state possesses a wide variety of other energy sources. Renewable energy efforts are concentrated on harnessing wind energy, and little work has been done to harness Wyoming's geothermal potential. In the 1980s, studies were done for the Western Area Power Administration to evaluate the geothermal potential of resources near Thermopolis for electricity generation (USDOE 2007a).

Wyoming



Laney, 2003h, http://geothermal.id.doe.gov/maps/wy.pdf

Wyoming

Electrical Power Generation and Capacity

The Western Governors' Association report did not identify geothermal resource potential for electrical generation in Wyoming, however, input for state and industry acknowledge that new technologies and undiscovered resources may yield geothermal resources that are viable for electrical generation in the future. The USGS estimates in its report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* a mean probability of electrical power generation for identified geothermal resources on all lands in Wyoming during the next 30 years at 39 MW, with a total low-high range of 5 MW to 100 MW (USGS 2008). There is interest in the potential for developing small geothermal electricity units in conjunction with oil and gas wells present in Wyoming. A demonstration project at the Teapot Dome oil field (operated by the US DOE) is under development and would install a binary unit for electrical generation and use on-site. This demonstration project, if successful, could lead to greater investment in Wyoming's geothermal resources (USDOE 2007a).

Tribal Lands

A Map and data for geothermal resources the Northern Arapaho tribe and Shoshone Tribe of the Wind river reservation in Wyoming is available through the USDOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_Wyoming.html (USDOE 2007l).

Laws and Regulations

Wyoming classifies geothermal resources as Water, and regulates them as a groundwater resource. Geothermal rights are a public resource and only available through appropriation. The State Engineer's Office is responsible for issuing water rights and well construction permits and is the lead agency in overseeing geothermal production wells. The state DEQ is responsible for administering surface and groundwater disposal of wastewater, including geothermal fluids (Battocletti 2005, Heasler 1985). Wyoming does not have comprehensive environmental review statutes, nor does it have a RES or RPS (Richter 2007). The state has no GHG laws or pending legislation. Wyoming has established a state Geothermal Working Group. The only incentive for geothermal development is sales-tax exemption for equipment used to generate renewable energy resources (USDOE 2007a).

Tribal Lands

Beyond those included in the aforementioned state profiles, no other geothermal projects have been developed recently on tribal lands, but there is significant potential for such development. For example, the Jemez Pueblo, the Acoma Pueblo lands west of Albuquerque, the Navajo Indian Reservation, the lands of the Jicarilla Apache tribe, and the Zia Pueblo lands have lower temperature geothermal potential. The analysis of geothermal potential relative to tribal lands deserves more attention to determine the extent to which developing these resources might involve or affect tribes. An informal analysis suggests that 57 reservations may have some potential for geothermal electricity production, representing approximately 10 percent of the American Indian population on reservations and Tribal Jurisdictional Statistical Areas (TJSAs, in Oklahoma). Another 72 reservations and TJSAs may have potential for geothermal direct-use applications (Dunley 2007).

Statutes, Policies, and Analyses

The following discussion covers the statutes and policies that may be relevant to geothermal development on tribal lands. These include the National Environmental Policy Act, the National Historic Preservation Act, the American Indian Religious Freedom Act, Executive Order 13007 on Indian Sacred Sites, the DOE policy on American Indians, and Environmental Impact Assessment analysis (Dunley 2007).

National Environmental Policy Act. The National Environmental Policy Act is an umbrella law that requires environmental reviews of federal actions, including environmental impact statements (EISs) and environmental assessments (EAs). This review process includes analysis of social impacts of the proposed actions when appropriate and may be utilized to review the social and environmental impacts of federal projects on tribal lands.

National Historic Preservation Act. The National Historic Preservation Act of 1966, amended in 1992, establishes a federal policy of encouraging preservation of cultural resources for present and future generations. The federal lead agency for a proposed action is responsible for initiating the "Section 106" review process and for consulting with the State Historic Preservation Officer and the Advisory Council on Historic Preservation. For example, in the case of several proposed Medicine Lake geothermal projects, the US Forest Service, as the Surface Managing Agency, initiated the Section 106 review process. The review included such issues as protection of Native American graves, archeological sites and resources, spiritual and vision quest sites, and paleontological resources (Dunley 2007).

American Indian Religious Freedom Act. The American Indian Religious Freedom Act of 1978 holds that federal agencies shall protect and preserve the religious freedom of American Indians. Although this issue was addressed during the Medicine Lake approval processes, the issue of spiritual values, in the public context, has still not been completely defined. More work will need to be done (Dunley 2007).

Executive Order 13007 on Indian Sacred Sites. Executive Order 13007 of 1996 (61 Federal Register 26771) provides that federal agencies are required to accommodate access to and ceremonial use of sacred sites by Indian religious practitioners, and to avoid adverse effects to sacred sites and to maintain their confidentiality. The act requires that, for any proposed action, agencies ascertain the impacts of the proposed activity on places of religious significance, sacred sites, plant species for food and healing, air quality, visual quality, noise quality, wildlife and game habitat, spiritual significance, battlegrounds, vision quest, power places, and other tribal activities such as hunting, camping, and gathering (Dunley 2007).

Tribal Lands

The Indian Development Act. The Geothermal Steam Act does not allow for BLM leasing on Indian reservations. The Indian Development Act provides that the BLM can be a technical consultant to a Native American tribe interested in negotiating with industry for development of geothermal resources at tribal lands. The BLM, if invited by the tribe, could facilitate the negotiation between the tribe and the developer (Dunley 2007).

Minerals Management Service Office of Indian Compliance and Asset Management. This office is a special organization within the Minerals Revenue Management dedicated to serving mineral-producing tribes and individual Indian mineral owners. Based in Denver, the office is a focal point for Indian mineral issues and contact with the Indian community (Dunley 2007).

American Indian and Alaska Native Tribal Government Policy, US Department of Energy. DOE first developed a policy governing its work with American Indians in 1992. The policy states that the department will identify and seek to remove impediments to working directly and effectively with tribal governments on DOE programs. Further, the policy committed DOE to consider Indian cultural issues in all its programs. Secretary Abraham has reaffirmed DOE's government-to-government policy (Dunley 2007).

Tribal Energy Self-Sufficiency Act (Draft). This bill is planned to be introduced in the Senate. Its provisions make energy projects eligible for revolving loans, loan guarantees, interest subsidies, and other incentives under the Indian Financing Act of 1974 (Dunley 2007).

Guidelines for Permitting on Tribal Lands

As sovereign nations, tribes have inherent authority over their land. Their approval must be obtained to use or lease tribal resources (e.g., land, water, and minerals). Tribes are not subject to state regulation and can negotiate with state and local governmental agencies.

Permitting on tribal land can take different paths, depending on the tribal authority provided by treaty or prescribed by constitutions developed under the Indian Reorganization Act of 1934, powers specified by Congress, and the inherent tribal authority the tribe asserts as a Sovereign Nation (Battocletti 2005).

Tribal Lands

The following are general tenets of law in Indian Country

- Federal agencies, such as the EPA, work directly with tribes on a "government to government" basis. Indian Country lands cannot be leased under the Geothermal Steam Act. They can be leased under agreements with the tribe itself or with the Indian Enterprise Corporations formed by the tribe, both with limitations on the rights granted. Often the tribes do not have commercial codes in place and cannot be sued without their permission (Battocletti 2005).

- Lands are generally (but not always) held in trust by the US and administered by the Bureau of Indian Affairs, which is generally the SMA in Indian Country when there is a third party lease or mineral management agreement (Battocletti 2005).

- Tribes can undertake exploration on their own, without BIA oversight. Even if there is no lease, there will be times in a tribally initiated project that will require working with BIA (Battocletti 2005).

- Tribes can write their own regulations or adopt the regulations of other federal, state, or local agencies. They may voluntarily relinquish sovereignty for a limited time and defined purpose to take advantage of another state, federal, or local agency's rules and oversight (Battocletti 2005).

- Tribes with appropriate regulations in place can apply for primacy over the Clean Air, Safe Drinking Water, and Clean Water Acts (Battocletti 2005).
- Projects with impacts outside of Indian Country may be subject to local and state permitting regulation (Battocletti 2005).

- Where no tribal ordinances applicable to a proposed action exist, an express federal statute allocating governmental authority over specific activities may control. Inherent tribal authority may also be preempted by a comprehensive federal regulatory scheme (Battocletti 2005).

- Tribes are not subject to NEPA unless they use funds from federal agencies such as the DOE. In some cases, BIA is the lead agency for NEPA on trust lands (Battocletti 2005).

- Where lands within Indian Country have been "allotted" to individual tribal members and then sold to non-Native Americans, another layer of jurisdictional uncertainty is created (Battocletti 2005).

- Tribes generally lack a history of natural resource development. Because of recent growing appreciation and expanded assertions of inherent sovereign powers by tribes, they may have difficulty accepting that there are jurisdictional authorities imposed by federal regulatory schemes for natural resource development on their land (Battocletti 2005).

- To determine the permitting path for a particular project, tribal sovereignty, tribal ordinances and codes, and tribal preferences must be weighed, along with other federal authorities. Tribes, consultants advising tribes, and members of industry forming contractual development agreements with tribes are urged to ensure that standard requirements for safety, health, environment, and conservation of the resource are applied to the project as would be done by responsible geothermal exploration and development projects on federal, state, and private lands, where permitting and regulatory requirements are more clearly outlined (Battocletti 2005).

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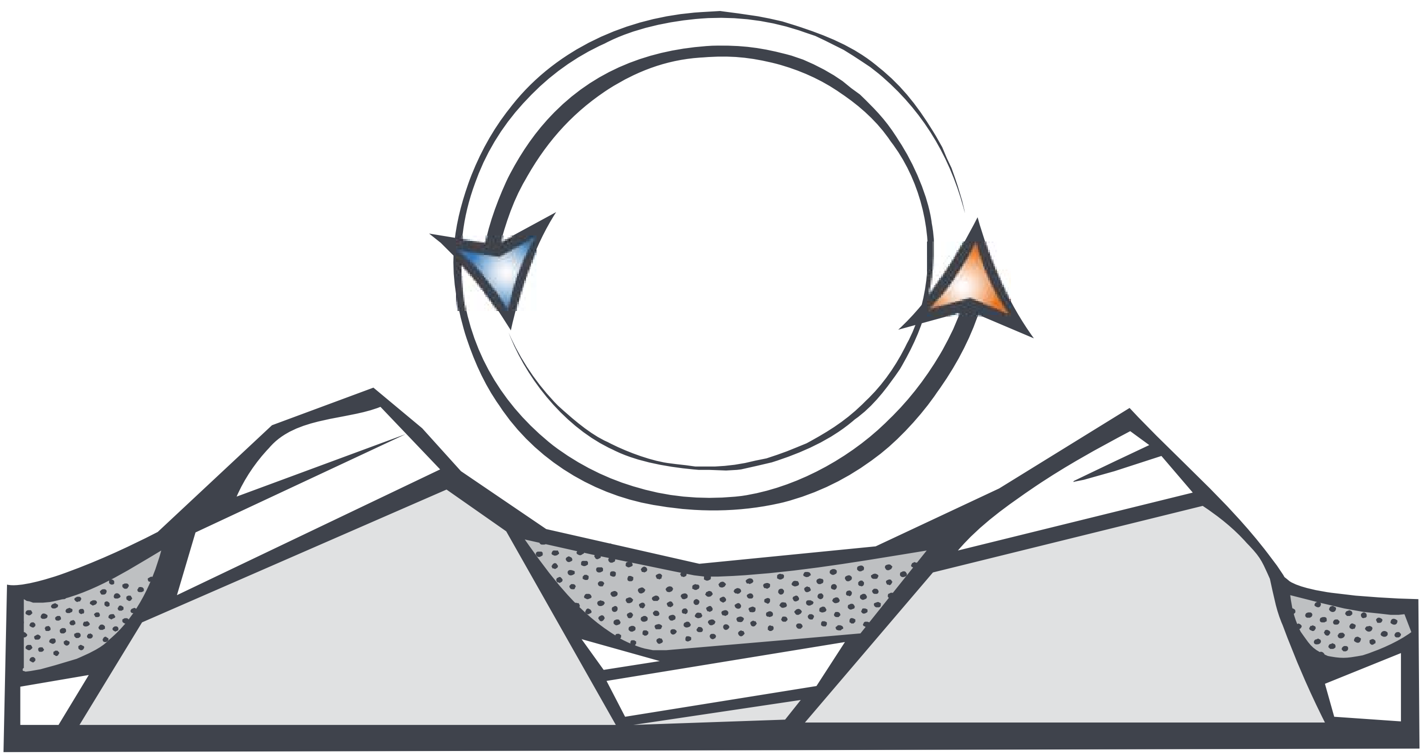

Appendix B

Memorandum of Understanding: Implementing of Section 225 of the Energy Policy Act of 2005 Regarding Geothermal Leasing and Permitting

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MEMORANDUM OF UNDERSTANDING
BETWEEN
UNITED STATES DEPARTIMENT OF THE INTERIOR
AND
UNITED STATES DEPARTMENT OF AGRICULTURE

IMPLEMENTATION OF SECTION 225 OF THE ENERGY POLICY ACT OF 2005 REGARDING GEOTHERMAL LEASING AND PERMITTING

Forest Service Agreement No. 06-SU-11132428-051

I. PARTIES AND PARTICIPATING AGENCIES

A. The parties to this Memorandum of Understanding (MOU) are the United States Department of the Interior (DOI) and the United States Department of Agriculture (USDA).

B. Participating agencies include:

1. Within DOI, the Bureau of Land Management (BLM); and

2. Within USDA, the Forest Service (FS).

II. PURPOSE

The purpose of this MOU is to facilitate interagency coordination and establish policies and procedures to implement Section 225 of the Energy Policy Act of 2005, Public Law 109-58 (hereinafter the “Act”). Section 225 requires the coordination of geothermal leasing and permitting on public lands and National Forest System (NFS) lands between the Secretary of the Interior and Secretary of Agriculture.

A. The Act requires that this MOU establish:

1. An administrative procedure for processing geothermal lease applications on lands managed by the FS, including specifying lines of authority, steps in application processing and time limits for the application process;

2. A 5-year program for geothermal leasing of lands in the National Forest System with a process for updating that program every 5 years;

3. A program to reduce the backlog of all geothermal lease applications pending on January 1, 2005, by 90 percent within the 5-year period beginning on the enactment of the Act, August 8, 2005; and

4. A data retrieval system for tracking lease and permit applications.

III. AUTHORITIES

A. The primary authority for this MOU is Section 225(a) of the Energy Policy Act of 2005 (Public Law 109-58).

B. Other authorities for entering into this MOU and the roles and responsibilities that each agency will undertake are under the provisions of the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001-1025), as amended and supplemented (P.L. 109-58, Title II, Subtitle B, §225, 119 Stat. 665 (Aug. 8, 2005), the Energy Security Act, 94 Stat. 611, 42 U.S.C. § 8001 note 8854-8855), the Mineral Leasing Act of 1920, as amended (30 U.S.C. § 226-3), the National Environmental Policy Act of 1969 (83 Stat. 852; 42 U.S.C. 4321-4347), the National Forest Management Act of 1974 (90 Stat. 2949), and the Federal Land Policy and Management Act of 1976 (90 Stat. 2743, 43 U.S.C. 1701-1782.)

IV. PRINCIPLES AND GOALS

A. Principles for implementing this MOU include:

1. Participating agencies will seek improved information sharing and use, as well as an improved understanding of respective agency roles and responsibilities;
2. Development of geothermal energy is a priority for both agencies;
3. Geothermal exploration and production on Federal lands will support the Nation's increased need for energy resources; and

4. The financial resources made available through Section 234 of the Act should be used to enhance the capability to process geothermal lease applications and permit authorizations.

B. Goals for implementing this MOU include:

1. Identifying new or improved ways to increase the efficiency and minimize duplication of the geothermal leasing process;

2. Establishing interagency coordination mechanisms that can adapt to changing demands or circumstances;

3. Developing a more consistent approach among the agencies, and greater certainty in processing time requirements, to improve customer service;

4. Establishing interagency coordination mechanisms to allow for adequate flexibility to adapt to changing demands and technologies related to geothermal development;

5. Promoting responsible stewardship of Federal subsurface and surface resources through permitting actions; and

6. Developing a joint interagency data retrieval system to track application progress.

V. ROLES, RESPONSIBILITIES AND DELEGATION OF AUTHORITY

A. BLM.

1. General regulatory and management responsibilities. The BLM administers more than 261 million surface acres of public lands and 700 million acres of subsurface mineral estate (Federal land beneath surface lands owned or managed by other parties, such as the FS, National Park Service, Department of Defense and U.S. Fish and Wildlife Service).

2. Geothermal leasing. The BLM receives nominations from applicants, which may include proposed tract configurations for parcels. The BLM then forwards the proposal to the FS, which decides whether or not to consent to leasing and if so, what lease stipulations are necessary to minimize impacts to other resources and comply with regulations, policy and forest plan direction. With FS consent and once lease parcels are configured, the BLM is responsible for conducting geothermal lease sales and issuing competitive and noncompetitive leases. Although the BLM cannot issue a lease without the consent of the FS, the BLM can add any additional terms, conditions or stipulations that it deems necessary and appropriate, and must make an independent decision whether to issue the lease after review of the decision and documentation presented by the FS, and any other relevant factors.

3. Geothermal operations. If an operator proposes to conduct exploration operations on unleased FS lands, the application is submitted directly to the FS, which has the lead to conduct any necessary National Environmental Policy Act (NEPA) review and decide if the permit application should be approved and, if approved, what conditions of approval will be attached. If an operator proposes to conduct exploration operations on leased FS lands where the operator also is the lessee, the permit application is submitted to the BLM, which is the lead agency for permit review. In this case, the BLM will coordinate the NEPA review with FS, which will propose permit conditions of approval involving surface issues. The BLM will determine if the permit application should be approved and, if approved, what conditions of approval will be attached to the permit.
Subsequent to leasing, if an operator proposes to drill wells intended for production or injection or to utilize the geothermal resource (which are lease exclusive operations) on Federal lands, the BLM is responsible for review and final approval of these types of operational permit applications, after consultation with the FS. Under most circumstances, a single NEPA document will be prepared with the BLM as lead and the FS as a cooperating agency. There are situations where specific interagency agreements apply and the FS will take the lead in preparing the NEPA document.

B. FS.

1. General regulatory and management responsibilities. The FS is responsible for the surface management of 192 million acres of National Forest System (NFS) lands. The Geothermal Steam Act as amended defines the role of the FS in the management of geothermal resources.

2. The FS is responsible for consenting (or not consenting) to the leasing of NFS lands, for conducting NEPA analysis for leasing, for developing appropriate terms and conditions under which the lease may be developed, and to ensure that doing so is consistent with the Land and Resource Management Plan developed under the National Forest Management Act.

3. Subsequent to leasing, the FS cooperates with the BLM to ensure that management goals and objectives for geothermal exploration and development activities are achieved, that operations are conducted to minimize effects on surface resources, and that the lands affected by operations are reclaimed. The BLM issues and administers geothermal leases on NFS lands only after the FS has consented to leasing under appropriate terms and conditions and has taken the actions necessary for the BLM to offer available lands for lease.

4. Administrative procedure for processing lease applications. The FS authorization to implement the leasing decision is to be forwarded to the BLM within 60 days of the initial receipt by FS of the leasing proposal if it conforms to a Forest Land Management Plan and is covered by an existing leasing NEPA document. If this timeframe cannot be met, FS is to provide the BLM with an expected date of completion, along with an explanation for the delay by entering information into the joint tracking system.

VI. FIVE-YEAR PROGRAM PLAN

The FS will:

A. Coordinate with the BLM, USGS, states and other interested parties to update potential geothermal areas through existing and new resource assessments;

B. Develop a process to delineate the boundaries of geothermal potential areas (including nominated lands) that will then be prioritized for leasing decisions and the associated NEPA process;

C. Coordinate with the BLM to establish the initial 5-year NEPA schedule needed for timely leasing decisions;

D. Review the schedule as new nominations are submitted or data from interested parties changes;

E. Address the existing backlog and newly nominated lands in the first 5-year plan; and

F. Coordinate with the BLM to find supplemental funding for the program such as that provided by Section 234 of the Act to ensure timely completion.

VII. PRE-LEASE ENVIRONMENTAL DOCUMENTATION

The FS, generally, will take the lead for completing the pre-lease NEPA documents and is responsible for providing the official FS consent or non-consent to leasing on FS lands. By this MOU, FS and the BLM agree to jointly prepare NEPA documents that will meet the requirements of both agencies in reaching their independent leasing decisions. The FS and the BLM will also identify, through the analysis, reasonable and justifiable stipulations needed to protect or minimize impacts to specific resources or land uses. The BLM will also provide a "reasonably foreseeable development (RFD) scenario" if requested by the FS, to facilitate the disclosure of potential environmental impacts. The FS will transmit the consent or non-consent decision on geothermal leasing to the BLM. Appropriate offices will be involved at appropriate levels of decision making. The following will apply, however, to the extent agreed upon by both agencies under sections VII. A. and B. below:

A. Subject to the terms of future, individualized MOUs regarding geothermal resources that may be developed between particular BLM and FS offices or for a particular NEPA process, as a general matter, the BLM will:

1. Appoint a specialist to participate as a member of the FS Interdisciplinary Team in the joint preparation, and completion of the NEPA document as necessary;
2. Provide informal training on geothermal operations, their potential impacts on the environment, the effect of mitigation on operations, mitigation development, and stipulation policy, upon request and in cooperation with the FS;
3. Assist the FS in jointly scoping the issues and determining the level of NEPA document to be prepared;
4. Assist the FS in the formulation of mitigation measures and lease stipulations;
5. Ensure that the NEPA document is consistent with the BLM leasing policies and NEPA document preparation standards, so that the document can be used by both agencies to reach independent decisions, if needed;
6. Cooperate with the FS to ensure that the draft NEPA document is completed on schedule (set in Section VI. C. above);
7. Complete review and comment on the draft NEPA document within 30 working days of receipt;

8. Assist and coordinate with the FS in the review of public and agency comments, discuss and work towards agreement on proposed lease stipulations and mitigations, make necessary revisions to the draft NEPA documents and assist in preparing the draft Decision Notice (DN)/Record of Decision (ROD);

9. After an independent review, adopt the final EA/EIS and sign the DN/ROD or prepare and sign a separate BLM decision document and return the original signed documents to the FS; and

10. Issue leases with recommended special environmental stipulations or reject lease applications in accordance with the DN/ROD.

B. Subject to the terms of future, individualized MOUs regarding geothermal resources that may be developed between particular BLM and FS offices or for a particular NEPA process, as a general matter, the FS will:

1. Jointly scope the issues to be addressed in the NEPA document with the BLM, including determining the level of NEPA document to be prepared and developing a schedule for completion of the document. The goal is to complete each NEPA document within 1 to 2 years;

2. Work with the BLM to provide a RFD scenario, if needed, to be used as a basis for impact analysis in the NEPA document;

3. Request training from the BLM on post-lease geothermal operations, their potential impacts on the environment, the effect of mitigation on operations, mitigation development, and stipulation policy when determined to be necessary;

4. Prepare the NEPA document in cooperation with and with the assistance of the BLM, and

    a. Include a specialist from the BLM staff on the FS Interdisciplinary (ID) Team as necessary;

    b. Coordinate with the BLM to ensure that the NEPA document is consistent with BLM leasing and analysis policies;

5. Discuss and work toward agreement on potential mitigation measures and lease stipulations as part of alternative development with the BLM;

6. Forward a copy of the preliminary NEPA document to the BLM for review and comment within 1 week of completion;

7. Jointly review with the BLM all comments on the draft NEPA document and incorporate comments and changes as agreed;

8. Prepare the final NEPA document for public comment and review, address all public comments, prepare a DN/ROD in cooperation with the BLM and forward the final copy to the deciding officer for the FS; and

9. Transmit the leasing consent or non-consent decision, the NEPA document, and the signed FS version of the DN/ROD to the BLM within 15 calendar days after any appeals are resolved.

VIII. COMPETITIVE LEASING

The BLM is responsible for conducting geothermal lease sales and issuing competitive leases (see attached Table).

A. BLM will:

1. Coordinate and schedule an annual BLM/FS meeting to develop a proposed competitive leasing schedule, considering each agency's budgets and other work priorities;

2. Send a written request to the FS for appropriate stipulations and special terms for lease issuance at least 180 days prior to the scheduled sale date; and

3. Coordinate with the FS (lead agency) to complete the pre-lease NEPA document according to the procedures outlined in this MOU.

B. FS will:

1. Coordinate with the BLM in scheduling and holding the proposed competitive sale meeting;

2. Utilize information in mineral resource assessment in future planning documents and decisions;

3. Provide appropriate stipulations for the NFS lands involved in a proposed lease sale and special terms for lease issuance at least 90 days prior to the scheduled sale date; and

4. Coordinate with the BLM to complete the pre-lease NEPA document according to the procedures in Section VII of this MOU.

IX. NONCOMPETITIVE LEASING

The BLM is responsible for conducting geothermal lease sales and issuing noncompetitive leases (see attached Table).

A. BLM will:

1. Transmit any noncompetitive lease application package involving NFS lands to the FS within 30 days of receipt; and

2. Upon receipt of the FS consent and stipulations, make an independent decision whether to issue each lease within 30 days of conveying terms and conditions to the applicant.

B. FS will:

1. Forward land parcel lease requests from the FS to the appropriate Forest Supervisor for environmental clearance within 15 days of receipt; and

2. Complete a review of the existing NEPA document and coordinate with the BLM during the environmental review process, as outlined in Part VII. A. above, and transmit a letter of consent or no consent to the BLM within 60 days from receipt of land parcel lease requests.

C. Direct Use

Outside of the circumstances outlined in the Geothermal Steam Act of 1970, 30 U.S.C. 1003(c) as amended, by section 222 of the Act, the only lands available to be leased without a competitive sale are those in areas designated by the Secretary of the Interior for exclusive direct-use utilization of geothermal resources only pursuant to 30 U.S.C. 1003(f). Subject to forthcoming implementing regulations, such exclusive direct-use areas may have been identified and designated via attached stipulation in advance of the nomination to lease, or the designation may occur in response to the nomination to lease after appropriate reviews at the conclusion of the 90-day competitive interest notice period (30 U.S.C. 1003(f)).

X. JOINT DATA RETRIEVAL SYSTEM FOR BLM AND FS TO TRACK STATUS OF LEASE AND PERMIT APPLICATIONS

The joint data retrieval system will be completed in time to implement the forthcoming geothermal regulations being prepared to implement the geothermal provisions of the Act.

A. BLM will:

1. Provide designated FS staff with the appropriate level of access to BLM's Automated Fluid Minerals Support System (AFMSS), Legacy Rehost 2000 (LR 2000), and National Integrated Land System (NILS) transaction and reporting systems, as well as data systems used for the management of geothermal resources. Access to users will be provided within 2 weeks after submission of a request using Form 1260. Systems will be available for use 90 percent of the time within standard business operating hours using established industry metrics. The details and specifics of how the FS will access and use BLM systems will be documented in a Service Level Agreement consistent with BLM/DOI policies. FS will be able to view the status of and enter updates to transactions related to proposals on National Forest System lands, while those on the BLM lands will appear as read-only to FS users;

2. Determine infrastructure, protocols, and procedures necessary to provide secure access to joint data retrieval systems and joint geographic information system. Provide security requirements to Forest Service;

3. Assure adequate system performance and security to maintain data integrity for FS users which access the BLM's data systems used for the management of geothermal resources; and

4. Be responsible for the Information Technology management, including Project Change Management, of the BLM's data systems used for the management of geothermal resources.

B. FS will:

1. Establish infrastructure, protocols, and procedures to meet the security requirements as determined by BLM for access to joint data retrieval systems and geographic information systems by designated Forest Service staff;

2. Provide the BLM with a completed BLM Form-1260 for all FS users who need to access the BLM's data systems used for the management of geothermal resources; and

3. Use the BLM's Project Change Management Boards for requesting changes to the BLM's data systems used for the management of geothermal resources.

XI. MEASURES OF SUCCESS OR CHANGE FOR GEOTHERMAL LEASING AND PERMITTING PROGRAMS

A. Success Measures. Measures of success for the Geothermal Leasing and Permitting Programs include:

1. Streamlining and increasing interagency efficiency in processing geothermal leases, permits and associated agency approvals;

2. Increasing ability to more timely process and issue geothermal leases and approve permits that will withstand administrative and judicial challenge; and

3. Decreasing the lease application backlog by 90 percent in 5 years.

B. Data for Measuring Success. For Geothermal Leasing and Permitting, the following, at a minimum, will be tracked and measured:

1. The total number of nominations and permit applications received, processed, and issued;

2. The elapsed time from receipt to issuance or approval, including the time required for major steps or components; and

3. The number of applications backlogged.

C. The information identified in the preceding paragraph will be collected for 5 fiscal years after enactment of the Act and will be compared to the same parameters in each of the 3 fiscal years preceding passage of the Act.

XII. MUTUAL UNDERSTANDING AND AGREEMENT

A. <u>Freedom of Information Act (FOIA).</u> Any information furnished to the BLM and FS under this instrument is subject to the Freedom of Information Act (5 U.S.C. 552).

B. <u>Participation in similar activities.</u> This instrument in no way restricts the BLM or FS from participating in similar activities with other public or private agencies, organizations, and individuals.

C. <u>Responsibilities of Parties.</u> The BLM and FS and their respective offices will handle their own activities and utilize their own resources, including expenditures of their own funds, in pursuing these objectives, except as previously outlined. Each party will carry out its separate activities in a coordinated and mutually beneficial manner.

D. Principal Contacts

1. BLM.

Assistant Director, Minerals, Realty and Resource Protection
1849 C Street, N.W.
Washington, DC 20240
(202) 208-4201

2. FS.

Director, Minerals and Geology Management
1400 Independence Ave., SW
Washington, DC 20250
(703) 605-4791

XIII. FUNDING

A. Section 234 of the Energy Policy Act of 2005 authorizes rentals, royalties and other payments required under leases under the Geothermal Steam Act of 1970, excluding funds required to be paid to state and county governments, to be deposited in a special fund available to "…the Secretary of the Interior for expenditure, without further appropriation and without fiscal year limitation, to implement the Geothermal Steam Act of 1970 and this Act…."

B. Section 234(c) of the Energy Policy Act of 2005 authorizes the Secretary of the Interior to expend or transfer funds as necessary to the FS for purposes of coordination and processing of geothermal leases and geothermal use authorizations on Federal land.

C. The details of the levels of support to be furnished to FS by the BLM, with respect to funding and personnel, will be developed in specific future agreements on an annual or case-by-case basis, contingent on the availability of identified staffing needs and types of funding.

XIV. COMMENCEMENT/EXPIRATION/TERMINATION AND MODIFICATION

As described in Section XIII. A. B. C., the Act mandates the establishment of a fund for geothermal leasing through fiscal year 2010. The MOU will continue beyond that date for the purposes of coordinating geothermal leasing. The BLM and FS will review this MOU every 5 years for currency and applicability. This MOU may be revised and modified as necessary; terms herein are contingent upon regulations yet to be promulgated. All parties potentially affected by a modification must sign the modification for it to be effective.

XV. MEETINGS

The agencies will meet on an annual basis. Additional coordination meetings or conference calls may be held as needed.

XVI. DISPUTE RESOLUTION

If a dispute arises under this MOU that is not resolved informally between or among the parties, then any party may pursue the following dispute resolution procedure:

A. The party that seeks resolution will provide a written statement of its dispute, along with any rationale or supporting documents, to the other interested party. The parties will engage in discussions in an attempt to arrive at a consensus and resolve the dispute.

B. If no resolution is reached within thirty (30) calendar days of receipt of the statement of dispute, then the dispute may be elevated to the parties' respective headquarters-level officials. If consensus is not achieved by the headquarters-level officials within thirty (30) calendar days of their receipt of the statement of dispute, the parties will promptly elevate the matter to the respective Secretaries' Offices, who will resolve the matter.

C. The time limits in the preceding paragraph may be extended on the agreement of the parties to the dispute.

XVII. SUPPLEMENTAL AGREEMENTS

Subsequent to the signing of this MOU, additional Federal or state interagency agreements may be required for the purposes of outlining more specific interagency relationships.

XVIII. NO PRIVATE RIGHT OF ACTION AND LIMITED APPLICABILITY

This MOU is not intended to, and does not create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity, by a person against the United States, its agencies, its officers, or any person. This MOU does not direct or apply to any person outside of the signatory Parties.

ACCORDINGLY, the parties have signed this MOU on the dates set forth below, to be effective for all purposes as of the date last signed. The signatures may be executed using counterpart original documents.

Kathleen Clarke — 4/5/06

DIRECTOR, BUREAU OF LAND MANAGEMENT — DATE

Dale N. Bosworth — 4/10/06

CHIEF, FOREST SERVICE — DATE

Geothermal Leasing on NFS Lands

The BLM and the Forest Service will coordinate geothermal resource leasing activities on NFS lands as follows:

J = joint responsibility S = sole responsibility

Action	Responsible Agency		Remarks
	BLM	FS	
Pre-Lease Environmental Documentation			
Serve as lead agency for geothermal leasing availability analyses and decisions and conduct analysis.		S	
Participate as co-lead agency or cooperating agency for geothermal leasing availability analyses and decisions for NFS lands.	S		
Analyze split estate lands (private surface/Federal minerals) within boundaries of NFS units.	J	J	Analysis and decision-making on all lands under Federal authority (both the BLM and the FS) within a defined leasing area will ensure consistency in geothermal resource management.
Provide expertise in the areas of geothermal engineering and geothermal geology on interdisciplinary teams performing environmental analyses for leasing on NFS lands.	S		The BLM must provide expertise in delegated program areas in geothermal operations, including ground water protection.
Provide Reasonably Foreseeable Development Scenario (RFD) for geothermal leasing on NFS lands.	S		Analysis must include information on geothermal reservoirs, resource distribution, and production characteristics, and must address downhole operations. The RFD will follow the Interagency Reference Guide "Reasonably Foreseeable Development Scenarios and Cumulative Effects Analysis". FS may need to provide information on surface use (roads, etc.) for inclusion or consideration in the RFD. RFD may be developed by other parties. If so, the BLM should provide final review.
Ensure consistency in lease stipulations across jurisdictional boundaries.	J	J	
Develop lease stipulations for NFS lands that are only as restrictive as necessary to protect the resources for which they are applied.		S	The FS should develop stipulations with the BLM input for consistency. (See above.)
Issue leasing decision.		S	The FS and the BLM should coordinate the signing and release of decision documents on leasing of NFS lands. NOTE: The BLM has sole decision authority for split estate lands (Federal minerals/private or State surface) within boundaries of Forest Service administrative units.)
Adopt FS leasing analysis.	S		

Action	Responsible Agency		Remarks
	BLM	**FS**	
Competitive Leasing			
Coordinate and schedule the BLM/FS meeting to develop a proposed competitive leasing schedule.	J	J	
Send written request to the FS for appropriate stipulation and special terms for lease issuance at least 180 days prior to sale.	S		
Utilize information in mineral resource assessment in future planning documents and decisions.	S		
Provide appropriate stipulations for NFS land involved in proposed lease sale and special terms for lease issuance at least 90 days prior to scheduled sale date.		S	.
Noncompetitive Leasing			
Transmit any noncompetitive lease application package involving NFS land to the FS within 30 days of receipt.	S		
Forward land parcel lease requests from the FS to appropriate Forest Supervisor for environmental clearance within 15 days of receipt.		S	
Complete a review of the existing NEPA document and transmit letter of consent or no consent to the BLM within 60 days from receipt of land parcel lease requests.		S	Coordinate with the BLM during the environmental review process, as outlined in Part VII. A.
Upon receipt of the FS consent and stipulation, make an independent decision as to whether to issue each lease within 30 days of conveying terms and conditions to applicant.	S		

J = joint responsibility   S = sole responsibility

Action	Responsible Agency		Remarks
	BLM	**FS**	
Joint Data Retrieval System for the BLM and the FS to Track Status of Lease and Permit Applications			
Determine infrastructure, protocols, and procedures necessary to provide secure access to joint data retrieval systems and joint geographic information system. Provide security requirements to Forest Service.	S		The BLM program and IT staff will work with corresponding staff in Forest Service to determine standards.
Establish infrastructure, protocols, and procedures to meet the security requirements as determined by BLM for access to joint data retrieval systems and geographic information systems by designated Forest Service staff.		S	Implement security requirements to meet BLM standards for those Forest Service staff requiring access to the joint data retrieval systems.
Provide designated FS staff with the appropriate level of access to the joint data retrieval system.	S		At the initiation of this MOU the joint data retrieval systems include AFMSS, LR 2000, and NILS. The details and specifics of how the FS will access and use BLM systems will be documented in a Service Level Agreement consistent with BLM/DOI policies.
Provide the BLM with a completed BLM Form- 1260 for all FS users who need to access the joint data retrieval system.		S	.
Assure adequate system performance and security to maintain data integrity for FS users who access the joint data retrieval system.	S		
Utilize the BLM's Project Change Management Boards for requesting changes to the joint data retrieval system.		S	
Be responsible for the Information Technology management, including Project Change Management, of the joint data retrieval system.	S		

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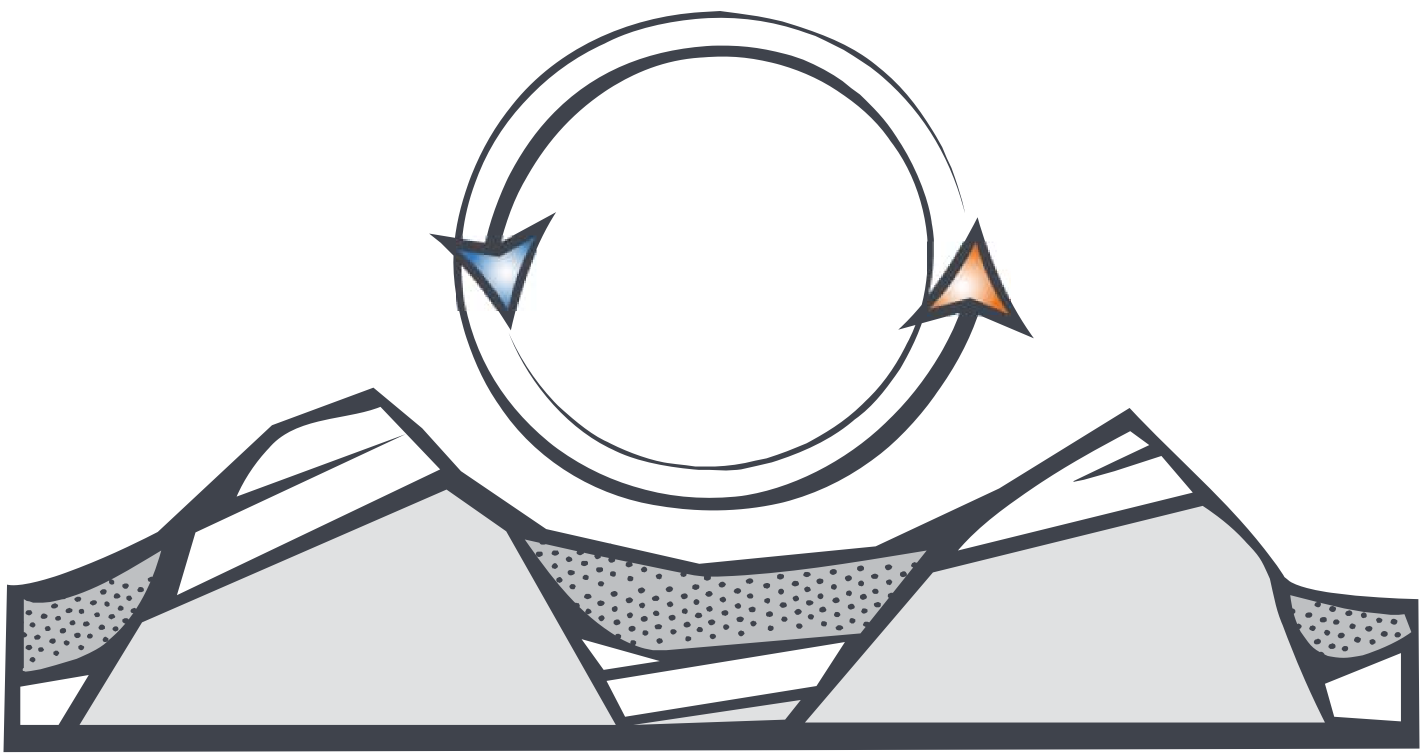

Appendix C

Preliminary List of ACEC Status for Fluid Mineral Leasing

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Appendix C

Preliminary List of ACEC Status for Fluid Mineral Leasing

28-Mar-08

List of Acronyms : NSO = No Surface Occupancy, TL = Timing Limitations, CSU = Controled Ssurface Use, CSM = Control Surface Management, CNL =Closed to New Leasing, NNR = No New ROW

State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
AK	Central Yukon	Dulbi-Kaiyuh Mountains	7,039		OPEN	
AK	Central Yukon	Dulbi-Kaiyuh Mountains	6,435		OPEN	
AK	Central Yukon	Dulbi-Kaiyuh Mountains	10,036		OPEN	
AK	Central Yukon	Dulbi-Kaiyuh Mountains	4,439		OPEN	
AK	Steese NCA	Big Windy Hot Spring	152	CLOSED		
AK	Utility Corridor	Kanuti Hot Springs ACEC	43	CLOSED		
AK	Central Yukon	Ishtalitna Creek Hot Springs RNA	1,025	CLOSED		
AK	Central Yukon	McQuesten Creek RNA	3,930	CLOSED		
AK	Central Yukon	Spooky Valley RNA	10,072	CLOSED		
AK	Central Yukon	Tozitna Subunit South	62,645		OPEN	
AK	Central Yukon	Hogatza	30,509		OPEN	
AK	Central Yukon	Indian River Watershed	161,198		OPEN	
AK	Central Yukon	Tozitna River Watershed	947,111		OPEN	
AK	Central Yukon	Galena Mountain Watershed ACEC - East Unit	6,054		OPEN	
AK	Central Yukon	Tozitna Subunit North	128,799		OPEN	
NM	Roswell	North Pecos			OPEN	None
NM	Roswell	Overflow Wetlands			OPEN	None
NM	Roswell	Ft. Stanton		CLOSED		None
NM	Roswell	Mescalero Sands		CLOSED		None
NM	Roswell	Roswell Cave Complex		CLOSED		None
NM	Rio Puerco	Torrejon Fossil Fauna			OPEN	CSU
NM	Rio Puerco	Jones Canyon			OPEN	NSO
NM	Rio Puerco	San Luis Mesa Raptor Area			OPEN	TL, CSU
NM	Rio Puerco	Cabezon Peak		CLOSED		None
NM	Rio Puerco	Canon Tapia			OPEN	NSO
NM	Rio Puerco	Elk Springs			OPEN	TL, CSU
NM	Rio Puerco	Tent Rocks			OPEN	TL, CSU
NM	Rio Puerco	Ojito			OPEN	CSU
NM	Rio Puerco	Ball Ranch		CLOSED		None
NM	Rio Puerco	Pronoun Cave Complex			OPEN	CSU
NM	Rio Puerco	Bluewater Canyon			OPEN	NSO
NM	Farmington	Cedar Hill			OPEN	CSM
NM	Farmington	*Chacra Mesa Complex			OPEN	CSM, NSO
NM	Farmington	East Side Rincon			OPEN	CSM, NSO
NM	Farmington	Farmer's Arroyo			OPEN	NSO
NM	Farmington	La Jara			OPEN	CSM
NM	Farmington	*Andrews Ranch			OPEN	NSO, CNL

Appendix C

Preliminary List of ACEC Status for Fluid Mineral Leasing

28-Mar-08

List of Acronyms : NSO = No Surface Occupancy, TL = Timing Limitations, CSU = Controled Ssurface Use, CSM = Control Surface Management, CNL =Closed to New Leasing, NNR = No New ROW

State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
NM	Farmington	*Bee Burrow			OPEN	NSO, CNL
NM	Farmington	*Bis Sa'ani			OPEN	NSO, CNL
NM	Farmington	Casa Del Rio		CLOSED		None
NM	Farmington	*Casamero Community			OPEN	NSO, CNL, NNR
NM	Farmington	Church Rock Outlier			OPEN	NSO, CNL
NM	Farmington	*Greenlee Ruin			OPEN	None
NM	Farmington	*Halfway House			OPEN	NSO, CNL, NNR
NM	Farmington	*Holmer Group			OPEN	NSO, CNL, NNR
NM	Farmington	*Indian Creek			OPEN	CNL, NNR
NM	Farmington	Jacques Chacoan Community			OPEN	NSO, NNR
NM	Farmington	*Kin Nizhoni			OPEN	NSO
NM	Farmington	Lake Valley			OPEN	NSO, CNL
NM	Farmington	*Morris 41			OPEN	NSO, CNL, NNR
NM	Farmington	*Pierre's Site			OPEN	NSO, CNL,NNR
NM	Farmington	*Toh-La-Kai			OPEN	NNR
NM	Farmington	*Twin Angels			OPEN	NSO, NNR
NM	Farmington	*Upper Kin Klizhin			OPEN	CNL, NNR
NM	Farmington	Ah-Shi-Sle-Pah Road			OPEN	CSM, NSO
NM	Farmington	*Crowpoint Steps and Herradura			OPEN	CSM, NNR
NM	Farmington	*North Road			OPEN	NSO, CNL
NM	Farmington	Adams Canyon			OPEN	NSO, NNR
NM	Farmington	Blanco Mesa			OPEN	NSO, NNR
NM	Farmington	Cagle's Site			OPEN	NSO
NM	Farmington	Canyon View Ruin			OPEN	NSO,NNR
NM	Farmington	Christmas Tree Ruin			OPEN	NSO, NNR
NM	Farmington	Cottonwood Divide			OPEN	NSO, NNR
NM	Farmington	Crow Canyon			OPEN	NSO, NNR
NM	Farmington	Deer House			OPEN	NSO, CSM, NNR
NM	Farmington	Devil's Spring Mesa			OPEN	NSO, CSM, NNR
NM	Farmington	Encinada Mesa-Carrizo Canyon			OPEN	NSO, NNR, CSM

Appendix C

Preliminary List of ACEC Status for Fluid Mineral Leasing

28-Mar-08

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State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
NM	Farmington	Frances Mesa			OPEN	NSO, CSM
NM	Farmington	Gould Pass Camp			OPEN	NSO
NM	Farmington	Humming Bird			OPEN	NSO, NNR
NM	Farmington	Kachina Mask			OPEN	NSO
NM	Farmington	Kin Yazhi			OPEN	NSO, NNR
NM	Farmington	Kiva			OPEN	NSO
NM	Farmington	Munoz Canyon			OPEN	CSM
NM	Farmington	Pointed Butte			OPEN	NSO, NNR
NM	Farmington	Pork Chop Pass			OPEN	NSO
NM	Farmington	Pretty Woman			OPEN	NSO, NNR
NM	Farmington	Prieta Mesa			OPEN	NSO, NNR
NM	Farmington	Rincon Largo District			OPEN	NSO, NNR
NM	Farmington	Rincon Rockshelter			OPEN	NSO
NM	Farmington	San Rafael Canyon			OPEN	CSM
NM	Farmington	Simon Ruin			OPEN	NSO, NNR
NM	Farmington	Star Rock			OPEN	NSO, NNR
NM	Farmington	String House			OPEN	NSO, NNR
NM	Farmington	Superior Mesa			OPEN	NSO, NNR
NM	Farmington	Tapacito and Split Rock			OPEN	NSO, NNR
NM	Farmington	Truby's Tower			OPEN	NSO
NM	Farmington	Albert Mesa			OPEN	NSO, NNR
NM	Farmington	Dogie Canyon School			OPEN	NSO
NM	Farmington	Gonzales Canyon-Senon S. Vigil Homestead			OPEN	NSO, NNR
NM	Farmington	Haynes Trading Post			OPEN	NSO
NM	Farmington	Margarita Martinez Homestead			OPEN	NSO, NNR
NM	Farmington	Martin Apodaca Homestead			OPEN	NSO
NM	Farmington	Moss Trail			OPEN	NSO, NNR
NM	Farmington	Rock House-Nestor Martin Homestead			OPEN	NSO
NM	Farmington	Santos Peak			OPEN	NSO
NM	Farmington	Ashiih Naa'a			OPEN	NSO, NNR
NM	Farmington	Cho'li'I			OPEN	NSO
NM	Farmington	Dzil'na'oodlii			OPEN	NSO, NNR
NM	Farmington	Bi Yaazh			OPEN	NSO
NM	Farmington	Blanco Star Panel			OPEN	NSO, NNR
NM	Farmington	Delgadita/Pueblo Canyons			OPEN	NSO, NNR
NM	Farmington	Encierro Canyon			OPEN	NSO

Appendix C

Preliminary List of ACEC Status for Fluid Mineral Leasing

28-Mar-08

List of Acronyms : NSO = No Surface Occupancy, TL = Timing Limitations, CSU = Controled Ssurface Use, CSM = Control Surface Management, CNL =Closed to New Leasing, NNR = No New ROW

State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
NM	Farmington	Four Ye'i			OPEN	NSO
NM	Farmington	Hummingbird Canyon			OPEN	NSO, NNR
NM	Farmington	Largo Canyon Star Ceiling			OPEN	NSO
NM	Farmington	Martinez Canyon			OPEN	NSO
NM	Farmington	Pregnant Basketmaker			OPEN	NSO
NM	Farmington	Shield Bearer			OPEN	NSO
NM	Farmington	Star Spring-Jesus Canyon			OPEN	NSO
NM	Farmington	Angel Peak			OPEN	NSO
NM	Farmington	*Simon Canyon			OPEN	NSO, CNL
NM	Farmington	Bald Eagle			OPEN	CSM
NM	Farmington	*The Hogback			OPEN	CSM, CNL
NM	Farmington	Mexican Spotted Owl			OPEN	CSM, NSO
NM	Farmington	River Tracts			OPEN	NSO
NM	Farmington	Ah-shi-sle-pah			OPEN	CNL
NM	Carslbad	Pecos River Canyons Complex			OPEN	NSO, NNR
NM	Carslbad	Lonesome Ridge			OPEN	NSO, NNR
NM	Carslbad	Dark Canyon			OPEN	NSO, NNR
NM	Carslbad	Chosa Draw			OPEN	NSO, NNR
NM	Carslbad	Blue Spring			OPEN	NSO, NNR
NM	Las Cruces	Three Rivers			OPEN	
NM	Las Cruces	Sacramento Escarpment			OPEN	
NM	Las Cruces	Cornudas Mts.			OPEN	
NM	Las Cruces	Alamo			OPEN	
NM	Las Cruces	Wind Mt.			OPEN	
NM	Las Cruces	Alkali Lakes			OPEN	
NM	Las Cruces	Alamo Hueco Mtns.			OPEN	
NM	Las Cruces	Apache Box			OPEN	
NM	Las Cruces	Big Hatchet Mtns			OPEN	
NM	Las Cruces	Bear Creek			OPEN	
NM	Las Cruces	Central Peloncillo Mtns.			OPEN	
NM	Las Cruces	Cooke's Range			OPEN	
NM	Las Cruces	Cowboy Spring			OPEN	
NM	Las Cruces	Florida Mtns			OPEN	
NM	Las Cruces	Gila Lower Box			OPEN	
NM	Las Cruces				OPEN	
NM	Las Cruces	Gila Middle Box			OPEN	
NM	Las Cruces	Granite Gap			OPEN	
NM	Las Cruces	Guadalupe Canyon			OPEN	
NM	Las Cruces	Los Tules		CLOSED		NSO

Appendix C

Preliminary List of ACEC Status for Fluid Mineral Leasing

28-Mar-08

List of Acronyms : NSO = No Surface Occupancy, TL = Timing Limitations, CSU = Controled Ssurface Use, CSM = Control Surface Management, CNL =Closed to New Leasing, NNR = No New ROW

State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
NM	Las Cruces	Northern Peloncillo Mtns.			OPEN	
NM	Las Cruces	Old Town			OPEN	
NM	Las Cruces	Organ/Franklin Mtns		CLOSED		
NM	Las Cruces	Rincon		CLOSED		NSO
NM	Las Cruces	Robledo Mtns			OPEN	
NM	Las Cruces	San Diego Mtn.			OPEN	
NM	Las Cruces	Uvas Valley			OPEN	
NM	Las Cruces	Aden Lava Flow RNA			OPEN	
NM	Las Cruces	Antelope Pass RNA			OPEN	
NM	Las Cruces	Kilbourne Hole NNL			OPEN	
NM	Las Cruces	Lordsburg Playa RNA			OPEN	
NM	Las Cruces	Paleozoic Trackways RNA			OPEN	
NM	Socorro	Ladron Mt/Devil's Backbone Complex			OPEN	NSO
NM	Socorro	Cerro Pomo			OPEN	
NM	Socorro	Horse Mountain			OPEN	NSO
NM	Socorro	Tinajas	40	CLOSED		
NM	Socorro	Sawtooth			OPEN	NSO
NM	Socorro	San Pedro			OPEN	NSO
NM	Socorro	Zuni Salt Lake	46,746	CLOSED		
NM	Socorro	Pelona Mountain			OPEN	CSU
NM	Taos	San Antonio Gorge	547		OPEN	NSO
NM	Taos	San Antonio WSA	7,000	CLOSED		None
NM	Taos	San Antonio	75,500		OPEN	CSU
NM	Taos	Winter Range	6,688		OPEN	TL
NM	Taos	Rio Grande and Red Wild and Scenic	17,286	CLOSED		None
NM	Taos	Wild Rivers Recreation Area			OPEN	NSO
NM	Taos	Orilla Verde Recreation Area	8,406	CLOSED		None
NM	Taos	Copper Hill			OPEN	NSO
NM	Taos	Lower Gorge	16,351	CLOSED		None
NM	Taos	Black Mesa			OPEN	CSU
NM	Taos	Ojo Caliente	13,000		OPEN	CSU
NM	Taos	Sombrillo	9,000		OPEN	CSU
NM	Taos	Ku Pueblo	65		OPEN	NSO
NM	Taos	Ojo de Zorro Pueblo	24		OPEN	NSO
NM	Taos	Pueblo Quemado	159		OPEN	NSO
NM	Taos	Pueblo Sarco	10		OPEN	NSO

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State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
NM	Taos	San Lazaro Pueblo	77		OPEN	NSO
NM	Taos	La Cienega	3,556		OPEN	NSO
NM	Taos	Rio Chama	19,956	CLOSED		None
NM	Taos	Santa Cruz Lake Recreation Area	640		OPEN	NSO
NM	Taos	Sabinoso WSA	15,760	CLOSED		None
NM	Taos	Riparian Aquatic			OPEN	None
NV	Elko	Salt Lake	6037			
NV	Winnemucca	Osgood Mountains Milkvetch	60		OPEN	NSO
NV	Winnemucca	Soldier Meadows	2,770	CLOSED		
NV	Winnemucca	High Rock Canyon	5,664	CLOSED		
NV	Carson City	Carson Wandering Skipper	243	CLOSED		
NV	Carson City	Incandescent Rocks	1072		OPEN	
NV	Carson City	Pah Rah High Basin Petroglyph District	3881	CLOSED		
NV	Carson City	Steamboat	40	CLOSED		
NV	Carson City	Stewart Valley	16000		OPEN	None
NV	Carson City	Virginia Range Williams Combleaf Habitat	473	CLOSED		
NV	Ely	Beaver Dam Slope	36900			
NV	Ely	Kane Springs	65900			
NV	Ely	Morman Mesa	109700		OPEN	NSO
NV	Las Vegas	Arden Historic Sites	1480		OPEN	NSO
NV	Las Vegas	Armagosa Mesquite	6891		OPEN	TL, CSU
NV	Las Vegas	Arrow Canyon	2084		OPEN	NSO
NV	Las Vegas	Ash Meadows	37152	CLOSED		
NV	Las Vegas	Big Dune	1920		OPEN	NSO
NV	Las Vegas	Bird Spring	161		OPEN	NSO
NV	Las Vegas	Coyote Springs	75500		OPEN	NSO
NV	Las Vegas	Crescent Townsite	437		OPEN	NSO
NV	Las Vegas	Devil's Throat	640		OPEN	NSO, NNR
NV	Las Vegas	Gold Butte Part A	185569		OPEN	NSO
NV	Las Vegas	Gold Butte Part B	118937		OPEN	TL, CSU
NV	Las Vegas	Gold Butte Part C (Virgin Mtns)	38431	CLOSED		
NV	Las Vegas	Gold Butte Townsites	160		OPEN	NSO, NNR
NV	Las Vegas	Hidden Valley	3360		OPEN	NSO
NV	Las Vegas	Keyhole Canyon	361		OPEN	NSO

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State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
NV	Las Vegas	Morman Mesa	151360		OPEN	NSO
NV	Las Vegas	Piute/Eldorado	329440		OPEN	NSO
NV	Las Vegas	Rainbow Gardens	37620		OPEN	NSO
NV	Las Vegas	Red Rock Springs	640		OPEN	NSO, NNR
NV	Las Vegas	River Mountains	5617		OPEN	NSO
NV	Las Vegas	Sloan Rock Art District	0		OPEN	NSO
NV	Las Vegas	Stump Spring	641		OPEN	NSO
NV	Las Vegas	Timber Mountain Caldera	110720			
NV	Las Vegas	Virgin River	6411		OPEN	NSO
NV	Las Vegas	Whitney Pocket	160		OPEN	NSO, NNR
NV	Battle Mt	Lunar Crater	39,680		OPEN	
NV	Battle Mt	Amargosa-Oasis	490		OPEN	
NV	Battle Mt	Cane Man Hill	680		OPEN	
NV	Battle Mt	Lone Mountain	14,400		OPEN	
NV	Battle Mt	Railroad Valley	15,470		OPEN	
NV	Battle Mt	Rhyolite	425		OPEN	
NV	Battle Mt	Tybo-McIntyre Charcoal Kilns	80		OPEN	
ID	Four Rivers	Snake River Birds of Prey NCA	26,300	CLOSED		
ID	Four Rivers	Guffey Butte/Black Butte Archaeological District			OPEN	
ID	Four Rivers	Boise Front	12000		OPEN	None
ID	Four Rivers	Columbian Sharp-tailed Gouse Habitat	4200		OPEN	TL
ID	Four Rivers	Long-billed Curlew Habitat	61000		OPEN	TL
ID	Owyhee	Owyhee River Bighorn Sheep Habitat Area	112276		OPEN	NSO
ID	Owyhee	Boulder Creek ONA	6978		OPEN	NSO
ID	Owyhee	Coal Mine Basin RNA	1604		OPEN	NSO
ID	Owyhee	Guffey Butte/Black Butte Archaeological District	7,750	CLOSED		
ID	Owyhee	McBride Creek RNA	261	CLOSED		
ID	Owyhee	Jump Creek Canyon	612	CLOSED		
ID	Owyhee	Cinnabar	277	CLOSED		
ID	Owyhee	Pleasant Valley Table RNA	1467	CLOSED		
ID	Owyhee	Sommercamp Butte RNA	440	CLOSED		
ID	Owyhee	Squaw Creek RNA	150	CLOSED		
ID	Owyhee	The Badlands RNA	1833	CLOSED		
ID	Owyhee	The Tules RNA	114	CLOSED		

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State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
ID	Owyhee	North Fork Juniper Woodland ONA	4204	CLOSED		
ID	Bruneau	Mud Flat Oolite RNA	5		OPEN	NSO
ID	Bruneau	Owyhee River Bighorn Sheep Habitat Area	56123		OPEN	NSO
ID	Bruneau	Triplet Butte	304		OPEN	NSO
ID	Bruneau	Cottonwood Creek	325		OPEN	NSO
ID	Jarbidge	Sand Point	810		OPEN	NSO
ID	Jarbidge	Salmon Falls Creek	2697		OPEN	NSO
ID	Jarbidge	Bruneau-Jarbidge River	85224		OPEN	NSO
ID	Salmon	Trial Creek			OPEN	NSO
ID	Salmon	Sevenmile			OPEN	NSO
ID	Upper Snake	North Menan Butte	1120		OPEN	NSO
ID	Upper Snake	Nine Mile Knoll	40090		OPEN	NSO
ID	Upper Snake	Snake River	11120		OPEN	NSO
ID	Upper Snake	Henry's Lake	1681		OPEN	NSO
ID	Upper Snake	North Menan Butte RNA			OPEN	NSO
ID	Upper Snake	St. Anthony Sand Dunes RNA			OPEN	NSO
ID	Upper Snake	Game Creek RNA			OPEN	NSO
ID	Upper Snake	Reid Canal Island RNA			OPEN	NSO
ID	Upper Snake	Pine Creek RNA			OPEN	NSO
ID	Upper Snake	Squaw Creek RNA			OPEN	NSO
ID	Upper Snake	China Cup Butte		CLOSED		
ID	Challis	Antelope Flat RNA			OPEN	
ID	Challis	Birch Creek			OPEN	
ID	Challis	Cronk's Canyon RNA			OPEN	
ID	Challis	Donkey Hills			OPEN	
ID	Challis	Dry Gulch RNA			OPEN	
ID	Challis	East Fork Salmon River Bench RNA			OPEN	
ID	Challis	Herd Creek Watershead RNA			OPEN	
ID	Challis	Lone Bird			OPEN	
ID	Challis	Malm Gulch/Germer Basin RNA			OPEN	
ID	Challis	Peck's Canyon RNA			OPEN	
ID	Challis	Penal Gulch			OPEN	
ID	Challis	Sand Hollow			OPEN	

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State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
ID	Challis	Summit Creek RNA			OPEN	
ID	Challis	Thousand Springs RNA			OPEN	
ID	Pocatello	Downey Watershead			OPEN	NSO
ID	Pocatello	Bown Canyon Blad Eagle Sanctury			OPEN	NSO
ID	Pocatello	Old Juniper Townsite			OPEN	NSO
ID	Pocatello	Indian Rocks			OPEN	NSO
ID	Pocatello	Travertine Park			OPEN	NSO
ID	Pocatello	Stump Creek			OPEN	NSO
ID	Pocatello	Van Komn Homestead			OPEN	NSO
ID	Pocatello	Dairy Hollow RNA			OPEN	NSO
ID	Pocatello	Formation Cave RNA			OPEN	NSO
ID	Pocatello	Oneida Narrows RNA			OPEN	NSO
ID	Pocatello	Pine Gap RNA			OPEN	NSO
ID	Pocatello	Robber's Roost RNA			OPEN	NSO
ID	Pocatello	Cheatbeck Canyon RNA			OPEN	NSO
ID	Burley	Granite Pass-Goose Creek Trail			OPEN	TL
ID	Burley	Goose Creek Mesa		CLOSED		
ID	Burley	Jim Sage Canyon			OPEN	TL
ID	Burley	Oregon California Trail Junction			OPEN	
ID	Burley	Salmon Falls Creek			OPEN	NSO
ID	Burley/Shoshone	Sub-Station Tract			OPEN	NSO
ID	Burley/Shoshone	Playas			OPEN	NSO
ID	Burley/Shoshone	Box Canyon			OPEN	
ID	Burley/Shoshone	Vineland Lake			OPEN	
ID	Shoshone	King Hill			OPEN	
ID	Shoshone	McKinney Butte			OPEN	
ID	Shoshone	Tee-Maze			OPEN	
ID	Shoshone	Big Beaver			OPEN	
ID	Shoshone	Sun Peak			OPEN	
ID	Shoshone	Elk Mountain			OPEN	
OR	Lakeview	Devils Garden ACEC	28,241	CLOSED		
OR	Lakeview	Lake Abert ACEC	50,165	CLOSED		NSO
OR	Lakeview	Lost Forest/Sand Dunes/Fossil Lake ACEC Complex	8,500	OPEN		None
OR	Lakeview	Lost Forest RNA	8,883	CLOSED		
OR	Lakeview	Sand Dunes	9,125	CLOSED		

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State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
OR	Lakeview	Fossil Lake	8,988		OPEN	NSO
OR	Lakeview	Warner Wetlands ACEC	52,033		OPEN	NSO
OR	Lakeview	Abert Rim ACEC	18,049	CLOSED		
OR	Lakeview	Black Hills ACEC/RNA	3,048		OPEN	NSO
OR	Lakeview	Connley Hills ACEC/RNA	3,599		OPEN	NSO
OR	Lakeview	Fish Creek Rim ACEC/RNA	8,725		OPEN, portion closed	
OR	Lakeview	Foley Lake ACEC/RNA	2,230		OPEN	
OR	Lakeview	Guano Creek/Sink Lakes ACEC/RNA	11,199	CLOSED		
OR	Lakeview	Hawksie-Walksie ACEC/RNA	17,339	CLOSED		
OR	Lakeview	High Lakes ACEC	38,985		OPEN	
OR	Lakeview	Juniper Mountain ACEC/RNA	6,335		OPEN	NSO
OR	Lakeview	Rahilly-Gravelly ACEC/RNA	19,648		OPEN	NSO
OR	Lakeview	Red Knoll ACEC	11,127		OPEN	
OR	Lakeview	Spanish Lake ACEC/RNA	4,699		OPEN	
OR	Lakeview	Table Rock ACEC	5,139		OPEN	NSO
OR	Klamath Falls	Upper Klamath River ACEC	5,092		OPEN	NSO
OR	Klamath Falls	Miller Creek ACEC	2,000		OPEN	NSO
OR	Klamath Falls	Yainax Butte ACEC	720		OPEN	NSO
OR	Klamath Falls	Spencer Creek OHV Vehicle Closure (Riparian)	320		OPEN	NSO
OR	Klamath Falls	Clover Creek Forest Educational Area	30		OPEN	NSO
OR	Klamath Falls	Surveyor Forest Special Management Area	150		OPEN	NSO
OR	Klamath Falls	Bumpheads Special Management Area	50		OPEN	NSO
OR	Klamath Falls	Old Baldy Research Natural Area	620		OPEN	NSO
OR	Klamath Falls	Alkali Lake Special Management Area	240		OPEN	NSO
OR	Klamath Falls	Tunnel Creek Special Management Area	280		OPEN	NSO
OR	Klamath Falls	Wood River Wetland	3,220		OPEN	NSO
OR	Klamath Falls	Four Mile Wetland	1,173		OPEN	NSO

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State	District and/or Field Office	ACEC Name	Acres	Closed to Leasing	Open to Geothermal Leasing	Applicable Stipulations*
WY	Casper	Jackson Canyon			OPEN	NSO
WY	Casper	Salt Creek			OPEN	None
WY	Casper	Alcova Fossil Area			OPEN	None
WY	Casper	Bates Hole			OPEN	CSU
WY	Cody	Carter Mountain	7819		OPEN	None
WY	Cody	Chapman Bench	160		OPEN	None
WY	Cody	Five Springs Falls	160		OPEN	NSO
WY	Cody	Little Mountain	22,270		OPEN	None
WY	Cody	Sheep Mtn Anticline	12,285		OPEN	NSO
WY	Kemmer	Raymond Mountain			OPEN	
WY	Lander	Green Mountain			OPEN	
WY	Newcastle	Whoopup Canyon			OPEN	
WY	Pinedale	Rock Creek			OPEN	
WY	Pinedale	Beaver Creek			OPEN	
WY	Rawlings	Como Bluff			OPEN	
WY	Rawlings	Sand Hills			OPEN	
WY	Rawlings	Jep Canyon			OPEN	
WY	Rawlings	Shamrock Hills			OPEN	
WY	Rock Springs	Greater Red Creek	131,890	CLOSED		
WY	Rock Springs	Greater Sand Dunes	38650		OPEN	TL
WY	Rock Springs	Natural Corrals	1276		OPEN	NSO
WY	Rock Springs	Oregon Buttes	3450	CLOSED		
WY	Rock Springs	Pine Springs	6030		OPEN	
WY	Rock Springs	Steamboat Mtn	43270		OPEN	
WY	Rock Springs	South Pass Historic Landsc	53780		OPEN	
WY	Rock Springs	White Mtn Petroglyphs	20		OPEN	TL, NSO
WY	Worland	Upper Owl Creek			OPEN	
WY	Worland	Spanish Point Karst		CLOSED		

* Stipulations and limitions are based on information provided. The lack of such constraints does not mean that they do not exist for the

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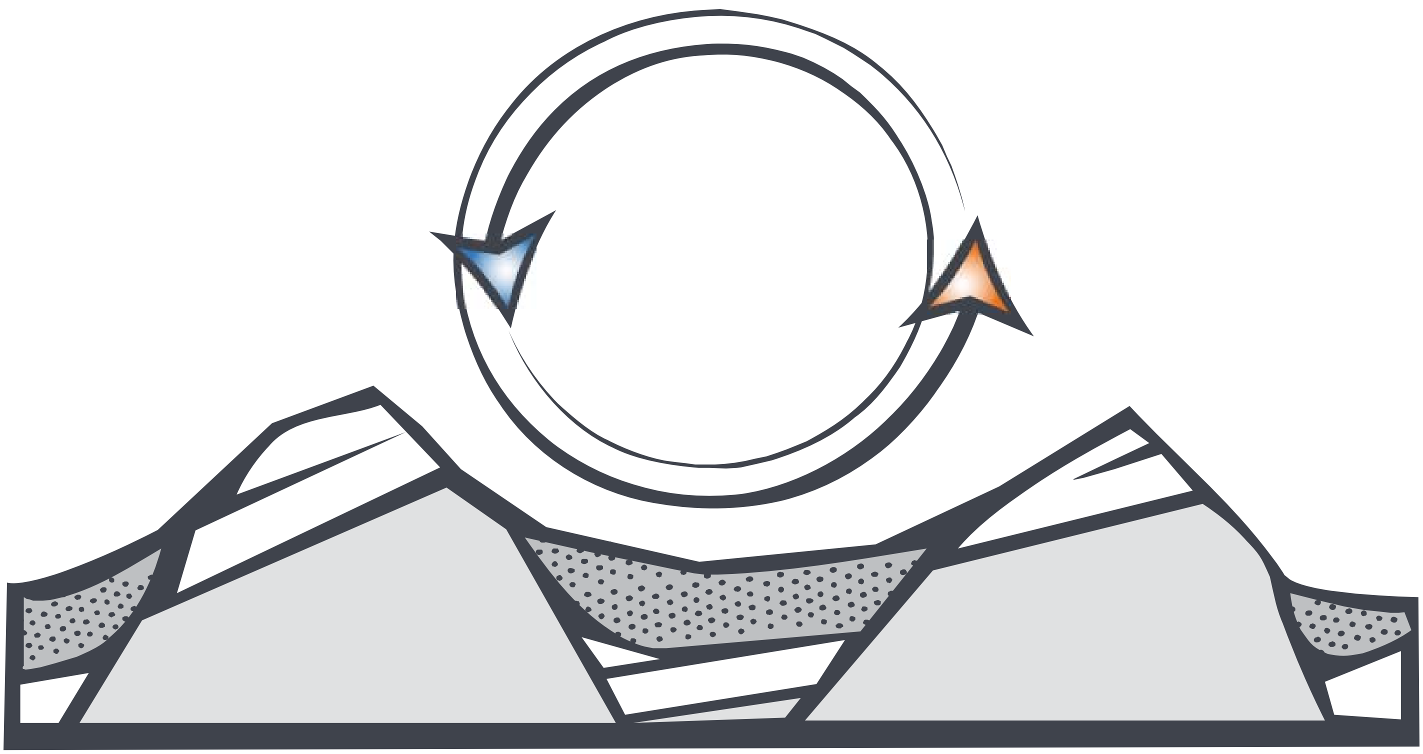

Appendix D

Best Management Practices and Mitigation Measures

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APPENDIX D
BEST MANAGEMENT PRACTICES AND MITIGATION MEASURES

Best Management Practices (BMP) are state-of-the-art mitigation measures 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 appendix provides a list of sample Best Management Practices that have been collected from various BLM and FS documents addressing geothermal and fluid mineral leasing and development, including resource management plans (RMPs), forest plans, and environmental reports for geothermal leasing and development. The purpose of this appendix is to provide a list of recommended BMPs that would be incorporated as appropriate into the permit application by the lessee or would be included in the approved use authorization by the BLM as conditions of approval. When implementing new BMPs, offices are encouraged to 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 with the least economic impact to the lessee. Offices should discuss potential resource impacts with the lessee and seek the operator's recommended solutions. The office should also encourage the lessee to incorporate necessary and effective BMPs into their project proposal. Best Management Practices 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.

All offices will incorporate appropriate environmental BMPs into proposed use authorizations after appropriate environmental review. Environmental BMPs to be considered in nearly all circumstances include the following:

- Interim reclamation of well locations and access roads soon after the well is put into production;
- Painting of all new facilities a color that best allows the facility to blend with the background, typically a vegetated background;
- Design and construction of all new roads to a safe and appropriate standard, "no higher than necessary" to accommodate their intended use; and
- Final reclamation recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography.

Other environmental BMPs are more 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. Examples of typical, case-by-case BMPs are identified below.

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 or FS-administered land.

The following typical BMPs provide the BLM, FS, industry, and stakeholders a menu of improved practices for developing geothermal energy and minimize impacts to the biophysical and cultural landscape. The list is extensive but is not meant to be all inclusive given the constant development of improved practices, diversity of the western states, and potential for unique site-specific conditions. Local land use plans may contain other BMPs that better address such unique situations. Where the BMPs presented here are inconsistent with or incompatible with those developed under a specific land use plan, the staff will conduct an environmental review to determine the appropriate practices.

Only those individual mitigation measures reasonably necessary to ensure environmentally responsible geothermal development should be selected from the list below. Not all of the individual mitigation measures below will apply in most situations and selection of appropriated 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.

A menu of typical BMPs can also be found on the BLM Washington Office Fluid Minerals web site at: www.blm.gov/bmp

Note: Commenters to the Draft EIS noted that the list of BMPs and mitigation measures appeared to be redundant, contradictory, confusing, and placed extensive emphasis on certain resources while deemphasizing others. The following list has been consolidated and updated to address those concerns. The BMPs and mitigation measures are arranged from Information Collection and Monitoring to Final Reclamation and have been further subcategorized. While many of the BMPs and mitigation measures will apply to all phases of geophysical exploration and development; to avoid duplication, the measures are listed only once.

INFORMATION COLLECTION & MONITORING

General

- Prior to geothermal exploration and development, a complete subsurface geotechnical investigation will be conducted to analyze the soil and geologic conditions. The investigation 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.
- 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.
- 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.
- [Refer to the Reclamation section for reclamation-specific monitoring.]

- The operator will comply with the Secretary of Agriculture's rules and regulations for all use and occupancy of the NFS lands prior to approval of an exploration plan by the Secretary of Interior and for uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of Interior; and use and occupancy of the NFS lands not authorized by an exploration plan approved by the Secretary of Interior.

Paleontological and Cultural Resources

- Before any specific permits are issued under leases, treatment of cultural resources will follow the procedures established by the Advisory Council on Historic Preservation for compliance with Section 106 of the National Historic Preservation Act. A pedestrian inventory will be undertaken of all portions that have not been previously surveyed or are identified by BLM as requiring inventory to identify properties that are eligible for the NRHP. Those sites not already evaluated for NRHP eligibility will be evaluated based on surface remains, subsurface testing, archival, and/or ethnographic sources. Subsurface testing will be kept to a minimum whenever possible if sufficient information is available to evaluate the site or if avoidance is an expected mitigation outcome. Recommendations regarding the eligibility of sites will be submitted to the BLM, and a treatment plan will be prepared to detail methods for avoidance of impacts or mitigation of effects. The BLM will make determinations of eligibility and effect and consult with SHPO as necessary based on each proposed lease application and project plans. 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. Avoidance of impacts through project design will be given priority over data recovery as the preferred mitigation measure. Avoidance measures include moving project elements away from site locations or to areas of previous impacts, restricting travel to existing roads, and maintaining barriers and signs in areas of cultural sensitivity. Any data recovery will be preceded by approval of a detailed research design, Native American Consultation, and other requirements for BLM issuance of a permit under the Archaeological Resources Protection Act (BLM 2007a).
- If cultural resources are present at the site, or if areas with a high potential to contain cultural material have been identified, a cultural resources management plan (CRMP) will be developed. This plan will address mitigation activities to be taken for cultural resources found at the site. Avoidance of the area is always the preferred mitigation option. Other mitigation options include archaeological

survey and excavation (as warranted) and monitoring. If an area exhibits a high potential, but no artifacts were observed during an archaeological survey, monitoring by a qualified archaeologist could be required during all excavation and earthmoving in the high-potential area. A report will be prepared documenting these activities. The CRMP also will (1) establish a monitoring program, (2) identify measures to prevent potential looting/vandalism or erosion impacts, and (3) address the education of workers and the public to make them aware of the consequences of unauthorized collection of artifacts and destruction of property on public land (BLM 2005).

- Operators will determine whether paleontological resources exist in a project area on the basis of the sedimentary context of the area, a records search for past paleontological finds in the area, and/or, depending on the extent of existing information, a paleontological survey.
- If paleontological resources are present at the site, or if areas with a high potential to contain paleontological material have been identified, a paleontological resources management plan will be developed. This plan will include a mitigation plan for avoidance, removal of fossils, or monitoring. If an area exhibits a high potential but no fossils were observed during survey, monitoring by a qualified paleontologist may be required during excavation and earthmoving in the sensitive area. The operator will submit a report to the agency documenting these activities. The paleontological resources management plan also will (1) establish a monitoring program, (2) identify measures to prevent potential looting/vandalism or erosion impacts, and (3) address the education of workers and the public to make them aware of the consequences of unauthorized collection of fossils on public land.

Water Resources

- Operators will develop a storm water management plan for the site to ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion.
- Operators will gain a clear understanding of the local hydrogeology. Areas of groundwater discharge and recharge and their potential relationships with surface water bodies will be identified.
- Operators will avoid creating hydrologic conduits between two aquifers during foundation excavation and other activities.

Vegetation and Fish and Wildlife

- The operator will conduct surveys 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 or NMFS, as appropriate. Particular care should be taken to avoid disturbing listed species during surveys in any designated critical habitat. The operator will monitor activities and their effects on ESA-listed species throughout the duration of the project.
- The operator will 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, FS, and other resource agencies, as available and applicable.

National Scenic and Historic Trails

- When any ROW application includes remnants of a National Historic Trail, is located within the viewshed of a National Historic Trail's designated centerline, or includes or is within the viewshed of a trail eligible for listing on the NRHP, 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.

Air Quality and Climate

- The operator will coordinate with the [State Air Quality Division] to develop and implement an air quality monitoring plan.

PLANNING, LOCATION, AND DESIGN

Traffic Planning

- 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.

Roads & Pads

- To plan for efficient use of the land, necessary infrastructure will be consolidated wherever possible.
- 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 maintain public safety and to minimize impacts to the environment such as erosion, sedimentation, fugitive dust, loss of vegetation.

- 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).
- 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.
- Where possible, access roads will be located to follow natural contours and minimize side hill cuts and fills. Excessive grades on roads, road embankments, ditches, and drainages shall be avoided, especially in areas with erodible soils.
- Roads will be designed so that changes to surface water runoff are minimized and new erosion is not initiated.
- 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. Operators will obtain all applicable federal and state water crossing permits.
- Roads will be located away from drainage bottoms and avoid wetlands, if practicable.

Geotechnical Analysis

- The operator will perform a detailed geotechnical analysis prior to the construction of any structures; 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).

Visual Mitigation

- 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 VRM objectives of the area and the agency.

Visual Design Considerations

- Construct low-profile structures whenever possible to reduce structure visibility.
- Select and design materials and surface treatments to repeat or blend with landscape elements.
- Site projects outside of the viewsheds of publically accessible vantage points, or if this cannot be avoided, as far away as possible;
- Site projects to take advantage of both topography and vegetation as screening devices to restrict views of projects from visually sensitive areas;
- Site facilities away from and not adjacent to prominent landscape features (e.g., knobs and water features);
- Avoid placing facilities on ridgelines, summits, or other locations such that they will be silhouetted against the sky from important viewing locations;
- 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 they do not bisect ridge tops or run down the center of valley bottoms.
- Site linear features (aboveground 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.
- Site facilities, especially linear facilities, to take advantage of natural topographic breaks (i.e., pronounced changes in slope) to avoid siting facilities on steep side slopes.
- Where available, site linear features such as rights-of-ways and roads to follow the edges of clearings (where they will be less conspicuous) rather than passing through the centers of clearings.
- Site facilities to take advantage of existing clearings to reduce vegetation clearing and ground disturbance, where possible.
- Site linear features (e.g., trails, roads, rivers) to cross other linear features at right angles whenever possible to minimize viewing area and duration.
- 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.

- 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.
- Use non-reflective or low-reflectivity materials, coatings, or paints whenever possible.
- Paint grouped structures the same color to reduce visual complexity and color contrast.
- 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.
- Site construction staging areas and laydown areas outside of the viewsheds of publically accessible vantage points and visually sensitive areas, where possible, including siting in swales, around bends, and behind ridges and vegetative screens.
- Discuss visual impact mitigation objectives and activities with equipment operators prior to commencement of construction activities.
- Mulch or scatter slash from vegetation removal and spread it to cover fresh soil disturbances or, if not possible, bury or compost slash.
- If slash piles are necessary, stage them out of sight of sensitive viewing areas.
- Avoid installing gravel and pavement where possible to reduce color and texture contrasts with existing landscape.
- 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.
- Avoid downslope wasting of excess fill material.
- 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.
- Leave planting pockets on slopes where feasible.
- Combine methods of re-establishing native vegetation through seeding, planting of nursery stock, transplanting of local vegetation within the proposed disturbance areas and staging of construction enabling direct transplanting.

- Revegetate with native vegetation establishing a composition consistent with the form, line, color, and texture of the surrounding undisturbed landscape."
- Provide benches in rock cuts to accent natural strata.
- Use split-face rock blasting to minimize unnatural form and texture resulting from blasting.
- Segregate topsoil from cut and fill activities and spread it on freshly disturbed areas to reduce color contrast and to aid rapid revegetation.
- Bury utility cables in or adjacent to the road where feasible.
- Minimize signage and paint or coat reverse sides of signs and mounts to reduce color contrast with existing landscape.
- Prohibit trash burning; store trash in containers to be hauled off-site for disposal.
- 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.
- Randomly scarify cut slopes to reduce texture contrast with existing landscape and to aid in revegetation.
- Cover disturbed areas with stockpiled topsoil or mulch, and revegetate with a mix of native species selected for visual compatibility with existing vegetation.
- Restore rocks, brush, and natural debris whenever possible to approximate preexisting visual conditions.

Air Quality and Climate

- 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 are maintained and operated as follows:
    - Are tuned to the engine manufacturer's specification in accordance with an appropriate time frame.
    - Do not idle for more than five minutes (unless, in the case of certain drilling engines, it is necessary for the operating scope).

- Are not tampered with in order to increase engine horsepower.
- Include particulate traps, oxidation catalysts, and other suitable control devices on all drilling/construction equipment used at the project site.
- Use diesel fuel having a sulfur content of 15 parts per million or less, or other suitable alternative diesel fuel, unless such fuel cannot be reasonably procured in the market area.
- 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.

Health and Safety

- 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.
- 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.
- 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.

- 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.
- A health and safety program will be developed to protect both workers and the general public during construction and operation of geothermal projects.
- 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 [OSHA] standard practices for safe use of explosives and blasting agents; and measures for reducing occupational electric and magnetic fields [EMF] 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.
- 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, ROWs, 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).
- 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.
- Operators will develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.

Livestock Grazing

- The operator will coordinate with livestock operators to minimize impacts to livestock operations.

Noxious Weeds and Pesticides

- 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. The use of certified weed-free mulching will be required. 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.
- 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 EPA-registered pesticides.

Vegetation and Fish and Wildlife

- The operator shall 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.

CONSTRUCTION

Traffic Management

- Traffic will be restricted to the roads developed for the project. Use of other unimproved roads will be restricted to emergency situations.
- 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.

- 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.
- When practical, construction activities will be avoided during high recreational use periods.

Roads & Pads

- The operator will obtain agency authorization prior to borrowing soil or rock material from agency lands.
- Road use will be restricted during the wet season if road surfacing is not adequate to prevent soil displacement, rutting, etc., and resultant stream sedimentation.
- Access roads and on-site roads will be surfaced with aggregate materials where necessary to provide a stable road surface, support anticipated traffic, reduce fugitive dust, and prevent erosion,
- Dust abatement techniques will be used before and during surface clearing, excavation, or blasting activities. Dust abatement techniques will be used on unpaved, unvegetated surfaces to minimize fugitive dust. Speed limits (e.g., 25 mph [40 kph]) 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.
- 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.

Pipelines

- 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. Projects should be analyzed to ensure adequate passage for all wildlife species. The pipeline will be raised higher to allow wildlife passage where needed. 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.

Utilities

- 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 back-filled immediately, escape ramps should be constructed at least every 100 feet.

SPECIFIC RESOURCES

Cultural and Paleontological Resources

- Unexpected discovery of cultural or 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.

Noise

- 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.
- Within [2] miles of existing, occupied residences, geothermal well drilling or major facility construction operations will be restricted to non-sleeping hours (7:00 am to 10:00 pm).
- 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.
- All stationary construction equipment (i.e., compressors and generators) will be located as far as practicable from nearby residences.
- If blasting or other noisy activities are required during the construction period, nearby residents will be notified by the operator at least 1 hour in advance.
- 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.

Noxious Weeds and Pesticides

- The use of certified, weed-free mulch will be required when stabilizing areas of disturbed soil.
- 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.

- Fill materials and road surfacing materials that originate from areas with known invasive vegetation problems will not be used.
- Revegetation, habitat restoration and weed control activities will be initiated as soon as possible after construction activities are completed.
- Use of pesticides must be approved by the agency. Pesticide use will be limited agency approved pesticides and will only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

Waste Management

- All refueling will occur in a designated fueling area that includes a temporary berm to limit the spread of any spill.
- Drip pans will be used during refueling to contain accidental releases.
- Drip pans will be used under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.
- Any containers used to collect liquids will be enclosed or screened to prevent access to contaminants by wildlife, livestock, and migratory birds.
- Spills will be immediately addressed per the spill management plan, and soil cleanup and removal initiated as soon as feasible.

Wild Horses and Burros

- 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.
- Observations of potential problems regarding wild horses or burros, including animal mortality, will be immediately reported to the agency.

Wildlife

- 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.

- 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 (detergents, oils), 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.

OPERATIONS/UTILIZATION

- "Good housekeeping" procedures will be developed by the operator to ensure that during all phases of exploration and operation the site will be kept clean of noxious weeds, debris, litter, garbage, fugitive trash or waste, and graffiti. Scrap heaps and dumps are prohibited. Storage yards are to be minimized to that which is absolutely necessary.

RECLAMATION

The following objectives, performance standards, and recommended reclamation BMPs and mitigation measures are based on the standards and guidelines found in the BLM and Forest Service Gold Book, 4th Edition, updated in 2007.

[ ] Indicates site-specific values to be filled in by the authorized officer.

Reclamation Objectives

- The objective of interim reclamation is to restore vegetative cover and a portion of the landform sufficient to maintain healthy, biologically active topsoil; control erosion; and minimize habitat, visual, and forage loss during the life of the well or facilities.

- The long-term objective of final reclamation is to return the land to a condition approximating that which existed prior to disturbance. This includes restoration of the landform and natural vegetative community, hydrologic systems, visual resources, and wildlife habitats. To ensure that the long-term objective will be reached through human and natural processes, actions will be taken to ensure standards are met for site stability, visual quality, hydrological functioning, and vegetative productivity.

Reclamation Performance Standards

The following reclamation performance standards will be met:

Interim Reclamation – Includes disturbed areas that may be redisturbed during operations and will be redisturbed at final reclamation to achieve restoration of the original landform and a natural vegetative community.

- Will be judged successful when the BLM authorized officer determines that…
- Disturbed areas not needed for active, long-term production operations or vehicle travel have been recontoured, 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.

Final Reclamation – Includes disturbed areas where the original landform and a natural vegetative community have been restored.

- Will be judged successful when the authorized officer determines that…
- The original landform has been 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 is 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]% 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]% of the basal cover on adjacent or nearby undisturbed areas where vegetation is in a healthy condition; or [80]% 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).]

- In agricultural areas, irrigation systems and soil conditions are reestablished in such a way as to ensure successful cultivation and harvesting of crops.
- Erosion features are 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 3 inches) are not observed.
- The site is free of State- or county-listed noxious weeds, oil field debris and equipment, and contaminated soil. Invasive and non-native weeds are controlled.

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 recontoured 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.

Reclamation - General

Procedure:

- The agency will be notified 24 hours prior to commencement of any reclamation operations.

Housekeeping:

- 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. Upon well completion, any hydrocarbons in the pit will be remediated or removed.

Vegetation Clearing:

- Vegetation removal and the degree of surface disturbance will be minimized wherever possible.
- *[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 (6) 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 (6) 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 vegetated ground to minimize surface disturbance.
- In areas to be heavily disturbed, the top [eight (8)] 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.
- Earthwork for interim and final reclamation will be completed within 6 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 frozen or too wet to adequately support construction equipment. If such equipment creates ruts in excess of four (4) inches deep, the soil will be deemed too wet.

- No major depressions will be left that would trap water and cause ponding.

Seeding:

- Seedbed Preparation. Initial seedbed preparation will consist of recontouring 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 2 feet, followed by recontouring 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 in order 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. A certified weed-free seed mix designed by BLM (shown below) to meet reclamation standards will be used. The following seed mix and rates will be used on all disturbed surfaces, including pipelines and road cut & fill slopes:

Species of Seed	Cultivar	App. Rate PLS (lbs/ac)
		Total:

- The application rate shown in the table is based on [45] pure live seeds (PLS) per square foot, drill-seeded to a depth of 0.25 to 0.5 inch, which is the method that will be used where feasible. [However, shrub species will be seeded during the winter on the ground surface or preferably on top of snow.] In areas that will not be drill-seeded, the seed mix will be broadcast-seeded at twice the application rate shown in the table and covered no more than

0.25 inch deep with a harrow, drag bar, or roller or will be broadcast-seeded into imprints, such as fresh dozer cleat marks.

- 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, waddles, 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 **sixty (60)** days of release of the rig. All reserve pits remaining open after **sixty (60)** days will require written authorization of the authorized officer. Immediately upon well completion, any hydrocarbons or 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 5 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 (PUP) will be submitted to the BLM for approval prior to the use of herbicides.

Interim Reclamation Procedures - Additional

Recontouring:

- Interim reclamation actions will be completed no later than 6 months from 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 recontoured 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 recontouring 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 recontoured 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 recontouring and revegetation can occur.

Application of Topsoil & Revegetation:

- Topsoil will be evenly respread and aggressively revegetated over the entire disturbed area not needed for all-weather operations including road cuts & 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. To prevent soil compaction,

under some situations, such as the presence of moist, clay soils, the vegetation and topsoil will be removed prior to workover operations and restored and reclaimed following workover operations.

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 recontoured slopes, reclamation will include measures to feather cleared lines of vegetation and to save and redistribute cleared trees, debris, and rock over recontoured 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 recontouring of the cut and fill slopes.
- All long-term above ground structures will be painted [Covert Green] (from the "Standard Environmental Colors" chart) to blend with the natural color of the late summer landscape background.

Final Reclamation Procedures – Additional

- Final reclamation actions will be completed within 6 months of well plugging, weather permitting.
- All disturbed areas, including roads, pipelines, pads, production facilities, and interim reclaimed areas will be recontoured to the contour existing prior to initial construction or a contour that blends indistinguishably with the surrounding landscape. Resalvaged topsoil will be respread evenly over the entire disturbed site to ensure successful revegetation. To help mitigate the contrast of recontoured slopes, reclamation will include measures to feather cleared lines of vegetation and to save and redistribute cleared trees, woody debris, and large rocks over recontoured 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, 4^{th} 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.

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 an annual reclamation report submitted to the authorized officer by [March 1]. 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; 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% or more of a reclaimed area is redisturbed, 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 E

REVIEW OF PALEONTOLOGICAL RESOURCE SECTIONS OF BLM RESOURCE MANAGEMENT PLANS IN THE PROJECT AREA

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APPENDIX E
REVIEW OF PALEONTOLOGICAL RESOURCE SECTIONS OF BLM RMPS IN THE PROJECT AREA

This appendix defines the potential fossil yield classification (PFYC) System (BLM-IM 2008-009) that the BLM applies to paleontological resources and includes a summary review and PFYC estimate for readily available RMPs within the project area.

Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources.

Using the Potential Fossil Yield Classification (PFYC) system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. This classification is applied to the geologic formation, member, or other distinguishable unit, preferably at the most detailed mappable level. It is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.

The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions.

The descriptions for the classes below are written to serve as guidelines rather than as strict definitions. Knowledge of the geology and the paleontological potential for individual units or preservational conditions should be considered when determining the appropriate class assignment. Assignments are best made by collaboration between land managers and knowledgeable researchers.

Class 1 – **Very Low**. Geologic units that are not likely to contain recognizable fossil remains.

- Units that are igneous or metamorphic, excluding reworked volcanic ash units.
- Units that are Precambrian in age or older.

(1) Management concern for paleontological resources in Class 1 units is usually negligible or not applicable.

(2) Assessment or mitigation is usually unnecessary except in very rare or isolated circumstances.

The probability for impacting any fossils is negligible. Assessment or mitigation of paleontological resources is usually unnecessary. The occurrence of significant fossils is non-existent or extremely rare.

Class 2 – **Low**. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

- Vertebrate or significant invertebrate or plant fossils not present or very rare.
- Units that are generally younger than 10,000 years before present.
- Recent aeolian deposits.
- Sediments that exhibit significant physical and chemical changes (i.e., diagenetic alteration).

(1) Management concern for paleontological resources is generally low.

(2) Assessment or mitigation is usually unnecessary except in rare or isolated circumstances.

The probability for impacting vertebrate fossils or scientifically significant invertebrate or plant fossils is low. Assessment or mitigation of paleontological resources is not likely to be necessary. Localities containing important resources may exist, but would be rare and would not influence the classification. These important localities would be managed on a case-by-case basis.

Class 3 – **Moderate** or **Unknown**. Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.

- Often marine in origin with sporadic known occurrences of vertebrate fossils.
- Vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently; predictability known to be low.

  (or)
- Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.

Class 3a – **Moderate Potential.** Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area, and opportunities may exist for hobby collecting. The potential for a project to be sited on or impact a significant fossil locality is low, but is somewhat higher for common fossils.

Class 3b – **Unknown Potential.** Units exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may uncover significant finds. The units in this Class may eventually be placed in another Class when sufficient survey and research is performed. The unknown potential of the units in this Class should be carefully considered when developing any mitigation or management actions.

(1) Management concern for paleontological resources is moderate; or cannot be determined from existing data.

(2) Surface-disturbing activities may require field assessment to determine appropriate course of action.

This classification includes a broad range of paleontological potential. It includes geologic units of unknown potential, as well as units of moderate or infrequent occurrence of significant fossils. Management considerations cover a broad range of options as well, and could include pre-disturbance surveys, monitoring, or avoidance. Surface-disturbing activities will require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action, and whether the action could affect the paleontological resources. These units may contain areas that would be appropriate to designate as hobby collection areas due to the higher occurrence of common fossils and a lower concern about affecting significant paleontological resources.

Class 4 – **High**. Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Surface disturbing activities may adversely affect paleontological resources in many cases.

Class 4a – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two acres. Paleontological resources may be susceptible to adverse impacts from surface disturbing actions. Illegal collecting activities may impact some areas.

Class 4b – These are areas underlain by geologic units with high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than two contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

(1) Management concern for paleontological resources in Class 4 is moderate to high, depending on the proposed action.

(2) A field survey by a qualified paleontologist is often needed to assess local conditions.

(3) Management prescriptions for resource preservation and conservation through controlled access or special management designation should be considered.

(4) Class 4 and Class 5 units may be combined as Class 5 for broad applications, such as planning efforts or preliminary assessments, when geologic mapping at an appropriate scale is not available. Resource assessment, mitigation, and other management considerations are similar at this level of analysis, and impacts and alternatives can be addressed at a level appropriate to the application.

The probability for impacting significant paleontological resources is moderate to high, and is dependent on the proposed action. Mitigation considerations must include assessment of the disturbance, such as removal or penetration of protective surface alluvium or soils, potential for future accelerated erosion, or increased ease of access resulting in greater looting potential. If impacts to significant fossils can be anticipated, on-the-ground surveys prior to authorizing the surface disturbing action will usually be necessary. On-site monitoring or spot-checking may be necessary during construction activities.

Class 5 – **Very High**. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation.

Class 5a – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two contiguous acres. Paleontological resources are highly susceptible to adverse impacts from surface disturbing actions. Unit is frequently the focus of illegal collecting activities.

Class 5b – These are areas underlain by geologic units with very high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has very high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than two contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

(1) Management concern for paleontological resources in Class 5 areas is high to very high.

(2) A field survey by a qualified paleontologist is usually necessary prior to surface disturbing activities or land tenure adjustments. Mitigation will often be necessary before and/or during these actions.

(3) Official designation of areas of avoidance, special interest, and concern may be appropriate.

The probability for impacting significant fossils is high. Vertebrate fossils or scientifically significant invertebrate fossils are known or can reasonably be expected to occur in the impacted area. On-the-ground surveys prior to authorizing any surface disturbing activities will usually be necessary. On-site monitoring may be necessary during construction activities.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
AK	Anchorage	Bay	July 2006	yes	2, 4 and 5	Short section with no specific information. Paleontological resources assessed by Lindsey (1986).
AK	Anchorage	Ring of Fire	June 2006	yes	2, 4 and 5	Moderately thorough description (by sub-area) of paleontological resources and previous work.
AK	Fairbanks and Anchorage	Kobuk-Seward	February 2006	yes	cannot be determined	Short section with little specific information. Paleontological resources assessed by Lindsey (1986).
AK	Glennallen	East Alaska	April 2006	yes	3, 4 and 5	Moderately thorough description (by sub-area) of paleontological resources and previous work.
AZ	Arizona Strip	Arizona Strip	January 2007	Appendix 3b	2, 3, 4 and 5	Virtually no paleontologic discussion within the AE chapter. Appendix 3B contains information on paleontological resource occurrences, and a geologic map is provided (map 3.10). Figures 3.1 and 3.2 are stratigraphic sections.
AZ	Arizona Strip	Vermillion Cliffs and Grand Canyon-Parashant Nat. Mons.	January 2007	yes	2, 3, 4 and 5	Essentially the same paleontological report as the Arizona Strip RMP
AZ	Lake Havasu	Arizona and California	May 2007	yes	cannot be determined	Paleontological resources are discussed, but no specific details of fossils, geologic formations, or paleontological sensitivity is included. Paleontological resource classification system used is not the current PFYC. Insufficient information is provided to assess paleontological sensitivity or to provide PFYC designations. Paleontology section written by an archaeologist.
AZ	Tucson	Ironwood Forest Nat. Mon.	March 2007	yes	1 and 2	Brief paleontological resource section that concludes that only PFYC class 1 and 2 are present. Paleontological resources analyzed by Cultural Resource and Geological Staff (not by a paleontologist). Insufficient information is included to properly assess paleontological sensitivity.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
AZ	Yuma	Arizona and California	December 2006	yes	2, 3, 4 and 5	Broad paleontological discussion with short list of known fossils provided, but no specifics on geologic formation associations, and no information about formations and their fossil occurrences. Paleontological resource evaluation conducted by a geologist/archaeologist.
CA	Arcata	Headwaters Forest Reserve	September 2003	no	cannot be determined	No mention of paleontological resources.
CA	Arcata	King Range	November 2004	yes	cannot be determined	Short paragraph concluding that paleontological resources would not be affected, and thus are not discussed or analyzed in the RMP. Based on the geologic map provided, and the information included in the geology section, paleontologic resources may actually be affected. No paleontologist input included in RMP.
CA	Bakersfield district	Caliente Resource Area	August 2007	no	2, 3, 4 and 5	Virtually no mention of paleontological resources and no specific AE chapter provided. Fossil occurrences are mentioned within three of the 16 ACEC sections (chapter 11). These provided sufficient information to tentatively provide PFYC designations.
CA	California Desert District	South Coast Resource	June 1994	no	cannot be determined	No mention of paleontological resources.
CA	California Desert District	California Desert Conservation area	March 1999	no	cannot be determined	Paleontological resources discussed in the context of "cultural and paleontological resources." However, no specific discussion of paleontological resources is provided, nor is there any mention of specific paleontological resources within the management area.
CA	Eagle Lake		May 2007	no	cannot be determined	Paleontological resources are included in the AE chapter section 3.2 (Cultural Resources and Paleontology), but no discussion of paleontology is provided, nor is there any mention of paleontological resources within the management area.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
CA	El Centro	Eastern San Diego Co.	February 2007	yes	cannot be determined	A paleontological resources discussion is included, but with no reference to the types of paleontological resources occurring in the management area, or to exposures of specific formations. Furthermore, the paleontological resource classification system used in this RMP is not the PFYC.
CA	Folsom	Sierra	not available	yes	cannot be determined	One short paragraph concluding that paleontological resources are limited to plant microfossils. No information about specific geologic formations is provided.
CA	Palm Springs-South Coast	Santa Rosa and San Jacinto Mnts	February 2004	no	cannot be determined	No assessment of paleontological resources.
CA	Surprise		May 2007	no	cannot be determined	Paleontological resources included in the AE chapter section 3.2 (Cultural Resources and Paleontology), but no discussion of paleontological resources is provided, nor is there any mention of paleontological resources within the management area.
CA	Ukiah District	Redding resource	July 1992	no	cannot be determined	No assessment of paleontological resources.
CO		McInnis Canyon/ Colorado Canyons Conservation area	July 2004	yes	2, 3, 4 and 5	General description of paleontological resources in the area with some reference to fossil types and mapped formations. No citations of primary literature used in analysis.
CO	Canon City District	Northeast Resource area	May 1985	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, there is no specific discussion about, nor specific reference to, fossils or formations.
CO	Canon City District	Royal Gorge	January 1995	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, no specific discussion about, nor specific reference to, fossils or formations is provided.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
CO	Canon City District	San Luis	September 1991	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, no specific discussion about, nor specific reference to, fossils or formations is provided.
CO	Craig District	Kremmling	1983	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, no specific discussion about, nor specific reference to, fossils or formations is provided.
CO	Craig District	White River	July 1997	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, no specific discussion about, nor specific reference to, fossils or formations is provided.
CO	Glenwood Springs	Roan Plateau	August 2006	yes	2, 3, 4 and 5	Fairly complete review of paleontological resources in the field office.
CO	Montrose District	San Juan/San Miguel	December 1984	yes	2, 3, 4 and 5	Paleontological resources section is brief, and references some specific formations, but lists no specific fossil types.
CO	Montrose District	Uncompahgre	September 1998	no	cannot be determined	Paleontological resources discussed in response to public comment; however, there is no specific discussion about, nor specific reference to, fossils or formations.
CO	San Juan	Silverton	August 2004	no	cannot be determined	No assessment of paleontological resources.
ID	Twin Falls District	Craters of the Moon	July 2005	yes	2	Very general discussion of types of fossils found in various Pleistocene deposits and tree molds in lava flows.
ID	Boise district	Snake River Birds of Prey	April 2006	yes	cannot be determined	Report concluded that paleontological resources would not be impacted. No specific information on the fossils or formations in the management area is provided.
ID	Boise district	Cascade Resource area	not available	yes	cannot be determined	Very brief paleontological resources section with no specifics on fossil types or formations.
ID	Burley	Cassia	January 1985	no	cannot be determined	No assessment of paleontological resources.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
ID	Challis	Challis Resource area	July 1999	no	cannot be determined	Very brief (6 pages) RMP with no mention of paleontological resources other than a statement of protection.
ID	Coeur d'Alene		October 2006	yes	1 and ?5	Paleontological resources determined to be of low significance, but no reference to specific formations was made. Report references an old PFYC classification system.
ID	Cottonwood		May 2006	yes	2, 3	Brief paleontological resources section with general description of types of fossils and rocks found in the management area.
ID	Jarbidge	Jarbidge Resource Area	1987- Under revision	yes	cannot be determined	Brief review of areas of paleontological resources in the management area.
ID	Idaho Falls district	Medicine Lodge	December 1985	no	cannot be determined	No assessment of paleontological resources.
ID	Lower Snake River Dist.	Bureau	August 2001	no	cannot be determined	2 page Environmental Statement; Notice of intent
ID	Lower Snake River Dist.	Owyhee	December 1999	no	cannot be determined	No assessment of paleontological resources.
ID	Pocatello		October 2006	yes	2, 3, 4 and 5	Thorough review of paleontological resources in the management area.
ID	Salmon	Lemhi	August 2001	no	cannot be determined	No assessment of paleontological resources.
ID	Shoshone and Burley	Monument	January 1986	no	cannot be determined	No assessment of paleontological resources.
MT	Butte	Butte Resource area	June, 2007	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
MT	Butte District	Garnet	January 1986	no	cannot be determined	No assessment of paleontological resources.
MT	Butte District	Headwaters	November 1983	no	cannot be determined	No assessment of paleontological resources.
MT	Dillon	Dillon	March 2004	yes	2, 3, 4 and 5	Thorough review of paleontological resources in the management area.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
MT	Lewiston District	West HiLine	1988	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
MT	Lewiston District	Upper Missouri River Breaks	September 2005	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
MT	Miles City District	Big Dry	February 1995	yes	2, 3, 4 and 5	Thorough review of paleontological resources in the management area.
MT	Miles City District	Billings Resource area	November 1983	no	2, 3, 4 and 5	Estimated PFYC classes based on stratigraphic section (Figure 3.1) included in chapter 3 geology section.
MT	Miles City District	Powder River	December 1984	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
MT	Montana State Office	Judith Valley Phillips	October 1992	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
NM	Farmington	Farmington	December 2003	yes	cannot be determined	No details provided in the paleontological resources section.
NM	Las Cruces	McGregor Range	January 2005	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
NM	Las Cruces	Sierra and Otero Counties	January 2005	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
NM	Las Cruces	Tri County	June 2006	yes	cannot be determined	No details provided in the paleontological resources section.
NM	Pecos		not available	yes	cannot be determined	No details provided in the paleontological resources section.
NM	Rio Puerco	Kasha-Katuwe	October 2006	yes	cannot be determined	No details provided in the paleontological resources section.
NM	Roswell	Carlsbad	October 1997	no	cannot be determined	No assessment of paleontological resources.
NM	Socorro		April 2007	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
NM		Roswell Resource area	October 1997	no	cannot be determined	No assessment of paleontological resources.
NV	Carson City		May 2001	no	cannot be determined	No assessment of paleontological resources.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
NV	Elko		March 1987	no	cannot be determined	No assessment of paleontological resources.
NV	Elko	Wells	1985	no	cannot be determined	No assessment of paleontological resources.
NV	Ely		June 2005	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
NV	Las Vegas	Sloan Canyon	June 2006	no	cannot be determined	No assessment of paleontological resources.
NV	Las Vegas	Las Vegas	October 1998	no	can not be determined	No assessment of paleontological resources.
OR	Burns	Andrews	August 2005	yes	cannot be determined	No details provided in the paleontology section, and the BLM classification system used is not current.
OR	Lakeview	Lakeview	November 2003	no	cannot be determined	No assessment of paleontological resources.
OR	State	West Oregon	August 2007	no	cannot be determined	No assessment of paleontological resources.
OR		Upper Deschutes	not available	no	cannot be determined	No assessment of paleontological resources.
UT	Cedar City	Cedar-Beaver-Garfield-Antimony	October 1984	no	cannot be determined	No assessment of paleontological resources.
UT	Kanab	Kanab	not available	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
UT	Moab		August 2007	yes	cannot be determined	Lengthy paleontological resources section with very little specific information on geologic formations or fossils present
UT	Moab	San Rafael	July 1989	no	cannot be determined	No assessment of paleontological resources.
UT	Price		July 2004	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
UT	Richfield	House Range	October 1987	no	cannot be determined	No assessment of paleontological resources.
UT	Richfield		October 2007	yes	cannot be determined	Lengthy paleontology section with no specific information on geologic formations or fossils.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
UT	Richfield District	Warm Springs	April 1987	no	cannot be determined	No assessment of paleontological resources.
UT	Salt Lake	Pony Express	November 1997	no	cannot be determined	No assessment of paleontological resources.
UT	Salt Lake	Box Elder	January 1988	no	can not be determined	No assessment of paleontological resources.
UT	Vernal	Book Cliffs and Diamond Mountain	not available	yes	2, 3, 4 and 5	No detail provided in the paleontological resources section, and BLM classification used is not current. Estimated classification here based on description of physical area (geologic setting).
UT	Vernal	Book Cliffs	November 1984	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
UT		Grand Staircase-Escalante	February 2000	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
WA	Spokane District	Iceberg Point	June 1990	no	cannot be determined	No assessment of paleontological resources.
WA	Spokane District	Spokane	June 1992	no	cannot be determined	No assessment of paleontological resources.
WA	Spokane District	Yakima Firing Center	June 1993	no	cannot be determined	No assessment of paleontological resources.
WY	Casper	Platte River	July 1985	no	cannot be determined	No assessment of paleontological resources.
WY	Casper	Newcastle/ Nebraska	May 1992	no	cannot be determined	No assessment of paleontological resources.
WY	Newcastle		September 2000	no	cannot be determined	No assessment of paleontological resources.
WY	Pinedale	Snake River	April 2004	no	cannot be determined	No assessment of paleontological resources.
WY	Rawlins	Lander	June 1987	no	cannot be determined	No assessment of paleontological resources.
WY	Rawlins	Great Divide	November 1990	no	cannot be determined	No assessment of paleontological resources.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
WY	Rock Springs	Green River	October 1997	no	cannot be determined	No assessment of paleontological resources.
WY	Rock Springs	Kemmerer	June 1986	no	cannot be determined	No assessment of paleontological resources.
WY	Rock Springs	Pinedale	December 1988	no	cannot be determined	No assessment of paleontological resources.
WY	Worland	Grass Creek	September 1998	no	cannot be determined	No assessment of paleontological resources.
WY	Worland	Washakie	September 1988	no	cannot be determined	No assessment of paleontological resources.
WY	Worland	Cody	November 1990	no	cannot be determined	No assessment of paleontological resources.
WY		Buffalo	October 1985	no	cannot be determined	No assessment of paleontological resources.

[1] PFYC Class Estimate estimates the potential sensitivities of geologic units within each BLM field office using information provided, if any, in each RMP.

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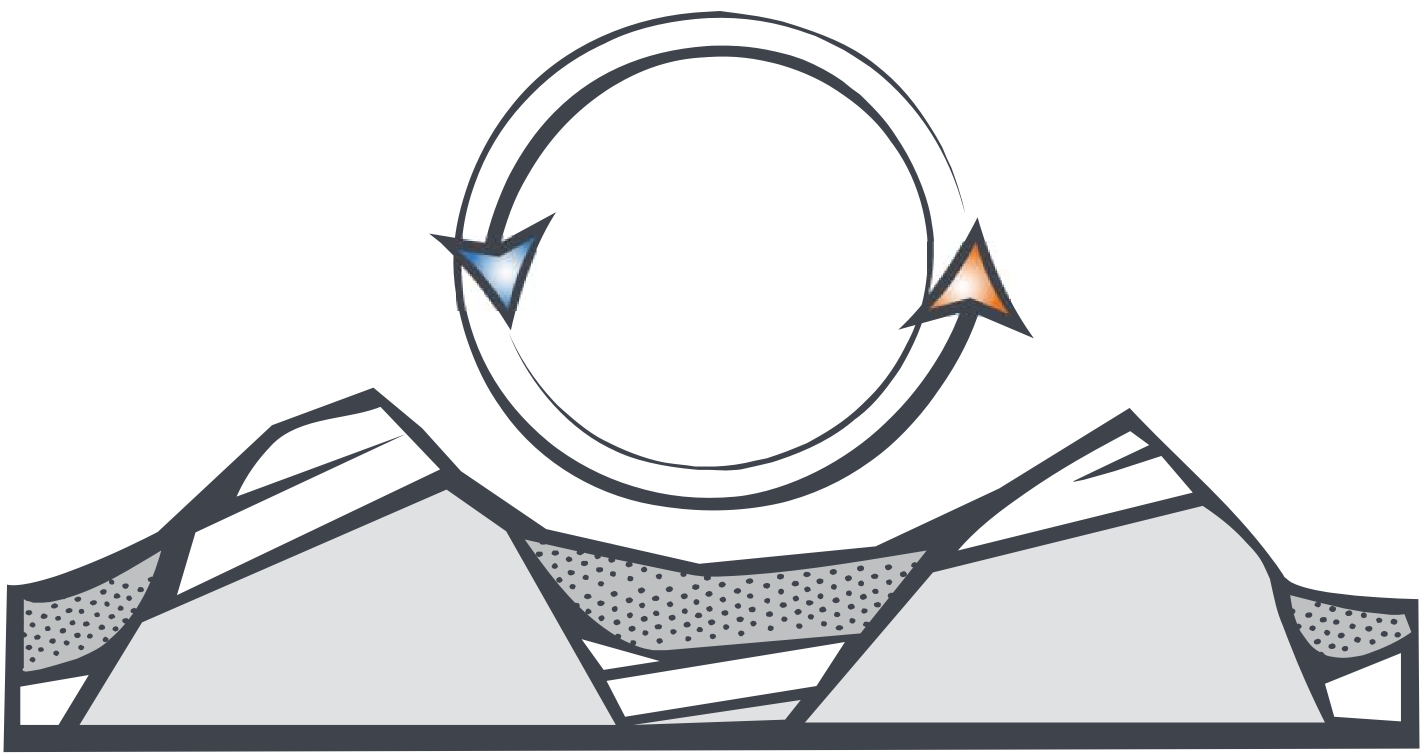

Appendix F

Hot and Warm Springs in the Project Area

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Appendix: F
Hot and Warm Springs in the Project Area

Source: US Department of Commerce, National Oceanic and Atmospheric Administration 2008

KEY:

TF = Maximum surface temperature in degrees Fahrenheit
TC = Maximum surface temperature in degrees Celsius
P.P. 492 = “Thermal Springs of the United States and Other Countries of the World – A Summary,” U.S.G.S. Professional Paper 492 (Waring, 1965)
Circ. 790 = “Assessment of geothermal resources of the United States,” U.S.G.S. Circular 790 (Muffler, 1979)
NOAA = 1:250,000-scale overlays in “Thermal Springs List for the United States,” NOAA KGRD 12 (Berry, Grim, Ikelman, 1980)
AMS = 1:250,000 AMS Maps
USGS quadrangle = The USGS 15-minute or 7.5-minute quadrangle on which spring may be found

State	Latitude	Longitude	"Popular" or USGS Spring Name	TF	TC	P.P. 492	Circ. 790	NOAA	AMS	USGS Quadrangle
AK	53.8920	-166.930	MAKUSHIN VOLCANO FUMAROLES	310	154	45	null	1	UNALASKA	null
AK	51.9250	-177.160	FUMAROLES ON KANAGA ISLAND	219	104	32	null	1	ADAK	null
AK	53.2130	-168.463	HOT SPRINGS NEAR GEYSER BIGHT	216	102	41	18	7	UMNAK	null
AK	53.2230	-168.477	HOT SPRINGS NEAR GEYSER BIGHT	214	101	41	18	6	UMNAK	null
AK	53.4430	-168.092	THERMAL SPRINGS IN OKMOK CALDERA	212	100	null	null	2	UMNAK	null
AK	52.0420	-176.108	HOT SPRINGS ON GREAT SITKIN ISLAND	210	99	34	16	1	ADAK	null
AK	55.9830	-131.661	BAILEY HOT SPRING	198	92	76	27	1	KETCHIKAN	KETCHIKAN (D-5) 15
AK	53.2420	-168.365	HOT SPRINGS NEAR HOT SPRINGS COVE	192	89	43	17	4	UMNAK	null
AK	54.1570	-165.850	HOT SPRINGS NEAR HOT SPRINGS BAY	181	83	46	20	3	UNIMAK	null
AK	58.0330	-136.017	HOT SPRINGS NORTH END TENAKEE INLET	180	82	null	22	1	MT. FAIRWEATHE R	(MT. FAIRWEATHER (A-1) 15)
AK	65.0930	-164.922	PILGRIM SPRINGS	178	81	6	3	2	BENDELEBEN	BENDELEBEN (A-6) 15
AK	57.8310	-156.513	W UKINEK SPRING	178	81	null	null	2	UGASHIK	(UGASHIK (D-2) 15)
AK	65.4590	-153.312	LITTLE MELOZITNA HOT SPRINGS	176	80	11	9	1	MELOZITNA	MELOZITNA (B-1) 15
AK	65.8580	-164.710	SERPENTINE HOT SPRINGS	171	77	4	2	1	BENDELEBEN	BENDELEBEN (D-6) 15
AK	52.1900	-174.250	HOT SPRINGS ON ATKA ISLAND	167	75	37	null	3	ATKA	null
AK	55.9330	-131.559	BELL ISLAND HOT SPRINGS	165	74	79	28	2	KETCHIKAN	KETCHIKAN (D-5) 15

State	Latitude	Longitude	"Popular" or USGS Spring Name	TF	TC	P.P. 492	Circ. 790	NOAA	AMS	USGS Quadrangle
AK	55.8630	-160.493	HOT SPRING NEAR PORT MOLLER	160	71	54	null	1	PORT MOLLER	PORT MOLLER (D-2) 15
AK	53.2530	-168.358	HOT SPRINGS NEAR HOT SPRINGS COVE	158	70	43	17	3	UMNAK	null
AK	51.9700	-176.610	HOT SPRINGS ON ADAK ISLAND	154	68	33	null	1	ADAK	null
AK	65.0530	-146.057	CHENA HOT SPRINGS	153	67	18	14	1	CIRCLE	CIRCLE (A-5) 15
AK	56.8360	-135.374	GODDARD HOT SPRINGS	153	67	70	25	1	PORT ALEXANDER	PORT ALEXANDER (D-5) 15
AK	58.3700	-137.090	HOT SPRINGS NEAR ICY POINT	153	67	null	null	1	MT. FAIRWEATHE R	(MT. FAIRWEATHER (B-4) 15)
AK	66.3420	-150.850	KANUTI HOT SPRINGS	151	66	null	11	1	BETTLES	(BETTLES (B-2) 15)
AK	64.8500	-162.300	CLEAR CREEK HOT SPRINGS	149	65	null	5	1	SOLOMON	(SOLOMON (D-1) 15)
AK	53.2330	-168.300	HOT SPRING ON UMNAK ISLAND	149	65	42	19	5	UMNAK	null
AK	54.9440	-163.251	HOT SPRINGS NEAR MORZHOVOI	145	63	50	null	1	FALSE PASS	null
AK	61.2000	-159.863	HOT SPRINGS NEAR OPHIR CREEK	145	63	26	null	1	RUSSIAN MISSION	(RUSSIAN MISSION (A-2) 15)
AK	51.7620	-178.770	FUMAROLES ON GARELOI ISLAND	144	62	null	null	2	GARELOI ISLAND	null
AK	65.9830	-150.560	HOT SPRINGS ON LOWER RAY RIVER	142	61	null	null	1	TANANA	(TANANA (D-2) 15)
AK	66.3670	-156.767	HOT SPRINGS NEAR DIVISION BM	140	60	3	null	1	SHUNGNAK	null
AK	65.2740	-148.847	TOLOVANA HOT SPRINGS	140	60	17	12	1	LIVENGOOD	LIVENGOOD (B-4) 15
AK	57.1780	-157.015	HOT SPRING NEAR MOTHER GOOSE LAKE	138	59	null	null	1	UGASHIK	(UGASHIK (A-4) 15)
AK	56.2330	-131.267	BRADFIELD CANAL HOT SPRINGS	135	57	null	null	2	BRADFIELD CANAL	(BRADFIELD CANAL (A-4) 15)
AK	65.4830	-144.637	CIRCLE HOT SPRINGS	135	57	19	15	1	CIRCLE	CIRCLE (B-2) 15
AK	65.0060	-150.633	MANLEY HOT SPRINGS	133	56	14	13	4	TANANA	TANANA (A-2)
AK	65.1290	-154.692	MELOZI (MELOZITNA) SPRINGS	131	55	10	8	3	MELOZITNA	MELOZITNA (A-4) 15
AK	66.2170	-149.547	DALL HOT SPRINGS	129	54	null	null	1	BEAVER	(BEAVER (A-6) 15)
AK	55.2170	-162.483	HOT SPRINGS EAST OF COLD BAY	129	54	null	21	2	COLD BAY	null
AK	57.8650	-156.499	GAS ROCKS HOT SPRING	127	53	56	null	1	UGASHIK	(UGASHIK (D-2) 15)
AK	65.2170	-162.900	HOT SPRINGS NEAR LAVA CREEK	127	53	null	4	1	BENDELEBEN	(BENDELEBEN (A-2) 15)
AK	65.2670	-155.280	HOT SPRINGS NEAR DULBI RIVER	126	52	null	7	1	MELOZITNA	(MELOZITNA (B-5) 15)
AK	57.0850	-134.839	BARANOF WARM SPRINGS	124	51	69	null	1	SITKA	SITKA (A-3) 15
AK	56.7170	-132.005	CHIEF SHAKES HOT SPRINGS	122	50	73	26	1	PETERSBURG	(PETERSBURG (C-1) 15)

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AK	66.1500	-157.117	HOT SPRINGS NEAR SOUTH BM	122	50	null	6	3	SHUNGNAK	null
AK	66.2330	-157.583	HOT SPRINGS ON HAWK RIVER	122	50	null	null	2	SHUNGNAK	null
AK	65.8100	-151.237	KILO HOT SPRING	122	50	null	null	1	TANANA	TANANA (D-3)
AK	67.2830	-155.067	REED RIVER HOT SPRING	122	50	1	10	1	SURVEY PASS	null
AK	52.8400	-169.900	CHUGINADAK HOT SPRINGS	H	H	39	null	2	SAMALGA ISLAND	null
AK	65.9080	-154.993	DENIKTOW RIDGE HOT SPRINGS	H	H	null	null	2	MELOZITNA	MELOZITNA (D-4) 15
AK	55.3680	-161.961	FUMAROLE	H	H	52	null	1	PORT MOLLER	null
AK	51.7750	-178.793	FUMAROLES ON GARELOI ISLAND	H	H	null	null	1	GARELOI ISLAND	null
AK	51.9670	178.444	FUMAROLES ON LITTLE SITKIN ISLAND	H	H	null	null	1	RAT ISLANDS	null
AK	51.9440	178.547	FUMAROLES ON LITTLE SITKIN ISLAND	H	H	null	null	3	RAT ISLANDS	null
AK	51.9630	178.491	FUMAROLES ON LITTLE SITKIN ISLAND	H	H	null	null	2	RAT ISLANDS	null
AK	61.2670	-151.238	HOT LAKE IN BOTTOM OF CRATER PEAK	H	H	null	null	1	TYONEK	(TYONEK (B-6) 15)
AK	58.2400	-155.090	HOT SPRING NEAR KATMAI PASS	H	H	57	null	1	MT. KATMAI	(MT. KATMAI (A-4) 15)
AK	65.4500	-150.000	HOT SPRING NEAR LITTLE MINOOK CR	H	H	16	null	3	TANANA	(TANANA (B-1) 15)
AK	61.0580	-160.692	HOT SPRING NEAR TULUKSAK RIVER	H	H	25	null	1	RUSSIAN MISSION	(RUSSIAN MISSION (A-5) 15)
AK	54.9000	-162.885	HOT SPRING ON AMAGAT ISLAND	H	H	51	null	1	FALSE PASS	(FALSE PASS (D-3) 15)
AK	52.9600	-169.710	HOT SPRING ON KAGAMIL ISLAND	H	H	40	null	1	SAMALGA ISLAND	null
AK	51.9400	178.500	HOT SPRING ON LITTLE SITKIN ISLAND	H	H	29	null	4	RAT ISLANDS	null
AK	52.3580	-172.317	HOT SPRING ON SEGUAM ISLAND	H	H	38	null	1	SEGUAM	null
AK	51.8100	-177.790	HOT SPRING ON TANAGA ISLAND	H	H	31	null	2	ADAK	null
AK	64.0020	-156.300	HOT SPRING ON TRIBUTARY OF INNOKO R	H	H	13	null	1	NULATO	(NULATO (A-1) 15)
AK	54.6600	-164.550	HOT SPRING ON UNIMAK ISLAND	H	H	49	null	1	UNIMAK	null
AK	58.9200	-153.980	HOT SPRING WEST OF CAPE DOUGLAS	H	H	59	null	1	AFOGNAK	(AFOGNAK (D-6) 15)
AK	53.2070	-168.445	HOT SPRINGS NEAR GEYSER BIGHT	H	H	41	18	8	UMNAK	null
AK	53.8510	-166.918	HOT SPRINGS NEAR MAKUSHIN VOLCANO	H	H	45	null	3	UNALASKA	null

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AK	58.2700	-154.890	HOT SPRINGS NEAR MT KATMAI	H	H	58	null	1	MT. KATMAI	(MT. KATMAI (B-3) 15)
AK	53.8770	-166.448	HOT SPRINGS NEAR SUMMER BAY	H	H	null	null	2	UNALASKA	null
AK	54.2300	-165.660	HOT SPRINGS ON AKUN ISLAND	H	H	null	null	1	UNIMAK	null
AK	54.1800	-165.410	HOT SPRINGS ON AKUN ISLAND	H	H	null	null	2	UNIMAK	null
AK	52.3400	-174.260	HOT SPRINGS ON ATKA ISLAND	H	H	35	null	1	ATKA	null
AK	52.2700	-174.042	HOT SPRINGS ON ATKA ISLAND	H	H	36	null	2	ATKA	null
AK	65.2330	-144.483	HOT SPRINGS ON BIG WINDY CREEK	H	H	20	null	2	CIRCLE	(CIRCLE (A-1) 15)
AK	53.9500	-168.037	HOT SPRINGS ON BOGOSLOF ISLAND	H	H	44	null	1	UMNAK	null
AK	61.3630	-157.733	HOT SPRINGS ON UPPER CHUILNUK RIVER	H	H	null	null	1	SLEETMUTE	(SLEETMUTE (B-4) 15)
AK	65.9700	-154.033	POCAHONTAS HOT SPRINGS	H	H	null	null	1	MELOZITNA	MELOZITNA (D-3) 15

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AZ	32.9710	-109.350	GILLARD HOT SPRINGS	180	82	null	32	2	SILVER CITY	GUTHRIE 15
AZ	32.7410	-114.068	RADIUM HOT SPRINGS	140	60	null	null	1	EL CENTRO	WELLTON MESA 7.5
AZ	33.0800	-109.303	HOT SPRING	138	59	null	31	2	CLIFTON	CLIFTON 15
AZ	33.4000	-109.152	HANNAH HOT SPRING	133	56	null	null	1	CLIFTON	DUTCH BLUE CREEK 7.5
AZ	32.3360	-110.240	HOOKERS HOT SPRINGS	127	53	19	null	4	TUCSON	WINCHESTER MTS. 15
AZ	35.9840	-114.742	HOT SPRING	H	H	null	null	1	KINGMAN	RINGBOLT RAPIDS 7.5

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CA	38.8020	-122.810	THE GEYSERS	214	101	72	48	21	SANTA ROSA	THE GEYSERS 7.5
CA	38.7670	-122.748	LITTLE GEYSERS	210	99	74	48	27	SANTA ROSA	(WHISPERING PINES 7.5)
CA	41.5340	-120.078	HOT SPRINGS (SURPRISE VALLEY)	208	98	18	35	8	ALTURAS	CEDARVILLE 15
CA	36.0450	-117.769	COSO HOT SPRINGS	207	97	142	57	8	DEATH VALLEY	HAIWEE RESERVOIR 15
CA	36.0360	-117.802	DEVILS KITCHEN	207	97	141	57	9	DEATH VALLEY	HAIWEE RESERVOIR 15
CA	41.6700	-120.206	LAKE CITY HOT SPRINGS	207	97	14	35	4	ALTURAS	CEDARVILLE 15
CA	40.3640	-120.243	HOT SPRING	204	96	null	42	3	SUSANVILLE	WENDEL 15
CA	40.3820	-121.513	MORGAN HOT SPRING	205	96	33	41	10	SUSANVILLE	LASSEN PEAK 15
CA	40.4210	-121.375	TERMINAL GEYSER	205	96	38	40	8	SUSANVILLE	MT. HARKNESS 15
CA	40.3550	-120.257	WENDEL HOT SPRINGS	205	96	30	42	4	SUSANVILLE	LITCHFIELD 15
CA	40.3020	-120.195	AMEDEE HOT SPRINGS	203	95	31	42	5	SUSANVILLE	WENDEL 15
CA	40.4400	-121.434	DEVILS KITCHEN	203	95	34	40	5	SUSANVILLE	MT. HARKNESS 15
CA	36.0310	-117.833	FUMAROLE	203	95	141	57	10	DEATH VALLEY	HAIWEE RESERVOIR 15
CA	40.3930	-121.507	GROWLER HOT SPRING	203	95	null	41	9	SUSANVILLE	LASSEN PEAK 15
CA	40.4550	-121.501	BUMPASS HELL	199	93	27	40	2	SUSANVILLE	LASSEN PEAK 15
CA	37.6480	-118.914	CASA DIABLO HOT SPRINGS AND GEYSER	199	93	123	56	13	MARIPOSA	MT. MORRISON 15
CA	37.6650	-118.828	HOT CREEK GORGE SPRINGS	199	93	null	56	8	MARIPOSA	MT. MORRISON 15
CA	40.4470	-121.536	SULPHUR WORKS, TOPHET HOT SPRINGS	199	93	26	40	3	SUSANVILLE	LASSEN PEAK 15
CA	41.4500	-120.834	KELLY HOT SPRING	198	92	8	38	12	ALTURAS	CANBY 15
CA	34.1850	-117.262	ARROWHEAD SPRINGS, WATERMAN HOT SPR	194	90	162	62	3	SAN BERNARDINO	SAN BERNARDINO NORTH 7.5
CA	34.5960	-118.998	SESPE HOT SPRINGS	194	90	111	61	2	LOS ANGELES	DEVILS HEART PEAK 7.5
CA	40.4340	-121.399	BOILING SPRINGS LAKE	190	88	37	40	7	SUSANVILLE	MT. HARKNESS 15
CA	41.6070	-121.523	HOT SPOT	191	88	3	null	1	ALTURAS	MEDICINE LAKE 15
CA	41.6150	-120.102	SEYFERTH HOT SPRINGS	185	85	16	35	5	ALTURAS	CEDARVILLE 15
CA	41.4070	-122.197	HOT SPRING, FUMAROLES	183	84	3	null	3	WEED	SHASTA 15
CA	37.9930	-119.028	PAOHA ISLAND SPRINGS	181	83	120	null	1	MARIPOSA	(MONO CRATERS 15)
CA	41.0250	-121.924	BIG BEND HOT SPRINGS	180	82	24	39	6	ALTURAS	BIG BEND 15
CA	38.3480	-119.400	FALES HOT SPRINGS	180	82	114	52	4	WALKER LAKE	FALES HOT SPRINGS 7.5
CA	37.6920	-118.839	LITTLE HOT CREEK SPRING	180	82	122	56	5	MARIPOSA	MT. MORRISON 15
CA	38.2450	-119.205	TRAVERTINE HOT SPRINGS	180	82	116	54	5	WALKER LAKE	BODIE 15
CA	41.1430	-121.110	BASSETT HOT SPRINGS	174	79	28	37	3	ALTURAS	BIEBER 15
CA	38.5800	-122.575	CALISTOGA HOT SPRINGS	172	78	81	50	30	SANTA ROSA	CALISTOGA 7.5
CA	41.1260	-121.028	KELLOG HOT SPRINGS	172	78	29	null	4	ALTURAS	BIEBER 15
CA	37.6560	-118.834	HOT CREEK SPRINGS	171	77	null	56	11	MARIPOSA	(MT. MORRISON 15)

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CA	41.1900	-120.383	WEST VALLEY RESERVOIR HOT SPRING	171	77	null	36	19	ALTURAS	(TULE MOUNTAIN 7.5)
CA	41.2290	-121.405	LITTLE HOT SPRING	169	76	11	null	2	ALTURAS	FALL RIVER MILLS 15
CA	37.6640	-118.802	THE TUB	167	75	null	56	9	MARIPOSA	(MT. MORRISON 15)
CA	37.6470	-118.859	CASA DIABLO HOT POOL	165	74	124	56	15	MARIPOSA	MT. MORRISON 15
CA	38.7680	-122.717	CASTLE ROCK SPRINGS	163	73	62	48	26	SANTA ROSA	WHISPERING PINES 7.5
CA	39.0570	-122.475	ELGIN MINE	156	69	69	null	9	UKIAH	WILBUR SPRINGS 15
CA	41.9730	-122.202	KLAMATH HOT SPRING	156	69	2	null	1	WEED	MACDOEL 15
CA	39.0020	-122.664	SULPHUR BANK	156	69	57	46	17	UKIAH	CLEARLAKE OAKS 7.5
CA	39.0390	-122.421	WILBUR SPRINGS	153	67	68	44	11	UKIAH	WILBUR SPRINGS 15
CA	40.4440	-121.409	DRAKESBAD	151	66	36	40	4	SUSANVILLE	MT. HARKNESS 15
CA	38.0480	-119.081	HOT SPRING	151	66	null	null	9	WALKER LAKE	BODIE 15
CA	40.4570	-121.545	MILL CREEK SPRINGS	150	66	25	40	1	SUSANVILLE	(LASSEN PEAK 15)
CA	38.7730	-119.713	null	149	65	null	null	1	WALKER LAKE	(MT. SIEGEL 15)
CA	38.6990	-119.846	GROVERS HOT SPRINGS	147	64	113	51	2	WALKER LAKE	MARKLEEVILLE 15
CA	39.1830	-122.700	BARTLETT SPRINGS	144	62	null	null	7	UKIAH	CLEARLAKE OAKS 15
CA	41.6000	-120.088	LEONARDS HOT SPRINGS	144	62	17	35	6	ALTURAS	CEDARVILLE 15
CA	36.2340	-121.546	TASSAJARA HOT SPRINGS	144	62	91	null	6	SANTA CRUZ	TASSAJARA HOT SPRINGS 7.5
CA	39.0330	-122.445	JONES FOUNTAIN OF LIFE SPRING	142	61	null	null	12	UKIAH	WILBUR SPRINGS 15
CA	38.2370	-119.326	BUCKEYE HOT SPRING	140	60	115	53	6	WALKER LAKE	MATTERHORN PEAK 15
CA	33.2840	-116.631	WARNER HOT SPRING	138	59	179	null	7	SANTA ANA	WARNER SPRINGS 7.5
CA	41.0360	-121.926	HUNT HOT SPRING	136	58	23	null	5	ALTURAS	BIG BEND 15
CA	37.8020	-118.532	BENTON HOT SPRINGS	134	57	127	null	2	MARIPOSA	GLASS MOUNTAIN 15
CA	37.6770	-118.790	DEHY HOT SPRING	134	57	null	56	6	MARIPOSA	(MT. MORRISON 15)
CA	41.2660	-120.080	HOT SPRINGS (MENLO BATHS)	135	57	20	null	14	ALTURAS	EAGLEVILLE 7.5
CA	34.5380	-119.560	AGUA CALIENTE SPRING	133	56	null	null	2	LOS ANGELES	HILDRETH PEAK 7.5
CA	33.5580	-117.154	MURRIETTA HOT SPRINGS	132	56	170	null	8	SANTA ANA	MURRIETTA 7.5
CA	35.6200	-118.473	SCOVERN HOT SPRINGS	133	56	149	60	3	BAKERSFIELD	LAKE ISABELLA SOUTH
CA	38.6910	-123.024	SKAGGS SPRINGS	135	56	71	49	3	SANTA ROSA	SKAGGS SPRINGS 7.5
CA	39.2260	-120.010	BROCKWAY HOT SPRINGS	131	55	44	null	5	CHICO	(KINGS BEACH 7.5)
CA	33.7530	-117.495	GLEN IVY HOT SPRINGS	131	55	167	null	4	SANTA ANA	LAKE MATTHEWS 7.5
CA	37.6480	-118.806	HOT SPRINGS	129	54	125	56	14	MARIPOSA	MT. MORRISON 15
CA	37.6670	-118.781	null	127	53	null	56	7	MARIPOSA	(MT. MORRISON 15)
CA	38.8730	-122.689	SEIGLER SPRINGS	126	52	59	47	14	SANTA ROSA	WHISPERING PINES 7.5
CA	33.6700	-117.325	WRENDEN HOT SPRS, ELSINORE HOT SPRS	125	52	168	null	5	SANTA ANA	(ELSINORE 7.5)
CA	36.2290	-118.302	JORDAN HOT SPRINGS	124	51	null	null	2	FRESNO	HOCKETT PEAK 15
CA	37.2530	-118.373	KEOUGH HOT SPRINGS	124	51	138	null	22	MARIPOSA	BISHOP 15
CA	34.4980	-119.341	STINGLEYS HOT SPRINGS	123	51	107	null	8	LOS ANGELES	MATILIJA 7.5

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CA	34.5020	-119.346	VICKERS HOT SPRINGS	124	51	106	null	7	LOS ANGELES	(WHEELER SPRINGS 7.5)
CA	35.8810	-118.670	CALIFORNIA HOT SPRINGS	122	50	137	null	1	BAKERSFIELD	CALIFORNIA HOT SPRINGS 15
CA	36.1230	-121.640	SLATES HOT SPRINGS	122	50	93	null	7	SANTA CRUZ	LOPEZ POINT 7.5
CA	38.9790	-122.659	FUMAROLE	H	H	null	null	4	SANTA ROSA	(CLEARLAKE HIGHLANDS 7.5)
CA	37.6220	-119.028	FUMAROLES	H	H	null	null	5	MARIPOSA	(DEVILS POSTPILE 15)
CA	41.0120	-121.274	HOT SPRINGS	H	H	null	null	7	ALTURAS	FALL RIVER MILLS 15
CA	39.9220	-120.024	ZAMBONI HOT SPRINGS	H	H	null	null	2	CHICO	CONSTANTIA 7.5

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CO	38.7320	-106.178	HORTENSE HOT SPRING	181	83	null	74	5	MONTROSE	PONCHA SPRINGS 15
CO	38.5140	-106.508	UPPER WAUNITA HOT SPRINGS	176	80	14	76	9	MONTROSE	PITKIN 7.5
CO	38.5170	-106.515	LOWER WAUNITA HOT SPRINGS	167	75	null	76	8	MONTROSE	(PITKIN 7.5)
CO	38.4980	-106.076	PONCHA HOT SPRINGS	160	71	21	75	10	MONTROSE	BONANZA 15
CO	38.0210	-107.672	OURAY HOT SPRINGS	156	69	28	null	3	MONTROSE	(OURAY 7.5)
CO	40.5590	-106.849	ROUTT HOT SPRINGS	147	64	2	72	1	CRAIG	ROCKY PEAK 7.5
CO	38.1680	-105.924	MINERAL HOT SPRINGS	140	60	23	null	5	PUEBLO	VILLA GROVE 7.5
CO	38.8120	-106.226	COTTONWOOD HOT SPRINGS	136	58	19	null	3	MONTROSE	BUENA VISTA 15
CO	37.2630	-107.011	PAGOSA SPRINGS	136	58	39	null	7	DURANGO	PAGOSA SPRINGS 7.5
CO	37.7470	-106.831	WAGON WHEEL GAP HOT SPRINGS	135	57	31	79	2	DURANGO	SPAR CITY 15
CO	38.7330	-106.162	MOUNT PRINCETON HOT SPRINGS	133	56	20	74	4	MONTROSE	PONCHA SPRINGS 15
CO	39.2270	-107.224	PENNY HOT SPRINGS	133	56	null	73	4	LEADVILLE	REDSTONE 7.5
CO	39.0170	-105.793	HARTSEL HOT SPRINGS	126	52	17	null	3	DENVER	HARTSEL 7.5
CO	38.1330	-107.736	ORVIS HOT SPRING	126	52	27	null	2	MONTROSE	DALLAS 7.5
CO	39.5480	-107.322	GLENWOOD SPRINGS	124	51	6	null	3	LEADVILLE	GLENWOOD SPRINGS 7.5

State	Latitude	Longitude	"Popular" or USGS Spring Name	TF	TC	P.P. 492	Circ. 790	NOAA	AMS		
ID	42.1070	-113.390	BLM WELL (FRAZIER HOT SPRING)	203	95	184	115	7	POCATELLO	CHOKECHERRY CANYON 7.5	1.
ID	45.3070	-114.338	BIG CREEK HOT SPRINGS	199	93	52	null	4	ELK CITY	SHOUP 15	2.
ID	44.3060	-116.745	CRANE CREEK HOT SPRINGS	198	92	null	null	12	BAKER	(CRANE CREEK RESERVOIR 15)	3.
ID	44.7990	-115.129	INDIAN CREEK HOT SPRING	190	88	null	null	6	CHALLIS	(BIG BALDY 7.5)	4.
ID	44.5680	-115.695	VULCAN HOT SPRINGS	190	88	32	null	20	CHALLIS	WARM LAKE 15	5.
ID	44.3640	-115.856	BOILING SPRINGS	185	85	38	null	29	CHALLIS	BOILING SPRINGS 15	6.
ID	44.1570	-115.314	BONNEVILLE HOT SPRINGS	185	85	80	96	34	CHALLIS	EIGHTMILE MTN. 7.5	7.
ID	42.1330	-111.928	BATTLE CREEK HOT SPRINGS	183	84	null	120	12	PRESTON	BANIDA 7.5	8.
ID	43.5630	-114.798	WORSWICK HOT SPRINGS	180	82	136	110	12	HAILEY	SYDNEY BUTTE 7.5	9.
ID	44.0920	-116.052	DEER HOT SPRINGS	176	80	null	97	14	BAKER	BANKS 15	10.
ID	42.3080	-111.707	MAPLE GROVE HOT SPRINGS	172	78	null	118	11	PRESTON	ONEIDA NARROWS RESERVOIR 7.	11.
ID	43.7550	-115.571	NINEMEYER HOT SPRINGS	169	76	116	98	11	HAILEY	BARBER FLAT 7.5	12.
ID	44.2680	-114.748	SUNBEAM HOT SPRINGS	169	76	93	107	14	CHALLIS	SUNBEAM 7.5	13.
ID	43.2930	-114.908	BARRONS HOT SPRING	167	75	139	112	18	HAILEY	(FAIRFIELD 15)	14.
ID	44.1540	-115.993	WARM SPRINGS CREEK HOT SPRINGS	167	75	73	null	35	CHALLIS	GARDEN VALLEY 15	15.
ID	43.3280	-114.399	MAGIC HOT SPRINGS	163	73	null	109	17	HAILEY	BELLEVUE 15	16.
ID	42.1190	-111.928	SQUAW HOT SPRINGS	163	73	null	121	13	PRESTON	WESTON 7.5	17.
ID	44.8130	-115.123	MIDDLE FORK INDIAN CREEK HOT SPRING	162	72	48	null	5	CHALLIS	PUNGO MOUNTAIN 7.5	18.
ID	44.4160	-116.031	CABARTON HOT SPRING	160	71	null	null	11	BAKER	(SMITHS FERRY 15)	19.
ID	42.3330	-115.650	INDIAN HOT SPRINGS	160	71	169	null	6	TWIN FALLS	null	20.
ID	43.6840	-114.410	GUYER HOT SPRINGS	158	70	142	null	7	HAILEY	GRIFFIN BUTTE 7.5	21.
ID	43.1550	-115.518	HOT SPRINGS	158	70	131	null	26	HAILEY	MOUNTAIN HOME 15	22.
ID	44.5860	-116.630	LAKEY HOT SPRING	158	70	null	null	6	BAKER	(CAMBRIDGE 15)	23.
ID	44.8310	-115.215	KWISKWIS HOT SPRING	156	69	null	null	4	CHALLIS	BIG BALDY 7.5	24.
ID	44.6690	-116.305	COUNCIL MTN HOT SPRINGS	154	68	18	null	4	BAKER	COUNCIL 15	25.
ID	43.7380	-115.583	VAUGHN HOT SPRING	154	68	115	null	12	HAILEY	SHEEP CREEK 7.5	26.
ID	44.1600	-115.177	SACAJAWEA HOT SPRINGS	153	67	81	null	32	CHALLIS	GRANDJEAN 7.5	27.
ID	42.7040	-114.856	SALMON FALLS HOT SPRING	153	67	173	null	1	TWIN FALLS	(THOUSAND SPRINGS 7.5)	28.
ID	42.3330	-111.716	CLEVELAND HOT SPRINGS	151	66	null	null	10	PRESTON	ONEIDA NARROWS RESERVOIR 7.	29.
ID	43.9510	-116.353	ROYSTONE HOT SPRINGS	151	66	66	95	2	BOISE	MONTOUR 15	30.
ID	43.6710	-115.696	TWIN SPRINGS	151	66	84	null	17	HAILEY	TWIN SPRINGS 7.5	31.
ID	43.7890	-115.434	DUTCH FRANK HOT SPRING	149	65	119	null	7	HAILEY	GRAND MTN. 7.5	32.
ID	44.0720	-115.543	KIRKHAM HOT SPRINGS	149	65	79	null	37	CHALLIS	LOWMAN 7.5	33.
ID	44.7300	-114.993	SUNFLOWER HOT SPRINGS	149	65	null	null	6	CHALLIS	SLIDEROCK RIDGE 7.5	34.
ID	44.0770	-115.553	HAVEN LODGE HOT SPRING	147	64	78	null	36	CHALLIS	(LOWMAN 7.5)	35.

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ID	43.3830	-114.931	WARDROP HOT SPRING	147	64	137	111	16	HAILEY	FAIRFIELD 15	36.
ID	44.6450	-114.739	UPPER LOON CREEK HOT SPRINGS	145	63	56	null	10	CHALLIS	ROCK CREEK 7.5	37.
ID	43.0490	-114.952	WHITE ARROW HOT SPRING	145	63	170	113	20	HAILEY	DAVIS MOUNTAIN 15	38.
ID	43.1160	-115.305	LATTY HOT SPRING	144	62	131	99	28	HAILEY	BENNETT MTN. 15	39.
ID	43.7880	-115.444	STRAIGHT CREEK HOT SPRING	144	62	118	null	8	HAILEY	(GRAND MTN. 7.5)	40.
ID	45.0390	-116.291	ZIMS RESORT HOT SPRINGS	144	62	16	null	5	GRANGEVILLE	BALLY MOUNTAIN 7.5	41.
ID	43.6960	-115.658	SHEEP CREEK BRIDGE HOT SPRING	142	61	110	null	16	HAILEY	TWIN SPRINGS 7.5	42.
ID	44.9140	-115.722	TEAPOT HOT SPRING	142	61	25	null	1	CHALLIS	TEAPOT MTN. 7.5	43.
ID	43.8110	-115.116	ATLANTA HOT SPRINGS	140	60	123	null	5	HAILEY	ATLANTA EAST 7.5	44.
ID	45.5120	-115.046	BARTH HOT SPRINGS	140	60	11	null	2	ELK CITY	SHEEP HILL 7.5	45.
ID	44.0510	-115.829	DAN HODGES HOT SPRING	140	60	75	null	41	CHALLIS	(GARDEN VALLEY 15)	46.
ID	43.6470	-114.816	SKILLERN HOT SPRINGS	140	60	133	null	8	HAILEY	PARADISE PEAK 7.5	47.
ID	44.6790	-116.231	WHITE LICKS HOT SPRING	140	60	19	null	3	BAKER	CASCADE 15	48.
ID	42.6880	-114.826	BANBURY HOT SPRING	138	59	175	114	3	TWIN FALLS	THOUSAND SPRINGS 7.5	49.
ID	43.5400	-115.288	BRIDGE HOT SPRINGS	138	59	128	null	23	HAILEY	(FEATHERVILLE 7.5)	50.
ID	45.4310	-116.015	COW FLATS HOT SPRING	138	59	12	null	1	GRANGEVILLE	(KELLY MOUNTAIN 7.5)	51.
ID	44.3820	-115.841	DASH CREEK HOT SPRINGS	138	59	37	null	28	CHALLIS	BOILING SPRINGS 15	52.
ID	44.6420	-115.693	MOLLYS HOT SPRING	138	59	33	null	13	CHALLIS	(WARM LAKE 15)	53.
ID	44.0620	-115.685	PINE FLAT HOT SPRINGS	138	59	77	null	38	CHALLIS	PINE FLAT 7.5	54.
ID	43.7200	-115.617	SMITH CABIN HOT SPRING	138	59	112	null	14	HAILEY	SHEEP CREEK 7.5	55.
ID	44.7210	-115.010	THOMAS CREEK RANCH HOT SPRING	138	59	null	null	10	CHALLIS	GREYHOUND RIDGE 15	56.
ID	44.2450	-114.885	ELKHORN HOT SPRING	136	58	90	null	19	CHALLIS	(STANLEY 7.5)	57.
ID	45.0350	-115.561	SHEEP CREEK HOT SPRING	136	58	24	null	6	ELK CITY	(PARKS PEAK 7.5)	58.
ID	43.1290	-115.340	COYOTE HOT SPRING	135	57	null	null	27	HAILEY	(BENNETT MTN. 15)	59.
ID	44.6610	-114.652	FOSTER RANCH HOT SPRINGS	135	57	57	null	8	CHALLIS	ROCK CREEK 7.5	60.
ID	44.2640	-114.818	BASIN CREEK HOT SPRING	133	56	92	null	15	CHALLIS	(EAST BASIN CREEK 7.5)	61.
ID	43.6050	-114.948	LIGHTFOOT HOT SPRINGS	133	56	134	null	10	HAILEY	BOARDMAN CREEK 7.5	62.
ID	44.6520	-114.734	OWEN CABIN HOT SPRING	133	56	56	null	9	CHALLIS	ROCK CREEK 7.5	63.
ID	43.6050	-115.664	RATTLESNAKE HOT SPRING	133	56	null	null	19	HAILEY	(LONG GULCH 7.5)	64.
ID	44.0450	-115.842	CORDER HOT SPRING	131	55	76	null	42	CHALLIS	GARDEN VALLEY 15	65.
ID	44.2110	-116.710	COVE CREEK HOT SPRING	131	55	null	null	13	BAKER	(HOLLAND GULCH 7.5)	66.
ID	44.7850	-114.855	COX HOT SPRINGS	131	55	49	null	5	CHALLIS	RAMEY HILL 7.5	67.
ID	44.0440	-115.851	DONLAY RANCH HOT SPRING	131	55	null	null	43	CHALLIS	(GARDEN VALLEY 15)	68.

State	Latitude	Longitude	"Popular" or USGS Spring Name	TF	TC	P.P. 492	Circ. 790	NOAA	AMS		
ID	43.8030	-115.401	GRANITE CREEK HOT SPRING	131	55	120	null	6	HAILEY	GRAND MTN. 7.5	69.
ID	43.5060	-114.354	HAILEY HOT SPRINGS	131	55	145	null	14	HAILEY	HAILEY 7.5	70.
ID	42.6920	-114.859	HOT SULPHUR (MIRACLE HOT) SPRINGS	131	55	174	null	2	TWIN FALLS	THOUSAND SPRINGS 7.5	71.
ID	45.7880	-115.198	RED RIVER HOT SPRINGS	131	55	10	null	1	ELK CITY	SABLE HILL 7.5	72.
ID	44.2470	-114.676	ROBINSON BAR HOT SPRINGS	131	55	95	null	18	CHALLIS	ROBINSON BAR 7.5	73.
ID	44.8530	-116.442	STARKEY HOT SPRINGS	131	55	null	null	2	BAKER	NEW MEADOWS 15	74.
ID	43.6370	-115.130	WILLOW CREEK HOT SPRING	131	55	126	null	18	HAILEY	CAYUSE POINT 7.5	75.
ID	43.7240	-115.604	LOFTUS HOT SPRING	129	54	113	null	13	HAILEY	SHEEP CREEK 7.5	76.
ID	43.9740	-114.499	LOWER BOWERY HOT SPRING	129	54	null	null	3	HAILEY	(RYAN PEAK 7.5)	77.
ID	44.6320	-115.697	SOUTH FORK PLUNGE	129	54	31	null	15	CHALLIS	(WARM LAKE 15)	78.
ID	44.6760	-115.943	GOLD FORK HOT SPRING	127	53	28	null	12	CHALLIS	GOLD FORK 15	79.
ID	43.5610	-114.415	CLARENDON HOT SPRINGS	126	52	151	null	13	HAILEY	MAHONEY BUTTE 7.5	80.
ID	43.4230	-114.627	ELK CREEK HOT SPRING	126	52	138	null	15	HAILEY	BLAINE 15	81.
ID	44.5310	-116.754	FAIRCHILD HOT SPRING	126	52	null	null	8	BAKER	STURGILL PEAK 15	82.
ID	42.0320	-115.363	MURPHY HOT SPRINGS	126	52	169	103	7	TWIN FALLS	null	83.
ID	43.5530	-115.267	PARADISE HOT SPRINGS	126	52	129	null	22	HAILEY	FEATHERVILLE 7.5	84.
ID	45.0130	-113.605	SHARKEY HOT SPRING	126	52	60	106	2	DILLON	GOLDSTONE MTN. 15	85.
ID	43.3270	-113.918	CONDIE HOT SPRINGS	124	51	147	null	3	IDAHO FALLS	null	86.
ID	44.0540	-115.907	HOT SPRING CAMPGROUND	124	51	74	null	40	CHALLIS	GARDEN VALLEY 15	87.
ID	44.1450	-112.554	LIDY HOT SPRINGS	124	51	150	null	3	DUBOIS	LIDY HOT SPRINGS 7.5	88.
ID	43.6410	-114.487	WARFIELD HOT SPRING	124	51	143	null	9	HAILEY	GRIFFIN BUTTE 7.5	89.
ID	43.9820	-114.486	WEST PASS HOT SPRING	124	51	103	null	2	HAILEY	RYAN PEAK 7.5	90.
ID	43.7790	-115.486	BROWN CREEK HOT SPRING	122	50	117	null	9	HAILEY	(GRAND MTN. 7.5)	91.
ID	45.3440	-114.463	OWL CREEK HOT SPRINGS	122	50	51	104	3	ELK CITY	SHOUP 15	92.
ID	44.6280	-114.601	SHOWER BATH SPRINGS	122	50	58	null	11	CHALLIS	SHELDON PEAK 7.5	93.
ID	44.1710	-114.624	SLATE CREEK HOT SPRING	122	50	99	108	21	CHALLIS	LIVINGSTON CREEK 7.5	94.
ID	44.6260	-115.749	TRAIL CREEK HOT SPRING	122	50	30	null	17	CHALLIS	(WARM LAKE 15)	95.
ID	43.7180	-115.563	BASSET HOT SPRING	H	H	null	null	15	HAILEY	(SHEEP CREEK 7.5)	96.
ID	43.7010	-114.738	BIG SMOKEY HOT SPRING	H	H	132	null	6	HAILEY	BAKER PEAK 7.5	97.
ID	44.7700	-115.663	BILLY HOT SPRING	H	H	null	null	7	CHALLIS	WHITE ROCK PEAK 7.5	98.
ID	44.4300	-115.762	BULL CREEK HOT SPRINGS	H	H	39	null	24	CHALLIS	BOILING SPRINGS 15	99.
ID	44.5830	-116.112	CASCADE RESERVOIR HOT SPRING	H	H	null	null	7	BAKER	(CASCADE 15)	100.
ID	44.8960	-114.563	FORGE CREEK HOT SPRINGS	H	H	null	null	2	CHALLIS	YELLOWJACKET 7.5	101.
ID	44.4000	-115.820	GOAT HOT SPRINGS	H	H	35	null	25	CHALLIS	BOILING SPRINGS 15	102.
ID	44.1600	-115.167	GRANDJEAN HOT SPRING	H	H	null	null	33	CHALLIS	GRANDJEAN 7.5	103.

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ID	43.8170	-115.046	LEGGIT CREEK HOT SPRING	H	H	null	null	3	HAILEY	(ATLANTA EAST 7.5)	104.
ID	46.0060	-115.021	MARTEN HOT SPRINGS	H	H	8	null	4	HAMILTON	MINK PEAK 7.5	105.
ID	43.5880	-115.988	MORES CREEK HOT SPRING	H	H	null	null	21	HAILEY	(ARROWROCK DAM 7.5)	106.
ID	44.9510	-114.704	MORMON RANCH WARM SPRING	H	H	54	null	1	CHALLIS	APAREJO POINT 7.5	107.
ID	42.6370	-114.892	POISON SPRINGS	H	H	176	null	4	TWIN FALLS	BUHL 15	108.
ID	46.2350	-114.707	PROSPECTOR HOT SPRINGS	H	H	7	null	3	HAMILTON	(WAHOO PEAK 7.5)	109.
ID	43.8310	-115.192	QUEENS RIVER HOT SPRING	H	H	null	null	1	HAILEY	ATLANTA WEST 7.5	110.
ID	45.1700	-115.807	SECESH HOT SPRING	H	H	22	null	4	ELK CITY	(LOON LAKE 7.5)	111.
ID	44.6280	-115.197	SHEEPEATER HOT SPRINGS	H	H	null	null	16	CHALLIS	GREYHOUND RIDGE 15	112.
ID	46.1380	-115.090	STUART HOT SPRINGS	H	H	6	null	3	HAMILTON	BIG ROCK MTN. 7.5	113.
ID	44.5850	-115.072	SULPHUR CREEK HOT SPRING	H	H	null	null	19	CHALLIS	(GREYHOUND RIDGE 15)	114.
ID	44.5540	-115.301	SULPHUR CREEK HOT SPRING	H	H	43	null	21	CHALLIS	(CHINOOK MTN. 15)	115.

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MT	45.3670	-111.726	ENNIS HOT SPRINGS	181	83	null	129	5	BOZEMAN	(ENNIS 15)	1.
MT	46.1780	-112.794	WARM SPRINGS (STATE HOSPITAL)	172	78	15	null	6	BUTTE	ANACONDA NE 7.5	2.
MT	46.1980	-112.094	BOULDER HOT SPRINGS	169	76	19	125	5	BUTTE	BOULDER 15	3.
MT	45.6850	-112.295	SILVER STAR HOT SPRINGS	163	73	30	128	3	DILLON	(TWIN BRIDGES 15)	4.
MT	46.0440	-112.811	GREGSON HOT SPRINGS	158	70	17	126	8	BUTTE	ANACONDA 15	5.
MT	45.0900	-110.774	LADUKE (CORWIN) HOT SPRING	154	68	38	null	6	BOZEMAN	MINER 15	6.
MT	44.9840	-111.613	WOLF CREEK HOT SPRINGS	154	68	null	null	1	ASHTON	CLIFF LAKE 15	7.
MT	46.5960	-112.108	BROADWATER (HELENA) HOT SPRINGS	151	66	7	123	3	BUTTE	(HELENA 15)	8.
MT	45.7570	-110.256	HUNTERS HOT SPRINGS	140	60	36	null	1	BOZEMAN	HUNTERS HOT SPRINGS	9.
MT	45.3680	-113.403	JARDINE HOT SPRING	140	60	25	null	3	DILLON	JACKSON 7.5	10.
MT	46.4480	-111.982	ALHAMBRA HOT SPRINGS	138	59	18	124	1	WHITE SULPHUR	(CLANCY 15)	11.
MT	46.5470	-110.903	WHITE SULPHUR SPRINGS	136	58	24	null	1	WHITE SULPHUR	WHITE SULPHUR SPRINGS 7.5	12.
MT	45.8960	-112.233	PIPESTONE HOT SPRINGS	135	57	20	null	1	DILLON	DRY MOUNTAIN 7.5	13.
MT	45.6600	-111.186	BOZEMAN HOT SPRINGS	131	55	35	null	1	BOZEMAN	BOZEMAN 15	14.
MT	45.4620	-112.475	NEW BILTMORE HOT SPRINGS	127	53	null	null	4	DILLON	BEAVERHEAD ROCK 7.5	15.
MT	45.5750	-111.683	NORRIS HOT SPRINGS	127	53	32	127	4	BOZEMAN	NORRIS 15	16.
MT	45.6020	-111.900	POTOSI WARM SPRINGS	124	51	null	null	2	BOZEMAN	HARRISON 15	17.
MT	45.5900	-111.899	POTOSI HOT SPRINGS	122	50	31	null	3	BOZEMAN	HARRISON 15	18.
MT	45.7920	-112.126	RENOVA HOT SPRINGS	122	50	null	null	2	DILLON	(VENDOME 7.5)	19.
MT	46.1060	-114.004	SLEEPING CHILD HOT SPRINGS	122	50	12	null	2	HAMILTON	DEER MOUNTAIN 7.5	20.

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NM	35.9080	-106.615	SULPHUR SPRINGS	189	87	12	171	3	ALBUQUERQUE	VALLE SAN ANTONIO 7.5	1.
NM	35.7720	-106.690	JEMEZ SPRINGS	169	76	15	172	7	ALBUQUERQUE	JEMEZ SPRINGS 7.5	2.
NM	33.1080	-108.483	TURKEY CREEK HOT SPRING	165	74	29	null	15	CLIFTON	(CANYON HILL 7.5)	3.
NM	33.1990	-108.209	GILA HOT SPRINGS	151	66	30	null	12	CLIFTON	GILA HOT SPRINGS 7.5	4.
NM	33.2330	-108.235	SPRING (HOT)	149	65	27	null	10	CLIFTON	GILA HOT SPRINGS 7.5	5.
NM	33.2120	-108.228	null	149	65	null	null	11	CLIFTON	(GILA HOT SPRINGS 7.5)	6.
NM	35.6530	-105.290	MONTEZUMA HOT SPRINGS	138	59	20	null	1	SANTA FE	MONTEZUMA 7.5	7.
NM	32.7480	-107.836	MIMBRES HOT SPRINGS	136	58	34	null	3	LAS CRUCES	DWYER 15	8.
NM	32.5540	-107.994	FAYWOOD HOT SPRINGS	129	54	36	null	6	LAS CRUCES	DWYER 15	9.
NM	35.9380	-106.646	SAN ANTONIO HOT SPRING	129	54	10	null	2	ALBUQUERQUE	SEVEN SPRINGS 7.5	10.
NM	35.6460	-106.888	WARM SPRINGS	129	54	null	null	8	ALBUQUERQUE	HOLY GHOST SPRING 7.5	11.
NM	32.5010	-106.926	RADIUM SPRINGS	127	53	38	175	1	LAS CRUCES	SAN DIEGO MOUNTAIN 15	12.
NM	33.1920	-108.180	LYONS HUNTING LODGE HOT SPRINGS	126	52	31	null	13	CLIFTON	(GILA HOT SPRINGS 7.5)	13.
NM	35.5920	-106.753	INDIAN SPRINGS	123	51	17	null	10	ALBUQUERQUE	(SAN YSIDRO 7.5)	14.
NM	33.2370	-108.880	HOT SPRINGS	H	H	null	null	9	CLIFTON	WILSON MOUNTAIN 7.5	15.

State	Latitude	Longitude	"Popular" or USGS Spring Name	TF	TC	P.P. 492	Circ. 790	NOAA	AMS	State	Latitude
NV	39.5650	-118.856	(SODA LAKE AREA)	210	99	null	144	3	RENO	SODA LAKE 15	1.
NV	40.5670	-116.588	BEOWAWE HOT SPRINGS (THE GEYSERS)	208	98	77	162	9	WINNEMUCCA	DUNPHY 15	2.
NV	39.7870	-119.011	BRADYS HOT SPRINGS	209	98	72	147	4	RENO	FIREBALL RIDGE 15	3.
NV	40.6620	-119.365	GREAT BOILING SPRING (GERLACH)	208	98	38	137	8	LOVELOCK	GERLACH 15	4.
NV	40.1460	-119.673	THE NEEDLE ROCKS HOT SPRING	208	98	49	139	12	LOVELOCK	THE NEEDLE ROCKS 7.5	5.
NV	40.1410	-119.687	THE NEEDLE ROCKS HOT SPRINGS	208	98	49	139	13	LOVELOCK	THE NEEDLE ROCKS 7.5	6.
NV	40.6040	-117.648	LEACH HOT SPRINGS	207	97	64	154	9	WINNEMUCCA	LEACH HOT SPRINGS 15	7.
NV	39.9540	-117.917	FUMAROLES	204	96	70	null	2	MILLETT	(HUMBOLDT SALT MARSH 15)	8.
NV	39.3880	-119.743	STEAMBOAT SPRINGS	205	96	null	141	13	RENO	STEAMBOAT 7.5	9.
NV	39.3800	-119.740	STEAMBOAT SPRINGS	205	96	56	141	14	RENO	STEAMBOAT 7.5	10.
NV	40.5850	-115.285	SULPHUR HOT SPRINGS	205	96	null	169	6	ELKO	LAMOILLE 15	11.
NV	41.0030	-119.008	null	204	96	null	null	26	VYA	null	12.
NV	38.8220	-117.183	DARROUGHS HOT SPRINGS	203	95	118	161	3	TONOPAH	CARVERS 7.5	13.
NV	40.3890	-119.402	HOT SEEPS (SAN EMIDIO DESERT)	203	95	null	138	10	LOVELOCK	(KUMIVA PEAK 15)	14.
NV	39.1610	-119.183	WABUSKA HOT SPRINGS	201	94	62	142	17	RENO	WABUSKA 15	15.
NV	39.4840	-119.804	MOANA SPRINGS	199	93	55	140	8	RENO	MT. ROSE NE 7.5	16.
NV	41.3630	-118.788	PINTO HOT SPRINGS	199	93	null	132	13	VYA	PINTO MOUNTAIN 7.5	17.
NV	39.3160	-117.549	HOT SPRINGS	198	92	85	159	4	MILLETT	CARROLL SUMMIT SE 7.5	18.
NV	41.3570	-118.809	WEST PINTO HOT SPRING	198	92	null	132	14	VYA	PINTO MOUNTAIN 7.5	19.
NV	41.4680	-116.150	HOT SULPHUR SPRINGS (TUSCARORA)	194	90	null	164	1	MCDERMITT	TUSCARORA 15	20.
NV	40.9480	-119.002	null	194	90	null	134	2	LOVELOCK	null	21.
NV	40.6740	-119.364	null	194	90	null	137	7	LOVELOCK	(GERLACH 15)	22.
NV	40.8130	-115.778	ELKO HOT SPRING	190	88	32	166	3	ELKO	ELKO WEST 7.5	23.
NV	39.2080	-118.723	LEE HOT SPRINGS, ALLEN SPRINGS	190	88	74	143	7	RENO	ALLEN SPRINGS 15	24.
NV	40.2620	-119.379	BOILING SPRINGS	187	86	50	null	11	LOVELOCK	KUMIVA PEAK 15	25.
NV	40.7700	-119.113	BUTTE SPRINGS (TREGO HOT SPRINGS)	187	86	63	135	5	LOVELOCK	null	26.
NV	40.3160	-116.433	HOT SPRING	186	86	null	null	13	WINNEMUCCA	FRENCHIE CREEK 15	27.
NV	39.5970	-119.110	PATUA HOT SPRINGS (FERNLEY)	187	86	null	146	6	RENO	(TWO TIPS 15)	28.
NV	40.7610	-117.492	HOT SPRINGS	185	85	19	157	8	WINNEMUCCA	GOLDRUN CREEK 7.5	29.
NV	40.0880	-117.725	SOU (SEVEN DEVILS) HOT SPRINGS	185	85	68	153	19	WINNEMUCCA	CAIN MOUNTAIN 15	30.

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NV	40.6530	-119.378	MUD SPRINGS	184	84	39	137	9	LOVELOCK	(GERLACH 15)	31.
NV	38.7680	-119.174	WILSON HOT SPRING	183	84	null	null	6	WALKER LAKE	YERINGTON 15	32.
NV	41.9210	-118.709	BALTAZOR HOT SPRING	181	83	null	130	3	VYA	DENIO 15	33.
NV	39.3420	-118.578	BORAX SPRING	180	82	74	null	5	RENO	(CARSON LAKE 15)	34.
NV	40.8570	-119.328	FLY RANCH (WARDS) HOT SPRINGS	180	82	37	136	3	LOVELOCK	null	35.
NV	38.5210	-116.365	HOT CREEK RANCH HOT SPRING	180	82	null	null	7	TONOPAH	HOBBLE CANYON 7.5	36.
NV	39.9410	-116.681	HOT SPRINGS	180	82	92	null	3	MILLETT	WALTI HOT SPRINGS 15	37.
NV	39.0280	-117.136	MCLEOD RANCH HOT SPRING	180	82	114	null	6	MILLETT	MILLETT RANCH 15	38.
NV	41.0510	-119.028	DOUBLE HOT SPRINGS	178	81	12	133	21	VYA	null	39.
NV	40.0030	-117.718	HYDER HOT SPRINGS	176	80	69	null	23	WINNEMUCCA	CAIN MOUNTAIN 15	40.
NV	39.6650	-114.807	MONTE NEVA HOT SPRINGS	176	80	98	null	5	ELY	null	41.
NV	40.3680	-117.327	BUFFALO VALLEY HOT SPRINGS	174	79	78	158	13	WINNEMUCCA	BUFFALO SPRINGS 15	42.
NV	40.6990	-116.133	HOT SPRINGS (CARLIN)	174	79	null	165	4	WINNEMUCCA	(CARLIN 15)	43.
NV	41.0130	-119.010	null	172	78	null	null	25	VYA	null	44.
NV	40.4080	-117.883	KYLE HOT SPRINGS	171	77	66	152	12	WINNEMUCCA	KYLE HOT SPRINGS 15	45.
NV	41.0520	-118.717	MACFARLANE HOT SPRING	170	77	null	null	16	VYA	KING LEAR PEAK 15	46.
NV	40.9610	-117.494	GOLCONDA HOT SPRING (NORTH)	165	74	19	155	2	WINNEMUCCA	GOLCONDA 7.5	47.
NV	41.7220	-118.523	null	163	73	null	null	7	VYA	DUFFER PEAK 15	48.
NV	40.4180	-117.415	BUFFALO SPRINGS	162	72	null	null	11	WINNEMUCCA	BUFFALO SPRINGS 15	49.
NV	39.7970	-118.067	DIXIE HOT SPRINGS	162	72	71	149	2	RENO	DIXIE HOT SPRINGS 15	50.
NV	39.3280	-116.858	SPENCER HOT SPRINGS	162	72	86	160	10	MILLETT	SPENCER HOT SPRINGS	51.
NV	39.9040	-116.588	WALTI HOT SPRINGS	162	72	93	null	4	MILLETT	WALTI HOT SPRINGS 15	52.
NV	41.0220	-119.015	null	161	72	null	null	24	VYA	null	53.
NV	40.5780	-117.219	null	162	72	null	null	10	WINNEMUCCA	(ANTLER PEAK 15)	54.
NV	38.4640	-115.792	CHIMNEY WARM SPRING	160	71	127	null	11	LUND	THE WALL NE 7.5	55.
NV	38.9810	-119.833	WALLEYS HOT SPRINGS	160	71	60	null	1	WALKER LAKE	MINDEN 7.5	56.
NV	41.5670	-118.564	DYKE HOT SPRINGS	158	70	10	131	10	VYA	DUFFER PEAK 15	57.
NV	41.1080	-117.578	HOT SPRINGS	158	70	null	null	2	MCDERMITT	(BLISS 15)	58.
NV	39.4040	-116.347	KLOBE (BARTHOLOMAE) HOT SPRING	156	69	93	null	9	MILLETT	ANTELOPE PEAK 15	59.
NV	41.1470	-119.022	null	153	67	null	null	18	VYA	null	60.
NV	40.9540	-117.488	GOLCONDA HOT SPRING (SOUTH)	151	66	19	155	3	WINNEMUCCA	GOLCONDA 7.5	61.
NV	41.5760	-115.181	HOT CREEK SPRINGS	151	66	30	null	4	WELLS	HOT CREEK 15	62.
NV	41.1120	-119.002	null	151	66	null	null	20	VYA	null	63.
NV	40.2200	-116.068	BRUFFEYS HOT SPRINGS	149	65	90	null	15	WINNEMUCCA	MINERAL HILL 15	64.
NV	40.2490	-115.409	SMITH RANCH SPRINGS	149	65	34	null	7	ELKO	RUBY LAKE NW 7.5	65.

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NV	40.7650	-116.040	HOT SULPHUR SPRINGS	147	64	31	null	2	WINNEMUCCA	HUNTSMAN RANCH 7.5	66.
NV	41.8670	-114.692	SAN JACINTO RANCH SPRING	148	64	22	null	5	WELLS	(DELAPLAIN 15)	67.
NV	36.0020	-114.742	SPRING	145	63	null	null	7	LAS VEGAS	(HOOVER DAM 15)	68.
NV	38.1880	-116.373	WARM SPRINGS	145	63	125	null	11	TONOPAH	WARM SPRINGS 7.5	69.
NV	39.8830	-114.893	CHERRY CREEK HOT SPRINGS	144	62	95	170	2	ELY	null	70.
NV	38.8990	-119.410	NEVADA (HINDS) HOT SPRINGS	144	62	61	null	3	WALKER LAKE	WELLINGTON 15	71.
NV	38.9220	-118.198	WEDELL HOT SPRINGS	144	62	113	null	2	WALKER LAKE	null	72.
NV	38.4370	-116.277	HOT CREEK VALLEY SPRING	142	61	124	null	8	TONOPAH	(BLUE JAY SPRING 7.5)	73.
NV	41.1830	-114.991	HOT SPRINGS	142	61	30	null	12	WELLS	OXLEY PEAK 7.5	74.
NV	37.8250	-117.337	ALKALI HOT SPRING	140	60	112	null	3	GOLDFIELD	ALKALI 7.5	75.
NV	41.7880	-114.735	MINERAL HOT SPRING	140	60	22	167	6	WELLS	(DELAPLAIN 15)	76.
NV	40.4170	-116.507	CRESCENT VALLEY HOT SPRINGS	138	59	null	163	10	WINNEMUCCA	CRESCENT VALLEY 15	77.
NV	40.4040	-116.517	CRESCENT VALLEY HOT SPRINGS	138	59	88	163	11	WINNEMUCCA	CRESCENT VALLEY 15	78.
NV	39.0310	-116.666	DIANAS PUNCH BOWL	138	59	null	null	14	MILLETT	DIANAS PUNCH BOWL 15	79.
NV	41.4120	-114.675	WINE CUP RANCH SPRINGS	138	59	null	null	7	WELLS	WINE CUP RANCH 7.5	80.
NV	40.9720	-119.007	BLACK ROCK HOT SPRING	136	58	16	134	1	LOVELOCK	null	81.
NV	40.6030	-116.463	HORSESHOE RANCH SPRINGS	136	58	88	null	7	WINNEMUCCA	(BEOWAWE 15)	82.
NV	40.9220	-117.108	HOT POT (BLOSSOM HOT SPRINGS)	136	58	19	156	4	WINNEMUCCA	HOT POT 7.5	83.
NV	41.3780	-119.182	SPRINGS (HOT)	136	58	null	null	7	VYA	SOLDIER MEADOW 7.5	84.
NV	40.1780	-117.496	HOME STATION RANCH HOT SPRING	135	57	null	null	18	WINNEMUCCA	MT. MOSES 15	85.
NV	41.7210	-118.505	HOWARD HOT SPRING	135	57	null	null	8	VYA	DUFFER PEAK 15	86.
NV	41.4210	-117.388	THE HOT SPRINGS	135	57	11	null	1	MCDERMITT	HOT SPRINGS PEAK 15	87.
NV	39.2860	-119.840	BOWERS MANSION HOT SPRING	133	56	57	null	15	RENO	WASHOE CITY 7.5	88.
NV	40.8190	-115.777	HOT HOLE	133	56	null	166	2	ELKO	ELKO WEST 7.5	89.
NV	41.3570	-119.188	SPRINGS (HOT)	133	56	null	null	9	VYA	MUD MEADOW 7.5	90.
NV	41.9250	-118.805	BOG HOT SPRINGS	131	55	2	null	2	VYA	RAILROAD POINT 15	91.
NV	41.8090	-118.861	PAINTED HILLS MINE	131	55	null	null	4	VYA	(RAILROAD POINT 15)	92.
NV	40.1830	-117.102	HOT SPRINGS RANCH	129	54	81	null	17	WINNEMUCCA	THE CEDARS 15	93.
NV	41.6470	-115.775	WILD HORSE HOT SPRINGS	129	54	null	null	3	WELLS	WILD HORSE 15	94.
NV	41.3830	-119.187	null	130	54	null	null	6	VYA	(SOLDIER MEADOW 7.5)	95.
NV	39.4200	-119.738	DIMONTE SPRING	127	53	55	null	12	RENO	(STEAMBOAT 7.5)	96.
NV	40.1910	-117.107	HOT SPRINGS	127	53	null	null	16	WINNEMUCCA	THE CEDARS 15	97.

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NV	40.1980	-117.103	HOT SPRINGS	127	53	80	null	15	WINNEMUCCA	THE CEDARS 15	98.
NV	41.3530	-119.216	SPRING (HOT)	127	53	null	null	11	VYA	MUD MEADOW 7.5	99.
NV	41.3390	-119.192	SPRINGS (HOT)	127	53	null	null	12	VYA	MUD MEADOW 7.5	100.
NV	38.9520	-115.230	WILLIAMS HOT SPRING	127	53	103	null	1	LUND	null	101.
NV	41.2610	-115.305	HOT SPRINGS	126	52	28	null	5	WELLS	HOT SPRINGS CREEK 7.5	102.
NV	39.0410	-116.663	HOT SPRING	124	51	null	null	13	MILLETT	DIANAS PUNCH BOWL 15	103.
NV	40.6730	-116.838	HOT SPRINGS	122	50	null	null	6	WINNEMUCCA	BATTLE MOUNTAIN 15	104.
NV	39.0580	-119.742	SARATOGA HOT SPRING	122	50	null	null	21	RENO	MC TARNAHAN HILL 7.5	105.
NV	41.3650	-119.221	SPRING (HOT)	122	50	null	null	8	VYA	MUD MEADOW 7.5	106.
NV	41.1590	-114.986	THREEMILE SPRING, SULPHUR HOT SPR	122	50	30	168	13	WELLS	OXLEY PEAK 7.5	107.
NV	39.9950	-117.854	SENATOR FUMAROLES	B	B	null	null	1	MILLETT	(HUMBOLDT SALT MARSH 15)	108.
NV	39.8660	-118.017	DIXIE COMSTOCK MINE	H	H	null	null	1	RENO	DIXIE HOT SPRINGS 15	109.
NV	39.7330	-119.039	EAGLE SALT WORKS SPRING	H	H	73	null	5	RENO	(TWO TIPS 15)	110.
NV	41.1480	-116.733	HOT LAKE	H	H	null	null	3	MCDERMITT	SQUAW VALLEY RANCH 7.5	111.
NV	41.1750	-115.278	HOT SPRING	H	H	29	null	7	WELLS	TWIN BUTTES 7.5	112.
NV	41.1450	-114.994	HOT SPRING	H	H	null	null	14	WELLS	OXLEY PEAK 7.5	113.
NV	38.8590	-119.175	HOT SPRING	H	H	null	null	4	WALKER LAKE	YERINGTON 15	114.
NV	39.8930	-116.649	LITTLE HOT SPRINGS	H	H	null	null	5	MILLETT	WALTI HOT SPRINGS 15	115.
NV	39.5590	-117.427	PETERSONS MILL HOT SPRING	H	H	null	null	3	MILLETT	MOUNT AIRY 7.5	116.
NV	39.2810	-118.420	SAND SPRINGS	H	H	75	null	6	RENO	FOURMILE FLAT 7.5	117.
NV	40.8640	-117.349	SULPHUR SPRING	H	H	null	null	6	WINNEMUCCA	BROOKS SPRING 7.5	118.
NV	41.1750	-119.957	null	H	H	36	null	17	VYA	null	119.
NV	39.2420	-116.880	null	H	H	87	null	11	MILLETT	(WILDCAT PEAK 15)	120.
NV	38.8600	-116.738	null	H	H	null	null	1	TONOPAH	(MOSQUITO CREEK 7.5)	121.

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OR	42.3380	-118.602	HOT SPRINGS	207	97	69	198	6	ADEL	BORAX LAKE 7.5	1.
OR	42.2210	-120.368	HUNTERS HOT SPRINGS	205	96	45	189	7	KLAMATH FALLS	LAKEVIEW NE 7.5	2.
OR	44.7820	-121.975	BREITENBUSH HOT SPRINGS	198	92	6	179	3	BEND	BREITENBUSH HOT SPRINGS 15	3.
OR	42.2190	-119.877	WARNER VALLEY RANCH	198	92	49	null	6	ADEL	(ADEL 7.5)	4.
OR	45.3720	-121.697	MOUNT HOOD FUMAROLES	194	90	1	177	1	THE DALLES	(MOUNT HOOD SOUTH 7.5)	5.
OR	42.1560	-120.345	BARRY RANCH HOT SPRINGS	190	88	47	189	9	KLAMATH FALLS	LAKEVIEW NE 7.5	6.
OR	44.0230	-117.460	NEAL HOT SPRINGS	189	87	75	203	7	BAKER	JAMIESON 15	7.
OR	45.0210	-122.009	AUSTIN HOT SPRINGS	186	86	4	178	1	VANCOUVER	FISH CREEK MTN. 15	8.
OR	42.6760	-118.344	MICKEY SPRINGS	187	86	null	196	4	ADEL	null	9.
OR	44.1530	-122.098	FOLEY SPRINGS	178	81	19	182	4	SALEM	MCKENZIE BRIDGE 15	10.
OR	45.2440	-117.958	HOT LAKE SPRINGS	176	80	11	null	3	GRANGEVILLE	CRAIG MOUNTAIN 7.5	11.
OR	42.5440	-118.533	ALVORD HOT SPRINGS	174	79	68	197	5	ADEL	ALVORD HOT SPRINGS 7.5	12.
OR	43.4410	-118.638	CRANE HOT SPRINGS	172	78	53	null	11	BURNS	CRANE 15	13.
OR	42.2260	-119.881	CRUMP GEYSER (CRUMP SPRING)	172	78	49	190	5	ADEL	ADEL 7.5	14.
OR	43.7270	-117.203	SNIVELY HOT SPRING	170	77	null	null	7	BOISE	OWYHEE DAM 7.5	15.
OR	42.1740	-121.615	OLENE GAP HOT SPRINGS	165	74	28	187	4	KLAMATH FALLS	(MERRILL 15)	16.
OR	43.8580	-118.544	null	165	74	null	null	3	BURNS	(VAN 15)	17.
OR	43.7080	-122.288	MCCREDIE SPRINGS	163	73	22	183	2	ROSEBURG	OAKRIDGE 15	18.
OR	43.9820	-117.233	VALE HOT SPRINGS	163	73	77	204	1	BOISE	(VALE EAST 7.5)	19.
OR	42.1620	-120.344	LEITHEAD HOT SPRING	162	72	46	189	8	KLAMATH FALLS	LAKEVIEW NE 7.5	20.
OR	44.1930	-122.049	BELKNAP SPRINGS	160	71	18	181	3	SALEM	MCKENZIE BRIDGE 15	21.
OR	43.8930	-117.501	null	158	70	76	202	3	BOISE	(HARPER 15)	22.
OR	42.2970	-119.776	FISHER HOT SPRINGS	154	68	49	191	3	ADEL	CRUMP LAKE 7.5	23.
OR	43.1850	-119.058	null	154	68	64	193	17	BURNS	null	24.
OR	43.4690	-118.202	LUCE HOT SPRINGS	145	63	84	195	10	BURNS	MCEWEN BUTTE 7.5	25.
OR	43.7190	-121.209	EAST LAKE HOT SPRINGS	144	62	33	184	2	CRESCENT	null	26.
OR	43.7630	-117.156	MITCHELL BUTTE HOT SPRING	144	62	79	null	5	BOISE	MITCHELL BUTTE 7.5	27.
OR	43.6460	-118.251	null	144	62	54	null	9	BURNS	(UPTON MOUNTAIN 7.5)	28.
OR	44.2410	-122.058	BIGELOW HOT SPRINGS	142	61	null	null	2	SALEM	(MCKENZIE BRIDGE 15)	29.
OR	45.1510	-118.659	LEHMAN SPRINGS	142	61	8	null	2	PENDLETON	LEHMAN SPRINGS 7.5	30.
OR	42.1160	-121.287	OREGON HOT SPRINGS (BIG HOT SPRING)	142	61	29	null	7	KLAMATH FALLS	MALIN 15	31.
OR	43.9440	-118.136	BEULAH HOT SPRINGS	140	60	74	null	1	BURNS	BEULAH 15	32.
OR	45.0180	-117.625	MEDICAL HOT SPRINGS	140	60	12	201	5	GRANGEVILLE	FLAGSTAFF BUTTE 7.5	33.
OR	44.9360	-122.173	BAGBY HOT SPRINGS	136	58	5	null	1	SALEM	BATTLE AX 15	34.

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OR	44.3540	-118.574	BLUE MOUNTAIN HOT SPRINGS	136	58	16	null	3	CANYON CITY	PRAIRIE CITY 15	35.
OR	44.9270	-117.939	RADIUM HOT SPRINGS	135	57	17	null	1	BAKER	HAINES 7.5	36.
OR	42.1880	-118.383	FLAGSTAFF BUTTE HOT SPRING	126	52	72	199	10	ADEL	null	37.
OR	44.8620	-121.201	KAHNEETA HOT SPRINGS	126	52	7	180	2	BEND	EAGLE BUTTE 7.5	38.
OR	44.8670	-121.228	SPRINGS	125	52	7	null	1	BEND	EAGLE BUTTE 7.5	39.
OR	42.0790	-117.760	null	126	52	86	200	5	JORDAN VALLEY	null	40.
OR	44.2080	-117.455	JAMIESON HOT SPRINGS	H	H	73	null	5	BAKER	(JAMIESON 15)	41.
OR	45.2060	-117.912	UNION STATION HOT SPRINGS	H	H	null	null	4	GRANGEVILLE	CRAIG MOUNTAIN 7.5	42.
OR	43.2150	-117.502	null	H	H	84	null	11	BOISE	(THE HOLE IN THE GROUND 7.	43.
OR	43.0730	-117.697	null	H	H	null	null	12	BOISE	(LAMBERT ROCKS 7.5)	44.
OR	43.5890	-117.326	null	H	H	83	null	9	BOISE	(THE ELBOW 7.5)	45.

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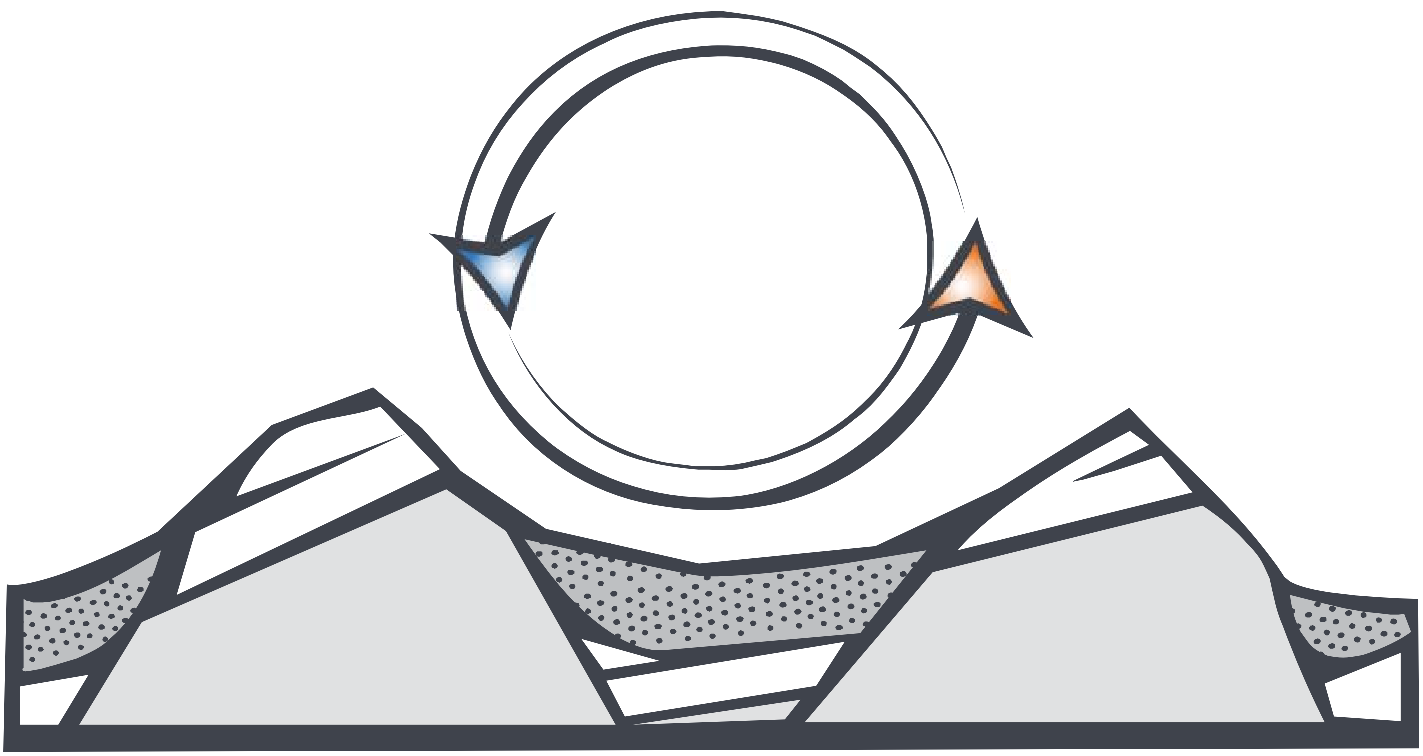
UT	40.4880	-111.911	CRYSTAL HOT SPRINGS	187	86	13	null	9	SALT LAKE CITY	JORDAN NARROWS 7.5	1.
UT	38.1860	-113.197	THERMO HOT SPRINGS	185	85	52	210	2	RICHFIELD	THERMO 15	2.
UT	38.1720	-113.204	THERMO HOT SPRINGS	181	83	52	210	3	RICHFIELD	THERMO 15	3.
UT	39.6130	-112.729	BAKER (ABRAHAM, CRATER) HOT SPRINGS	180	82	24	205	3	DELTA	BAKER HOT SPRINGS 7.5	4.
UT	38.6390	-112.098	RED HILL HOT SPRING	171	77	null	206	7	RICHFIELD	MONROE 15	5.
UT	38.6330	-112.107	MONROE (COOPER) HOT SPRINGS	169	76	48	206	8	RICHFIELD	MONROE 15	6.
UT	38.6130	-112.202	JOSEPH HOT SPRINGS	147	64	49	207	9	RICHFIELD	MONROE 15	7.
UT	39.9060	-113.430	WILSON HEALTH SPRINGS	142	61	20	null	1	DELTA	FISH SPRINGS NW 7.5	8.
UT	41.1380	-112.175	HOOPER HOT SPRINGS	140	60	null	null	14	BRIGHAM CITY	OGDEN BAY 7.5	9.
UT	41.3380	-112.031	UTAH HOT SPRINGS	138	59	6	null	11	BRIGHAM CITY	PLAIN CITY 7.5	10.
UT	41.2360	-111.924	OGDEN HOT SPRING	135	57	8	null	3	OGDEN	OGDEN 7.5	11.
UT	40.8150	-111.918	BECKS HOT SPRING	133	56	11	null	1	SALT LAKE CITY	SALT LAKE CITY NORTH 7.5	12.
UT	38.5030	-112.849	ROOSEVELT HOT SPRINGS	133	56	51	209	12	RICHFIELD	(PINNACLE PASS 7.5)	13.
UT	41.6590	-112.087	CRYSTAL (MADSENS) HOT SPRINGS	129	54	4	null	6	BRIGHAM CITY	HONEYVILLE 7.5	14.
UT	41.8550	-112.158	UDY HOT SPRINGS	124	51	3	null	2	BRIGHAM CITY	RIVERSIDE 7.5	15.

State	Latitude	Longitude	"Popular" or USGS Spring Name	TF	TC	P.P. 492	Circ. 790	NOAA	AMS	State	Latitude
WA	48.7700	-121.813	SHERMAN CRATER FUMAROLES	266	130	null	null	2	CONCRETE	(MT. BAKER 15)	1.
WA	48.7890	-121.804	DORR FUMAROLE FIELD	194	90	null	null	1	CONCRETE	(MT. BAKER 15)	2.
WA	46.1980	-122.197	MT ST HELENS FUMAROLES	190	88	12	null	2	HOQUIAM	(MOUNT ST. HELENS 15)	3.
WA	46.8520	-121.758	MT RAINIER FUMAROLES	162	72	null	null	1	YAKIMA	(MT. RAINIER WEST 7.5)	4.
WA	46.2020	-121.492	MOUNT ADAMS FUMAROLES	150	66	12	null	6	YAKIMA	(MOUNT ADAMS EAST 7.5)	5.
WA	48.1500	-121.062	GAMMA HOT SPRINGS	140	60	null	213	5	CONCRETE	GLACIER PEAK 15	6.
WA	47.4840	-121.391	GOLDMEYER HOT SPRINGS	127	53	8	null	3	WENATCHEE	SNOQUALMIE PASS 15	7.
WA	45.7010	-121.728	COLLINS HOT SPRINGS	122	50	null	null	4	THE DALLES	(HOOD RIVER 15)	8.
WA	48.9740	-119.475	HOT LAKE	122	50	null	null	1	OKANOGAN	OROVILLE 15	9.
WA	46.7380	-121.562	OHANAPECOSH HOT SPRINGS	122	50	11	214	3	YAKIMA	PACKWOOD 15	10.
WA	48.9060	-119.455	POISON LAKE	122	50	null	null	2	OKANOGAN	(OROVILLE 15)	11.
WA	47.7070	-121.155	SCENIC HOT SPRINGS	122	50	7	null	2	WENATCHEE	(SCENIC 7.5)	12.
WA	47.9690	-123.864	SOL DUC HOT SPRINGS	122	50	2	null	2	SEATTLE	BOGACHIEL PEAK 7.5	13.
WA	45.7230	-121.927	ROCK CREEK HOT SPRINGS	H	H	null	null	3	THE DALLES	BONNEVILLE DAM 15	14.

State	Latitude	Longitude	"Popular" or USGS Spring Name	TF	TC	P.P. 492	Circ. 790	NOAA	AMS	State	Latitude
WY	44.5440	-110.788	BLACK WARRIOR GROUP, SHELF SPRING	205	96	null	215	87	ASHTON	MADISON JUNCTION 15	1.
WY	44.5660	-110.871	FLAT CONE SPRING, STEEP CONE	205	96	null	215	78	ASHTON	MADISON JUNCTION 15	2.
WY	44.5710	-110.811	MORNING MIST SPRINGS	205	96	19	215	76	ASHTON	MADISON JUNCTION 15	3.
WY	44.5630	-110.834	RIVER GROUP	205	96	18	215	81	ASHTON	MADISON JUNCTION 15	4.
WY	44.5200	-110.828	FLOOD GROUP	203	95	26	215	97	ASHTON	MADISON JUNCTION 15	5.
WY	44.5680	-110.805	QUAGMIRE GROUP	203	95	null	215	77	ASHTON	MADISON JUNCTION 15	6.
WY	44.5370	-110.801	WHITE DOME GEYSER, SURPRISE POOL	203	95	22	215	90	ASHTON	MADISON JUNCTION 15	7.
WY	44.9080	-110.393	CALCITE SPRINGS	201	94	65	215	3	ASHTON	TOWER JUNCTION 15	8.
WY	44.5430	-110.859	FAIRY SPRINGS	201	94	20	215	89	ASHTON	MADISON JUNCTION 15	9.
WY	44.5540	-110.812	FOUNTAIN GROUP	201	94	null	215	83	ASHTON	MADISON JUNCTION 15	10.
WY	44.6910	-110.728	GEYSER SPRINGS GROUP	201	94	15	215	45	ASHTON	NORRIS JUNCTION 15	11.
WY	44.7220	-110.708	null	201	94	null	215	31	ASHTON	NORRIS JUNCTION 15	12.
WY	44.6930	-110.738	ARTISTS PAINTPOTS	199	93	14	215	44	ASHTON	NORRIS JUNCTION 15	13.
WY	44.7330	-110.703	CISTERN SPRING	199	93	null	215	28	ASHTON	(NORRIS JUNCTION 15)	14.
WY	44.5260	-110.835	EXCELSIOR GEYSER CRATER	199	93	25	215	95	ASHTON	MADISON JUNCTION 15	15.
WY	44.6970	-110.724	GIBBON HILL GEYSER	199	93	13	215	42	ASHTON	NORRIS JUNCTION 15	16.
WY	44.6900	-110.384	HOT SPRINGS ON BOG CREEK	199	93	79	215	47	ASHTON	CANYON VILLAGE 15	17.
WY	44.7390	-110.324	JOSEPHS COAT SPRINGS	199	93	72	215	24	ASHTON	CANYON VILLAGE 15	18.
WY	44.5660	-110.816	null	199	93	null	215	79	ASHTON	MADISON JUNCTION 15	19.
WY	44.6790	-110.746	BERYL SPRING	198	92	16	215	50	ASHTON	NORRIS JUNCTION 15	20.
WY	44.7610	-110.730	BIJAH SPRING	198	92	9	215	14	ASHTON	MAMMOTH 15	21.
WY	44.7430	-110.242	HOT SPRING BASIN GROUP	198	92	75	215	21	ASHTON	PELICAN CONE 15	22.
WY	44.5180	-110.813	HOT SPRINGS, RABBIT CREEK GROUP	198	92	26	215	98	ASHTON	MADISON JUNCTION 15	23.
WY	44.6840	-110.753	MONUMENT GEYSER BASIN	197	92	16	215	48	ASHTON	MADISON JUNCTION 15	24.
WY	44.5140	-110.828	RABBIT CREEK GROUP	198	92	null	215	99	ASHTON	MADISON JUNCTION 15	25.
WY	44.7860	-110.740	SEMI-CENTENNIAL GEYSER	198	92	7	215	8	ASHTON	MAMMOTH 15	26.
WY	44.5300	-110.297	STEAMBOAT SPRINGS	198	92	95	215	93	ASHTON	CANYON VILLAGE 15	27.
WY	44.5440	-110.258	TURBID SPRINGS	198	92	94	215	88	ASHTON	CANYON VILLAGE 15	28.
WY	44.7970	-110.725	AMPHITHEATER SPRINGS	196	91	7	215	7	ASHTON	MAMMOTH 15	29.

State	Latitude	Longitude	"Popular" or USGS Spring Name	TF	TC	P.P. 492	Circ. 790	NOAA	AMS	State	Latitude
WY	44.7560	-110.308	COFFEE POT HOT SPRINGS	196	91	73	215	15	ASHTON	TOWER JUNCTION 15	30.
WY	44.5910	-110.321	HOT SPRINGS AT SULPHUR HILLS	196	91	89	215	72	ASHTON	CANYON VILLAGE 15	31.
WY	44.5560	-110.832	RIVER GROUP	196	91	null	215	82	ASHTON	MADISON JUNCTION 15	32.
WY	44.7660	-110.429	WASHBURN HOT SPRINGS	196	91	50	215	12	ASHTON	TOWER JUNCTION 15	33.
WY	44.6810	-110.326	HOT SPRINGS ON UPPER SOUR CREEK	194	90	null	215	49	ASHTON	CANYON VILLAGE 15	34.
WY	44.5320	-110.796	FIVE SISTERS SPRINGS	192	89	null	215	92	ASHTON	MADISON JUNCTION 15	35.
WY	44.5320	-110.874	IMPERIAL GEYSER, SPRAY GEYSER	192	89	24	215	91	ASHTON	MADISON JUNCTION 15	36.
WY	44.5640	-110.869	QUEENS LAUNDRY	192	89	17	215	80	ASHTON	MADISON JUNCTION 15	37.
WY	44.6530	-110.482	SULPHUR SPRINGS	194	89	61	215	57	ASHTON	CANYON VILLAGE 15	38.
WY	44.7020	-110.767	SYLVAN SPRINGS	192	89	12	215	40	ASHTON	MADISON JUNCTION 15	39.
WY	44.7280	-110.701	null	192	89	null	215	29	ASHTON	NORRIS JUNCTION 15	40.
WY	44.7690	-110.269	RAINBOW SPRINGS	190	88	null	215	11	ASHTON	TOWER JUNCTION 15	41.
WY	44.6280	-110.433	SULPHUR CALDRON	190	88	61	215	61	ASHTON	CANYON VILLAGE 15	42.
WY	44.7520	-110.418	HOT SPRINGS AT SEVENMILE HOLE	189	87	52	215	18	ASHTON	TOWER JUNCTION 15	43.
WY	44.5210	-110.275	BUTTE SPRINGS	187	86	96	215	96	ASHTON	CANYON VILLAGE 15	44.
WY	44.7330	-110.712	HORSESHOE SPRING	187	86	null	215	27	ASHTON	(NORRIS JUNCTION 15)	45.
WY	44.6900	-110.750	null	187	86	null	215	46	ASHTON	NORRIS JUNCTION 15	46.
WY	44.7220	-110.701	ECHINUS GEYSER	185	85	11	215	32	ASHTON	NORRIS JUNCTION 15	47.
WY	44.6970	-110.375	HOT SPRINGS ON BOG CREEK	185	85	79	215	43	ASHTON	CANYON VILLAGE 15	48.
WY	44.5290	-110.791	WHITE CREEK GROUP	185	85	null	215	94	ASHTON	(MADISON JUNCTION 15)	49.
WY	44.2440	-111.022	BOUNDARY CREEK HOT SPRINGS	181	83	null	215	1	ASHTON	WARM RIVER BUTTE 15	50.
WY	44.6710	-110.290	PONUNTPA SPRINGS GROUP	180	82	83	215	53	ASHTON	CANYON VILLAGE 15	51.
WY	44.7140	-110.475	null	167	75	null	215	35	ASHTON	CANYON VILLAGE 15	52.
WY	44.9670	-110.708	MAMMOTH HOT SPRINGS	163	73	2	215	2	ASHTON	MAMMOTH 15	53.
WY	43.9580	-110.696	JACKSON LAKE HOT SPRINGS	162	72	null	null	1	DRIGGS	(COLTER BAY 7.5)	54.
WY	44.7530	-110.724	ROADSIDE SPRINGS, FRYING PAN SPRING	158	70	9	215	17	ASHTON	MAMMOTH 15	55.
WY	44.5980	-110.236	HOT SPRINGS IN PELICAN VALLEY	156	69	null	215	70	ASHTON	PELICAN CONE 15	56.
WY	44.7540	-110.403	SEVENMILE HOLE	154	68	null	215	16	ASHTON	(TOWER JUNCTION 15)	57.
WY	44.7390	-110.258	HOT SPRING BASIN GROUP	153	67	75	215	25	ASHTON	CANYON VILAGE 15	58.

State	Latitude	Longitude	"Popular" or USGS Spring Name	TF	TC	P.P. 492	Circ. 790	NOAA	AMS	State	Latitude
WY	42.8280	-110.999	AUBURN HOT SPRINGS	144	62	103	218	1	PRESTON	null	59.
WY	44.7810	-110.699	WHITEROCK SPRINGS	144	62	8	215	10	ASHTON	MAMMOTH 15	60.
WY	44.7200	-110.715	null	144	62	null	215	33	ASHTON	NORRIS JUNCTION 15	61.
WY	44.5820	-110.314	VERMILION SPRINGS	140	60	91	215	74	ASHTON	CANYON VILLAGE 15	62.
WY	44.5880	-110.341	EBRO SPRINGS	136	58	90	215	73	ASHTON	CANYON VILLAGE 15	63.
WY	44.5500	-110.805	FOUNTAIN PAINT POT	136	58	21	215	86	ASHTON	MADISON JUNCTION 15	64.
WY	44.9850	-110.689	HOT RIVER	136	58	1	215	1	ASHTON	MAMMOTH 15	65.
WY	43.6540	-108.194	THERMOPOLIS HOT SPRINGS	133	56	111	null	1	THERMOPOLIS	THERMOPOLIS 7.5	66.
WY	44.6250	-110.433	MUD VOLCANO	131	55	61	215	62	ASHTON	CANYON VILLAGE 15	67.
WY	42.5450	-106.725	ALCOVA HOT SPRINGS	129	54	113	null	1	CASPER	(ALCOVA 7.5)	68.
WY	41.4500	-106.804	SARATOGA HOT SPRINGS	129	54	115	null	1	RAWLINS	SARATOGA 7.5	69.
WY	44.7110	-110.741	CHOCOLATE POTS	124	51	null	215	36	ASHTON	NORRIS JUNCTION 15	70.
WY	44.8420	-110.732	APOLLINARIS SPRING	H	H	null	215	4	ASHTON	MAMMOTH 15	71.
WY	44.5530	-110.301	BEACH SPRINGS	H	H	93	215	84	ASHTON	CANYON VILLAGE 15	72.
WY	44.7080	-110.461	FOREST SPRINGS	H	H	54	215	39	ASHTON	CANYON VILLAGE 15	73.
WY	44.7500	-110.714	GAS VENT	H	H	null	215	20	ASHTON	MAMMOTH 15	74.
WY	44.6120	-110.618	GAS VENT	H	H	null	215	65	ASHTON	NORRIS JUNCTION 15	75.
WY	44.7410	-110.699	GAS VENT	H	H	null	215	23	ASHTON	NORRIS JUNCTION 15	76.
WY	44.6010	-110.632	GAS VENT EAST OF MARY LAKE	H	H	null	215	68	ASHTON	NORRIS JUNCTION 15	77.
WY	44.7150	-110.555	GAS VENTS	H	H	null	215	34	ASHTON	NORRIS JUNCTION 15	78.
WY	44.8250	-110.675	GAS VENTS AT HORSESHOE HILL	H	H	null	215	6	ASHTON	MAMMOTH 15	79.
WY	44.5950	-110.622	GAS VENTS SOUTHEAST OF MARY LAKE	H	H	null	215	71	ASHTON	NORRIS JUNCTION 15	80.
WY	44.6160	-110.616	HIGHLAND HOT SPRINGS	H	H	57	215	64	ASHTON	NORRIS JUNCTION 15	81.
WY	44.7520	-110.256	HOT SPRING	H	H	null	215	19	ASHTON	TOWER JUNCTION 15	82.
WY	44.6420	-110.238	HOT SPRING	H	H	null	215	58	ASHTON	PELICAN CONE 15	83.
WY	44.7660	-110.300	HOT SPRINGS	H	H	null	215	13	ASHTON	TOWER JUNCTION 15	84.
WY	44.5720	-110.691	HOT SPRINGS	H	H	27	215	75	ASHTON	NORRIS JUNCTION 15	85.
WY	44.6100	-110.438	HOT SPRINGS	H	H	null	215	66	ASHTON	CANYON VILLAGE 15	86.
WY	44.6670	-110.282	HOT SPRINGS	H	H	null	215	54	ASHTON	CANYON VILLAGE 15	87.
WY	44.6720	-110.236	HOT SPRINGS	H	H	null	215	51	ASHTON	PELICAN CONE 15	88.
WY	44.7110	-110.468	HOT SPRINGS	H	H	null	215	37	ASHTON	CANYON VILLAGE 15	89.
WY	44.6070	-110.617	HOT SPRINGS EAST OF MARY LAKE	H	H	59	215	67	ASHTON	NORRIS JUNCTION 15	90.
WY	44.6170	-110.432	MUD GEYSERS	H	H	61	215	63	ASHTON	CANYON VILLAGE 15	91.
WY	44.5510	-110.850	SPRINGS ON FAIRY CREEK	H	H	null	215	85	ASHTON	MADISON JUNCTION 15	92.
WY	44.7810	-110.738	STEAM VENTS AT ROARING MOUNTAIN	H	H	null	215	9	ASHTON	MAMMOTH 15	93.
WY	44.6340	-110.234	THE MUDKETTLES	H	H	87	215	59	ASHTON	PELICAN CONE 15	94.
WY	44.6340	-110.226	THE MUSHPOTS	H	H	88	215	60	ASHTON	PELICAN CONE 15	95.
WY	44.6560	-110.572	VIOLET SPRINGS	H	H	56	215	56	ASHTON	NORRIS JUNCTION 15	96.



Appendix G

Ecoregion Divisions

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APPENDIX G
ECOREGION DIVISIONS

The descriptions in this appendix were adapted from the United States Forest Service "Description of Ecoregions of the United States," compiled by Roger G. Bailey in 1995 with the exception of the ecoregions unique to Alaska which were adapted from "Description of Ecological Subregions: Sections of the Conterminous United States," compiled by W. H. McNab, D. T. Cleland, J. A. Freeouf, J. E. Keys, Jr., G. J. Nowacki, and C. A. Carpenter in 2007.

POLAR DOMAIN

Arctic Division

The northern continental fringes of North America, from the Arctic Circle northward to about the 75th parallel, lie within the outer zone of control of arctic air masses. This produces the arctic climate. The average temperature of the warmest month lies between 50F (10C) and 32F (0C).

The arctic climate has a very short, cool summer and a long, severe winter. No more than 188 days per year, and sometimes as few as 55, have a mean temperature higher than 32F (0C). Annual precipitation is light, often less than 8 inches (200 mm), but because potential evaporation is also very low, the climate is humid.

Vegetation on the tundra consists of grasses, sedges, lichens, and willow shrubs. As one moves south, the vegetation changes into birch-lichen woodland, and then into needleleaf forest. In some places, a distinct tree line separates forest from tundrauses this line, which coincides approximately with the 50F (10C) isotherm of the warmest month, as a boundary between subarctic and arctic climates.

Wildlife species in arctic habitats fall into three categories: 1) resident species that remain active year-round, 2) resident species hibernating in winter such as the polar bear, and 3) migratory species present for only a portion of the year. Resident species that remain active year-round include the willow ptarmigan, common raven, snowy owl, Arctic fox, brown lemming, muskoxen, and caribou. Hibernating species include the Arctic ground squirrel, and hoary marmot. The great majority of the approximately 100 bird species using the arctic are migratory.

Except for the wood frog, there are no amphibians or reptiles in the Arctic Ecoregion. Because they are cold-blooded animals, the climate is too cold for these groups. Wood frogs are unique in that they partially freeze in winter; up to one-third of the water in a wood frog's body may turn to ice for a period of several weeks.

The arctic has low species diversity; arctic insect fauna, for example, is only one percent to five percent as rich in species as the insect fauna found at temperate latitudes. Wildlife populations are also constrained by the low plant productivity, and can fluctuate greatly in response to annual changes in plant productivity. Animal population peaks can markedly alter vegetation and other habitat features in some instances, leading to sharp declines in population numbers.

Insect fauna provides an important prey base for migratory shorebirds and waterfowl. To cope with the short summer and limited food supplies, migratory birds tend to nest almost immediately upon arriving on the breeding grounds, and young hatch when insects and vegetation are most abundant.

Brant and common eider are prevalent in this area. Seabirds such as the pomarine jaeger, glaucous gull, and black guillemot are characteristic breeders. The semipalmated sandpiper is a common breeder in this section as is the rare Arctic Loon. The breeding range of the rare curlew sandpiper is limited to the tundra adjacent to the coast. Waterfowl, other small birds, and small mammals are preyed upon by Arctic fox, snowy owl, gyrfalcons, peregrine falcons, and rough-legged hawks.

Suitable habitat for denning or burrowing species may be limited in areas with continuous or near-continuous permafrost. Burrowing species must select areas where the permafrost is not near the surface. The presence of deep snowdrifts is important for denning wolverines, polar bears, and brown bears. Talus slopes and cut banks are important habitat features used by denning Arctic foxes. Raptors tend to nest along river and coastal bluffs because of the generally flat, treeless character of the Arctic tundra. Pink and chum salmon are present in this Section as are king, sockeye, and Coho salmon.

Soil particles in the arctic derive almost entirely from mechanical breakup of rock, with little or no chemical alteration. Inceptisols with weakly differentiated horizons are dominant. Continual freezing and thawing of the soil have disintegrated its particles. Like the northern continental interior, the arctic has a permanently frozen sublayer of soil known as permafrost. The permafrost layer is more than 1,000 feet (300 m) thick throughout most of the region; seasonal thaw reaches only 4-24 inches (10-60 cm) below the surface.

Geomorphic processes are distinctive in the arctic, resulting in a variety of curious landforms. Under a protective layer of sod, water in the soil melts in summer to produce a thick mud that sometimes flows downslope to create bulges, terraces, and lobes on hillsides. The freeze and thaw of water in the soil sorts out coarse particles, giving rise to such patterns in the ground as rings, polygons, and stripes made of stones. The coastal plains have numerous lakes of thermokarst origin, formed by melting groundwater.

Arctic Tundra Province

Land-surface form.--The north coast of Alaska is a broad, level plain that is generally less than 1,000 feet (300 m) in elevation. Rolling foothills rise near the Colville River and gain altitude southward into the Brooks Range. In summer, thousands of lakes and marshes dot the plain.

Climate.--The severe arctic climate reaches temperatures of -60F (-51C) in winter. Average annual temperature is only 10 to 20F (-12C to -6C). Due to its location in the extreme north, this province gets very different amounts of sunlight at different times of year. In summer, the sun remains above the horizon 24 hours a day for from 2 to 85 consecutive days, depending on the latitude; in winter, it can remain below the horizon 24 hours a day for as long as 67 consecutive days. All sunlight is received at oblique angles that average 41 degrees. The growing season averages only two weeks per year. Precipitation is very low throughout the year; average annual precipitation is only seven inches (180 mm).

Vegetation.--Permafrost limits the rooting depth of plants and forces surface water to drain by preventing it from seeping into the soil. Extensive marshes and lakes result. Cottongrass-tussock, the most widespread vegetation system in the Arctic, is associated with sedges, dwarf shrubs, lichens, mosses, dwarf birch, Labrador-tea, and cinquefoil. These highly productive systems produce 500-1,000 lb (227-454 kg) of vegetation per acre, an important source of food for caribou and waterfowl. Several forbs flower brightly in the short summer.

Soils.--The soils are wet, cold Inceptisols with weakly differentiated horizons. Soils on south slopes and low moraines are well drained and loamy, with permafrost and ice features. They are underlain by coarse outwash and till. The uplands have localized areas of poorly drained clayey soils; lowland soils are deep, wet, and silty. There is no surface water in winter and only moderate flows in summer. Supplies of ground water are very limited. The entire province is under continuous permafrost to depths of 2,000 feet (600 m) in some areas.

Fauna.--Mammals of the Arctic include brown bear, wolf, wolverine, caribou, arctic hare, mink, weasel, and lemming. Polar bear, walrus, and arctic fox are common on the ice pack and coastal areas during winter.

Shore and lake areas provide rich habitat for millions of migrating waterfowl and shore birds during the summer months. Ptarmigans, ravens, hawks, and open country owls are common. Gyrfalcons have also been seen on sea ice.

Brooks Range Tundra

Land-surface form.--The Brooks Range, a northern extension of the Rocky Mountains, reaches 600 miles (970 km) westward from Canada to the Chukchi Sea. Its rugged peaks reach elevations of 9,000 feet (2,700 m) in the east, falling to 3,000 feet (900 m) in the west. Broad U-shaped valleys, morainal topography, and braided stream channels show evidence of glaciation. A series of rolling plateaus and low mountains, the arctic foothills, borders the coastal plain to the north.

Climate.--The climate of the Brooks Range is similar to that of the arctic coastal plain, but precipitation increases at the higher altitudes and at the east end of the range. Summer temperatures reach 90 to 100F (32 to 38C), and winter temperatures drop as low as -75F (-60C). Because the province lies above the Arctic Circle, it gets several days of 24-hr sunlight in June, and several sunless days in December. Precipitation averages 7 to 15 inches (180 to 390 mm), but drainage is rapid due to the area's steep slopes and the low holding capacity of its soils.

Vegetation.--In the higher alpine areas, plant cover is discontinuous over barren rock. It consists chiefly of low mats of such herbaceous and shrubby species as dwarf arctic birch, crowberry, Labrador-tea, arctic willow, resin birch, and dwarf blueberry. Areas at lower elevations may be covered by a mat of sedge and shrub that provides valuable forage for caribou. Cottongrass, bluejoint, mosses, dwarf willow, dwarf birch, Labrador-tea, and bistort are common. Regeneration is extremely slow for most species; some mosses require more than 60 years to recover from disturbance.

Soils.--The mountains are underlain by folded and faulted limestone, the foothills by various sediments. Soils are rocky and poorly developed. Inceptisols cover the lower slopes. Glacial and alluvial deposits occur in the valleys and at the base of the mountain slopes. Permafrost is continuous under the entire area.

Fauna.--The Brooks Range is an important big-game area in Alaska, supporting brown and black bear, wolf, wolverine, caribou, and Dall sheep. Smaller mammals include marmot, red and arctic fox, ground squirrel, lemming, and pika.

The Brooks Range is an important resting area for migrating waterfowl and songbirds during summer. Raptors prominent in many areas include golden eagles, marsh hawks, gyrfalcons, and snowy and other open country owls.

Bering Sea Tundra Province

Land-surface form.--The Bering Sea Tundra is a western extension of the arctic coastal plain, a broad lowland area rising gradually to the east. General topography is less than 1,000 feet (300 m) in elevation, broken in places by small mountain groups that rise 2,500-3,500 feet (800-1,100 m). Standing water is present in thousands of shallow lakes and marshes along the coast. Two large braided rivers, the lower Yukon and the Kuskokwim, flow out of the province to the southwest.

Climate.--The climate is less severe in the Bering Sea Tundra than on the arctic slope, but it also has cold winters and generally cool summers. Temperatures range from a high of 90F (32C) in summer to a low of -70F (-57C) in winter. Annual precipitation averages 17 inches (430 mm).

Vegetation.--Vegetation along the wet coastal areas is chiefly sedge and cottongrass; woody plants grow on higher sites. Birch-willow-alder thickets are extensive in transition zones between beach and forest. The lower Yukon and Kuskokwim Valleys are dominated by white spruce mixed with cottonwood and balsam poplar in tall, relatively dense stands, with a dense undergrowth of thinleaf alder, willow, rose, dogwood, and various species of berry bushes.

Soils.--Coastal soils are wet, cool Inceptisols over silt, sand, and marine sediments. The lower Yukon and Kuskokwim Valley bottoms have pockets of Entisols with no soil horizons. Ground water throughout the area is limited, but some is present in the major river valleys. Surface water on the Seward Peninsula ceases to flow in winter, but further south it flows year-round. Permafrost is continuous under most of the area.

Fauna.--River bottom lands provide excellent habitat for furbearers, game birds, and moose. Upland and coastal areas support brown and black bear, wolf, wolverine, coyote, caribou, reindeer, snowshoe hare, red fox, lynx, beaver, moose, squirrels, mice, weasel, mink, and marten. Along the northern Bering Sea coast, polar bear, walrus, and arctic fox are occasionally found.

Coastal areas provide extensive and excellent habitat for migrating waterfowl and shore birds. Other bird species in the area include ospreys, falcons, grouse, ravens, golden eagles, and various hawks and owls.

Subarctic Division

The source region for the continental polar air masses is south of the tundra zone between latitude 50 and 70 N. The climate type here shows very great seasonal range in temperature; winters are severe, and the region's small amounts of annual precipitation are concentrated in the three warm months. This cold, snowy forest climate, referred to in this volume as the boreal subarctic type, is classified as E in the Koppen-Trewartha system. This climate is moist all year, with cool, short summers. Only one month of the year has an average temperature above 50F (10C).

Winter is the dominant season of the boreal subarctic climate. Because average monthly temperatures are subfreezing for six to seven consecutive months, all moisture in the soil and subsoil freezes solidly to depths of many feet. Summer warmth is insufficient to thaw more than a few surface feet, so permafrost prevails under large areas. Seasonal thaw penetrates from 2 to 14 feet (0.6 to 4 m), depending on latitude, aspect, and kind of ground. Despite low temperatures and long winters, the valleys of interior Alaska were not glaciated during the Pleistocene, probably because of insufficient precipitation.

The subarctic climate zone coincides with a great belt of needleleaf forest, often referred to as boreal forest, and with the open lichen woodland known as taiga. Most trees are small, with less value as lumber than as pulpwood.

Boreal forests are structurally more complex than tundra, and thus support a greater diversity of wildlife species. These forests provide habitat for large mammals, such as grizzly bear, black bear, wolf, moose, and wolverine; small mammals, such as red fox, American beaver, American marten, and weasels; birds, such as spruce and ruffed grouse, owls, and raven; and the amphibian, wood frog. Cliffs along the Yukon and Porcupine Rivers provide habitat for several raptor species: osprey, gyrfalcon, hawks, and the endangered American peregrine falcon. Rich fish resources support bald eagles and osprey on the coastline. Many species have unique adaptations to survive in subarctic forests. Herbivores typically graze on herbaceous and shrubby vegetation during the summer, but shift to a high fiber diet of conifer needles and woody shrub browse during winter. White-winged crossbills are an example of a species that have adapted to the abundant cone seeds in boreal forests. These birds move in large flocks when cone supplies are abundant, but are nomadic when cone supplies are limited. White-winged crossbills also breed opportunistically, when cone supplies are most abundant. The boreal forests also provide a rich source of lichen, a food-source that comprises 60-80 percent of the winter diet for barren-ground caribou.

There are fewer wildlife species are found in bogs of the subarctic ecoregion than in upland forests, given the lack of diversity in flora. The high water table of bogs also discourages burrowing species.

The arctic needleleaf forest grows on Inceptisols with pockets of wet, organic Histosols. These light gray soils are wet, strongly leached, and acid; they form a very distinct layer beneath a topsoil layer of humus and forest litter. Agricultural potential is poor, due to the natural infertility of soils and the prevalence of swamps and lakes left by departing ice sheets. In some places, ice scoured rock surfaces bare, entirely stripping off the overburden. Elsewhere rock basins were formed and stream courses dammed, creating countless lakes.

Yukon Intermontane Taiga Province

Land-surface form.--A series of broad valleys, dissected uplands, and lowland basins covered with alluvial deposits extends across interior Alaska between the Brooks and Alaska Ranges. Four major rivers, the Yukon, Tanana, Koyukuk, and upper Kuskokwim, provide the area's outstanding hydrologic features. All four form wide valleys, with extensively braided channels; in some areas, the valleys contain hundreds of small lakes and marshes. Elevations are generally less than 2,000 feet (600 m).

Climate.--The semiarid climate has extreme temperatures. Summers are short and hot, with temperatures up to 100F (38C); winters are long and severe, with temperatures as low as -75F (-60C). Average annual precipitation is only 17 inches (430 mm). Temperature inversions, frequent in upland areas in winter, result in warmer temperatures on lower slopes than in bottom lands.

Vegetation.--The major river bottoms support dense white spruce-cottonwood-poplar forests on floodplains and southfacing slopes up to about 1,000 feet (300 m). The undergrowth is dense shrubbery formed by green and thinleaf alder, willow, dogwood, and berries. The outer valley edges support evergreen and coniferous forests, often with pure stands of black spruce. The undergrowth consists of willow, dwarf birch, crowberry, fern, blueberry, lichens, and mosses. Upland areas are generally covered by a rather dense white spruce-birch-aspen-poplar forest. Pure stands of white spruce grow near streams. Typical undergrowth includes willow, alder, fern, berries, grasses, and mosses. Root systems are shallow. Water balance is likely the factor limiting growth in most of these areas because of the hot, dry summer climate. Old river terraces, ponds, and sloughs contain scattered but extensive bogs where the vegetation is chiefly sphagnum and other mosses, sedges, bog rosemary, and Labrador-tea. Marginal areas may support willow and alder.

Soils.--River bottom and lower slope soils are generally deep, well-drained Inceptisols over sands, silts, and gravels that are only slightly weathered. Permafrost is discontinuous in major river valleys. Soils on northfacing slopes are shallow and poorly developed, with continuous permafrost. Upland soils that support spruce-hardwood forests are well-drained, shallow Inceptisols over continuous permafrost. Bog soils are Histosols.

Fauna.--The spruce-hardwood forests provide excellent habitat for furbearers and other mammals. Brush zones and immature forests recovering from fires furnish especially good browse for moose. Common game animals in addition to moose include black and brown bear, wolf, wolverine, and caribou. Smaller mammals include lynx, red fox, beaver, mink, muskrat, weasel, river otter, marten, red and northern flying squirrel, and deer mouse. Woodland game birds find plentiful habitat. Upland birds include northern hawk-owl, spruce grouse, and boreal chickadee.

Upper Yukon Taiga Province

Land-surface form.--This province is mostly a flat plains and rounded low mountains. The plains consist of marshy lake-dotted flats rising from 300 feet (90 m) in altitude in the west to 600-900 feet (180-270 m) in the north and east. The mountains rise to 4,000 feet (600-1,200 m). The province is made up of outwash fans and floodplains of the Chandalar, Christian, Sheenjek, and Upper Yukon Rivers. Rolling silt- and gravel-covered marginal terraces with sharp escarpments 150-600 feet (50-180 m) high rise above the flats, sloping gradually upward to altitudes of about 1,500 feet (460 m) at the base of surrounding uplands and mountains.

Climate.--The climate is the extreme continental boreal type, with its large annual temperature range, severely cold winters, and short, hot summers. The average daily minimum temperature of the coldest month is -29F (-33C). At Fort Yukon, more than 130 days per year have a minimum temperature of 0F (-18C) or below. The record low at Fort Yukon is -78F (-61C), and the record high is 100F (38C). The growing season is less than 3 months. The region is semiarid, with an average annual precipitation of about seven inches (179 mm), with a summer maximum. Snowfall averages 45 inches (1,150 mm) per year.

Vegetation.-- The vegetation pattern in the area is complex. Bottom land spruce-aspen-birch grow on the better drained alluvial sites. Alder and willow form thickets on newly exposed alluvial sites subject to periodic flooding. Forests of white spruce, paper birch, and quaking aspen cover most lower slopes in the south and southfacing slopes in the north. Black spruce forest vegetation grows at higher elevations, on all northfacing slopes in the south, on all but steep southfacing slopes in the north, and on lower slopes with impeded soil drainage throughout the area. Above the black spruce forest, the vegetation is alpine meadow characterized by sedges on poorly drained sites and by low-growing shrubs on drier sites.

Soils.--Principal soils are wet Inceptisols, mostly in flats and low areas. Lower parts of the floodplains are poorly drained and covered with peat, whereas river terraces are better drained.

Fauna.--The fauna of the Yukon Flats Province are similar to those in other taiga regions. But this province provides what may be the most productive arctic habitat for avian wildlife on the continent. Predominant waterfowl species that breed in the region include the lesser scaup, pintail, scoter, and wigeon. The area supports 15-20 percent of remaining canvasbacks. Arctic, red-throated, and common loons, horned and red-necked grebes, and sandhill cranes are also common. Cliffs along the Yukon and Porcupine Rivers support several raptor species, including osprey, gyrfalcon, Swainson's hawk, and the endangered American peregrine falcon.

Alaska Range Taiga

Land-surface form--The Alaska Range is a continuation of the Pacific Coast Mountains extending in an arc across the northern Pacific. The towering, glaciated peaks of the Wrangell Mountains and of the Alaska Range--which includes Mt. McKinley at 20,320 feet (6,194 m)--typify the ruggedness of the area. The only major waterways are the Susitna and upper Copper Rivers.

Climate.--The Alaska Range and the Wrangell Mountains have a transitional climate of severe winters and hot, dry summers. Temperatures range from 90F to -70F (32C to -57C). Precipitation averages only 16 inches (410 mm) annually.

Vegetation.--Vertical vegetational zonation characterizes the Alaska Range and Wrangell Mountains, beginning with dense bottom-land stands of white spruce and cottonwood on the floodplains and low terraces of the Copper and Susitna Rivers. Above the terraces, poorly drained areas up to 1,000 feet (300 m) support stands of black spruce. Upland spruce-hardwood forests of white spruce, birch, aspen, and poplar, with an undergrowth of moss, fern, grass, and berry, extend to timberline at about 2,500-3,500 feet (800-1,100 m). Tundra systems of low shrubs and herbaceous plants form discontinuous mats among the rocks and rubble above timberline. White mountain-avens may cover entire ridges in the Alaska Range, associated with moss campion, black oxytrope, arctic sandwort, lichens, grasses, and sedges. These tundra systems stop short of the permanent ice caps on the highest peaks.

Soils.--Bottom-land and terrace soils of the Copper and Susitna Rivers are stratified, well-drained Entisols without pedogenic horizons. Upland hardwood forest soils are mostly shallow, well-drained Inceptisols. Permafrost is continuous on northfacing slopes, discontinuous on southfacing ones. Soils that support the moister tundra areas range from wet Inceptisols to Histosols. Alpine Inceptisols are generally shallow and poorly developed, with discontinuous or continuous permafrost.

Fauna.--The Alaska Range supports large big-game populations of moose, Dall sheep, black and brown bear, wolf, caribou, and wolverine. Smaller mammals include beaver, red fox, lynx, otter, marten, squirrels, and weasel. Golden eagles, ptarmigan, ravens, and sharp-shinned hawks inhabit the uplands. Near timberline in Lake Clark National Park, Alaska Range.

Humid Temperate Domain

Warm Continental Division

South of the subarctic climate lies the humid warm-summer continental climate. Located squarely between the source regions of polar continental air masses to the north and maritime air masses to the south, it is subject to strong seasonal contrasts in temperature as these air masses push back and forth across the land.

It has a cold snowy winter climate with a warm summer. The climate has four to seven months when temperatures exceed 50F (10C), with no dry season. The average temperature during the coldest month is below 32F (0C). The warm summer has an average temperature during its hottest month that does not exceed 72F (22C). Precipitation is ample all year, but is substantially greater during the summer.

Needleleaf and mixed needleleaf-deciduous forest grows throughout the colder northern parts of the humid continental climate zone, extending into the mountain regions north of Cook Inlet.

Alaska Mixed Forest Province

Land-surface form.--This province is a moraine- and outwash-mantled lowland that rises from sea level to an altitude of 2,000 feet (600 m). Drained by the Nushagak and other large rivers that flow into Bristol Bay, the lowland is dotted with morainal and thaw lakes. The Copper River lowland is also part of the province. It is a broad basin of rolling to hilly moraines and nearly level alluvial plains on the site of a Pleistocene glacial lake.

Climate.--This province has a marine phase of the tundra climate, with cold winters and cool, short summers. Although the climate is subarctic, it is less severe than the interior of Alaska, because much of the region is sheltered by the Alaska Range to the north. Proximity to the Gulf of Alaska makes the climate transitional to the marine climates to the south. Average annual temperatures range from 32 to 39F (0 to 4C), with a winter average of about 5F (-15C) and summer maximums of about 64F (18C). Average annual precipitation ranges from 10 to 18 inches (260 to 460 mm). Annual snowfall averages from 4 to 10 inches (100 to 260 mm).

Vegetation.-- Throughout the Cook Inlet lowlands, lowland spruce-hardwood forests are abundant. Bottom land spruce-poplar forest adjoins the larger river drainages, along with thickets of alder and willow. Wet tundra communities exist along the Cook Inlet coastline. The Copper River lowland is characterized by black spruce forest interspersed with large areas of brushy tundra. White spruce forests occur on southfacing gravelly moraines, and cottonwood-tall bush communities are common on large floodplains.

Soil.--Dominant soils are Inceptisols. Most soils are formed in ash deposits of various thickness, underlain by gravelly glacial till, outwash deposits, or silty alluvium. Coastal plain soils are formed in gravelly alluvium, cinders, or weathered rock blanketed by thick sedge peat. Spodosols are the principal upland soils in the Cook Inlet. Permafrost is sporadic or absent.

Fauna.-- The diversity of habitats in this province supports a large variety of species. Muskrats and red foxes abound, moose flourish in lowland areas, and Dall sheep are frequently seen in the uplands. Black bear populations are dense throughout the region. Trumpeter swans nest here, and tundra swans are present during migration. King, sockeye, and Coho salmon are common or abundant. Brown bears are common mammals, partly because of large salmon runs in this area. Bristol Bay provides staging and migration habitat for large numbers of waterfowl. Ospreys occur more frequently in this province than in any other part of Alaska. Blackpoll warblers are common breeders in conifer stands in the north.

Cold Oceanic Division

The Cold Oceanic division includes much of the Alaska Peninsula and all of the Aleutian Islands. The islands that chiefly make up this province are mountainous, rising steeply from the sea. The Islands and the Alaska peninsula experience a maritime climate. Precipitation varies widely, from 20 to 82 inches. Generally, larger islands receive more precipitation than smaller ones, and coastal areas more than inland areas. Temperatures range from average lows of 20 to -4F in winter to average highs of 50 to 55F in summer

Trees are absent from the division and vegetation consists of low shrubs of willow, birch, and alder interspersed with lichen, and grass communities. At lower elevations, there is a luxuriant growth of tall grasses, flowering plants, and ferns, with thickets of low willows in some places. A little higher up, several types of heath cover vast areas. The boreal forest and coastal rainforest are slowly encroaching from the east on the area of this province. This is explained by the assumption that the distribution of the vegetation is not yet adjusted to the climatic conditions produced by retreat of the last continental glaciers Alpine tundra is found on mountainsides.

The division supports many seabird colonies of extraordinary size and global importance. The Pribilof Islands, for example, provide breeding habitat for approximately three million seabirds including virtually all of the world's 250,000 red-legged kittiwakes. Many of the islands also support endemic species, including the Pribilof Island shrew and the Aleutian shield fern, the only federally-listed endangered plant in Alaska.

The division has most soils form of volcanic ash or cinders over basaltic rock, and dominant soil types are Typic Haplocryands and Typic Vitricryands. Higher elevations often are covered in bare rock and basaltic rubble.

Aleutian Meadow Province

Land-surface form.--The islands that chiefly make up this province are mountainous, rising steeply from the sea. They contain more than 75 volcanoes, about half of which are know to have erupted during the last 200 years. Altitudes of the volcanoes decrease southwestward from 7,500 feet (2,300 m) at Mount Katmai on the Alaska Peninsula to 6,000 feet (1,800 m) on the Aleutian Islands. Not much of the land on the islands or on the peninsula is level. Steep slopes prevail all the way to water's edge, and shores are rocky and craggy. The Alaska Peninsula has intensely glaciated mountains indented with fjords that are bordered by cliffs. Several large lakes are on the peninsula.

Climate.--The climate is similar to that on the arctic coastal plain, except it is a marine phase (described above for the Bering Tundra Province). Winters are less severe than those on the coastal plain, with temperature ranges of 18 to 27F (10 to 15C), as compared to a 54F (30C) range on the coastal plain. The climate is characterized by fog and rain, with the amount of precipitation varying little from month to month. Annual precipitation varies from 21 inches (530 mm) to more than 78 inches (2,000 mm). In general, smaller islands receive less precipitation than larger islands. Winds are often severe on the islands. Pacific Ocean water moving northward through the straits between the islands produces complex mixing with Bering Sea water, including upwelling. The Pribilof Islands in the Bering Sea are about at the southern limit of the arctic ice pack in winter.

Vegetation.--Trees are absent from the Aleutian Province, although there are a few shrubs, chiefly dwarf willows. At lower elevations, there is a luxuriant growth of tall grasses, flowering plants, and ferns, with thickets of low willows in some places. A little higher up, several types of heath cover vast areas. The boreal forest and coastal rainforest are slowly encroaching from the east on the area of this province. This is explained by the assumption that the distribution of the vegetation is not yet adjusted to the climatic conditions produced by retreat of the last continental glaciers.

Soils.--About 30 percent of the area consists of high mountains without soil cover. Dominant soils are Inceptisols formed from volcanic ash or pumice, with large components of pyroclastic materials. Permafrost is generally absent.

Fauna.--The Aleutian Islands support no land mammals larger than foxes. Marine mammals such as seals, sea lions, and sea otters are abundant, using the islands for hauling out and as rookeries.

Bald eagles and hawks are prevalent predators, feeding on the millions of sea birds that use the islands and rocks as rookeries.

Marine Division

Situated on the Pacific coast between latitudes 40 and 60 N. is a zone that receives abundant rainfall from maritime polar air masses and has a rather narrow range of temperatures because it borders on the ocean. The average temperature of the warmest month is below 72F (22C), but at least four months per year have an average temperature of 50F (10C). The average temperature during the coldest month of the year is above 32F (0C).

Precipitation is abundant throughout the year, but is markedly reduced during summer. Although total rainfall is not great by tropical standards, the cooler air temperatures here reduce evaporation and produce a very damp, humid climate with much cloud cover. Mild winters and relatively cool summers are typical. Coastal mountain ranges influence precipitation markedly in these middle latitudes. The mountainous coasts of British Columbia and Alaska annually receive 60 to 80 inches (1,530 to 2,040 mm) of precipitation and more. Heavy precipitation greatly contributed to the development of fiords along the coast: heavy snows during the glacial period fed vigorous valley glaciers that descended to the sea, scouring deep troughs that reach at their lower ends below sea level.

Natural vegetation in the Marine Division is needleleaf forest. In the coastal ranges of the Pacific Northwest, Douglas-fir, redcedar, and spruce grow to magnificent heights, forming some of the densest of all coniferous forests with some of the world's largest trees.

The Marine Division is dominated by evergreen and, to a lesser extent, deciduous forests located along the Pacific Coast. Temperate forests are among the most productive habitats in the world and, due to routine subjection to disturbances that increase variability in the environment, they provide habitat for a diversity of wildlife, including mule deer, bobcat, mountain lion, black bear and grey fox.

In general evergreen trees support less wildlife than deciduous, as they are less palatable. Conifers do possess characteristics that are critical to the survival of many wildlife species, providing critical winter cover for elk, deer and Spruce grouse. Grey squirrels are common among the oak trees of deciduous groves.

Since this ecoregion is characterized by abundant rainfall, there is an abundance of moisture on the forest floor, as well as in ponds and streams, to support a diversity of amphibians. All frogs and toads in this region lay their eggs in water. Most salamanders lay their eggs in or near water, while others lay their eggs on land under logs, in rock outcrops, or both. Many of these amphibians spend a portion or most of their lives out of water, living under moist logs, dead wood, or forest litter, or in burrows or root or rock crevasses.

Few reptiles are found in this ecoregion. The alligator lizard is the only widely distributed species found in forested habitats, and the painted turtle and western pond turtle are the only turtles common in the area. The most common snake is the northwestern garter snake.

Birds have adapted to exploit the different layers of vegetation in the forest. Cavities in snags provide shelter and nesting sites for woodpeckers, owls, and other cavity-using wildlife, while dead and dying bark often harbors large numbers of insect prey for birds. Ruffed grouse, winter wren, American robin, spotted towhee, and dark-eyed junco are often found near the forest floor or in shrubs. Woodpeckers and brown creepers are seen moving up and down the trunks of trees in search of insects. Nuthatches and chickadees exploit the cone seeds, while warblers and kinglets glean insects from the upper deciduous forest canopy. Shrews, mice and moles are fossorial and also exploit the vegetation types and strata of the forest, while rabbits and hares see shelter in dense vegetation near forest edges

A number of species rely on old-growth forests for most or all of their life requisites. Old-growth forests in the Marine Ecoregion generally consist of conifer trees with a diameter of more than 3 feet at the base of the tree, and that are more than 200 years old. These forests also contain a multilayered canopy and numerous snags and logs. Vaux's swifts depend on large, hollow snags for nesting and roosting habitat. Marbled murrelets use the stout branches of old-growth trees for nest platforms. Northern spotted owl nest in tree cavities and feed on northern flying squirrels. Banana slugs, Pacific giant salamander, Olympic salamander, and Oregon slender salamander are other species that prefer the rotting logs and moist soil conditions found in old-growth habitats.

Soils are strongly leached, acid Inceptisols and Ultisols. Due to the region's cool temperatures, bacterial activity is slower than in the warm tropics, so vegetative matter is not consumed and forms a heavy surface deposit. Organic acids from decomposing vegetation react with soil compounds, removing such bases as calcium, sodium, and potassium.

Pacific Lowland Mixed Forest Province

Land-surface form.--The Pacific Lowland Mixed Forest occupies a north-south depression between the Coast Ranges and the Cascade Mountains. Elevations range from sea level to 1,500 feet (460 m). The Willamette Valley has nearly level to gently sloping floodplains bordered by dissected high terraces and hills. The Puget Sound Valley is a moderately dissected tableland covered by glacial till, glacial outwash, and lacustrine deposits. This province includes isolated hills and low mountains.

Climate.--Because this province is close to the Pacific Ocean, its climate is generally mild throughout the year. Annual temperatures average 48 to 55F (9 to 13C). The moderate rainfall reaches its maximum in winter; summer has a slight moisture deficit. Average annual rainfall ranges from 15 to 60 inches (380 to 1,530 mm); but in much of the area, the range is from 30 to 45 inches (760 to 1,150 mm). Coastal mountains are responsible for the drier and less muted climate. Fog partially compensates for the summer drought.

Vegetation.--Before cultivation, dense coniferous forest dominated the vegetation here. Principal trees are western redcedar, western hemlock, and Douglas-fir. In interior valleys, the coniferous forest is less dense than along the coast and often contains deciduous trees, such as big-leaf maple, Oregon ash, and black cottonwood. There are prairies that support open stands of oaks or are broken by groves of Douglas-fir and other trees; principal indicator species are Oregon white oak and Pacific madrone. Poorly drained sites with swamp or bog communities are abundant.

Soils.--Alfisols, Inceptisols, and Ultisols are the principal soil orders. Inceptisols dominate in Puget Sound Valley.

Fauna.--The fauna are closely related to those of the surrounding Cascade Province (described below). Mule deer is the most common large mammal. Chief mammalian predators are the mountain lion and bobcat. The western gray squirrel lives in oak trees, and the bushytail wood rat builds nests on shrub-covered stream margins and at forest edges. Isolated thickets are inhabited by brush rabbit and gray fox. Ruffed grouse inhabit the same scattered thickets. The dusky Canada goose winters exclusively in the Willamette Valley in Oregon. The periodically abundant acorn crop attracts flocks of band-tailed pigeons, acorn woodpeckers, and mountain quail. The dry terrain is ideal for reptiles, including the northern Pacific rattlesnake, the only poisonous snake in the Pacific Northwest.

Cascade Mixed Forest--Coniferous Forest--Alpine Meadow Province

Land-surface form.--The Cascade Province covers a series of steep, rugged mountains bordered in places by a narrow coastal plain. Mountains along the coast rise 5,000 feet (1,500 m) above sea level, with a local relief of 1,000-3,000 feet (300-900 m). The interior Cascade Range has mountains 8,000-9,000 feet (2,400-2,700 m) in altitude, dominated every 5-85 miles (8-135 km) by a volcano of much higher elevation. Mt. Rainier, for example, rises more than 14,000 feet (4,300 m) above sea level. Some parts of the province, especially its northern portion and the Cascade Range, have been glaciated.

Climate.--Because this province borders on the Pacific Ocean, its climate is characterized by generally mild temperatures averaging 35 to 50F (2 to 10C) throughout the year. Rainfall is heavy, 30 to 150 inches (770 to 3,800 mm) per year, with a maximum in winter. Humidity is always high, producing an extremely favorable precipitation/evaporation ratio. The southern part of this province is winter-wet with no snow; fog partially compensates for the summer drought. As one moves to the north, the summer dry season shortens, and the proportion of precipitation falling as snow increases. On high mountains, all precipitation may be snow, which reaches depths of 50 to 65 feet (15 to 20 m). East slopes are much drier than west slopes, accumulating less than 20 inches (511 mm) of precipitation per year.

Vegetation.--The Cascade Province is primarily montane, but it ranges from sea level to altitudes above 5,000 feet (1,500 m). At the lowest elevations, there is a dense conifer forest of Douglas-fir, western redcedar, western hemlock, grand fir, silver fir, Sitka spruce, and Alaska-cedar. Numerous species of shrubs grow exceptionally well in this forest and around its margins. In many places, this vegetation is practically impenetrable.

Although Douglas-fir is the most abundant tree at lower elevations in the region, it is not part of the climax forest. Western hemlock and several other species of fir are more tolerant of shade than Douglas-fir, and in mature forest stands, Douglas-fir cannot regenerate. On the western and southern slopes of the Olympic Mountains in Washington, hemlock is eventually displaced by the more shade-tolerant silver fir.

In the humid conifer forests of southwestern Oregon, Alaska-cedar is replaced by silver fir and redwood. In the fog belt along the coast of northwestern California, redwood is the characteristic tree. Douglas-fir and other conifers associate with it to form perhaps the densest of all coniferous forests, with the world's largest trees. Some redwoods attain heights of more than 325 feet (99 m) and girths of more than 65 feet (19.8 m).

A xerophytic forest of ponderosa pine grows along the dry eastern slopes of the Cascades, descending to 500 feet (150 m) along the eastern foot of the range at the Columbia River. This is typically open forest mixed with grass and shrubs. It occurs throughout the Southwest, the Sierra Nevada, the Rocky Mountains, and the Black Hills.

The high, snowcapped mountains of the Cascades have a well-marked subalpine forest belt that reaches into British Columbia. Important trees are mountain hemlock, subalpine fir, whitebark pine, and Alaska-cedar. To the north, the subalpine forest becomes fragmentary or disappears completely.

All but the highest peaks are covered by forest. In the Cascade Mountains of Oregon, timberline varies from 7,700 to 10,000 feet (2,350 to 3,050 m). Above timberline, there is an alpine zone with rich communities of shrubs and herbs. Perpetual snow is confined to small patches.

Riparian forests in the Pacific Northwest are an exception to the general rule that conifers dominate in the region. Along the region's many rivers and streams, needleleaf trees are replaced by broadleaf species such as black cottonwood and red alder. This kind of forest occurs from southern Alaska south through Washington, Oregon, Idaho, and western Montana, continuing into northern California and the Sierra Nevada.

Soils.--Andisols are extensive where underlain by volcanic ash. Moist Inceptisols are found west of the Cascades; dry soils predominate in the rain shadow east of the mountains.

Fauna.--Common large mammals include elk, deer, mountain lion, bobcat, and black bear. Small mammals include mice, Douglas squirrels, martens, Townsend chipmunks, red tree voles, and bushytail wood rats.

The more common birds are the winter wren, Townsend's warbler, chestnut-backed chickadee, red-breasted nuthatch, gray jay, and Steller's jay. The most important game birds are blue and ruffed grouse; there are hawks and owls in the northwestern part of the province. Spotted owl and marbled murrelet depend on remaining old-growth forests.

Among the many species of amphibians that live in this region's moist, cool forests are the Pacific treefrog and the Pacific giant salamander. Reptiles include the northern alligator lizard and rubber boa.

The many swift-flowing rivers of the region are high in dissolved oxygen and generally unpolluted, making them ideal habitats for various salmon and trout species.

Pacific Coastal Icefields

Land-surface form.--The Coast Mountains rise precipitously from the sea to altitudes of about 9,000 feet (2,700 m), cut by an intricate network of deep, narrow fiords. Farther north, in the rugged St. Elias, Chugach, and Kenai Mountains, elevations range from sea level to more than 16,000 feet (4,900 m). Mount Logan (19,850 feet [6,050 m]) and Mount St. Elias (18,008 feet [5,490 m]) are the second and forth highest peaks on the continent of North America. Icefields and glaciers cover the higher parts of the mountains, forming some of the most extensive valley glacier systems in North America.

Climate.--The marine climate is the same as in Oregon and Washington, except that it has cool summers. Less than four months each year have average temperatures higher than 50F (10C). Despite the many glaciers, the climate is surprisingly mild, with average winter temperatures of about 32F (0C) and minimum temperatures of 0F (18C). Summer temperatures average in the 50's (10-15C), with highs in the 90's (32-37C). The growing season lasts four months or more. Precipitation is heavy, generally averaging more than 80 inches (2,040 mm) annually, with some places getting more than 150 inches (3,830 mm). Inland, the climate grows increasingly severe, partly because of rising distance from the ocean, but chiefly due to higher altitude. Topography and high precipitation form so much ice in the mountains that glaciers extend down to sea level despite mild temperatures. Above 3,000 feet (900 m), there is perennial ice, and above 8,000 feet (2,400 m), even summer storms are usually accompanied by snow.

Vegetation.--The most important trees in the thick forest that covers the lower elevations of this province are Alaska-cedar, western hemlock, mountain hemlock, Sitka spruce, several species of willow, and black cottonwood. Several kinds of shrubs also grow in the forest, often forming a fringe on its margins. In many places, the dense vegetation is practically impenetrable.

The timberline is at low elevations, and much of the mountainous area above it is covered with nearly bare rocks, snowfields, and glaciers. Wherever soil has accumulated, however, there are grasses, herbs, and low shrubs. The timberline varies greatly in elevation from place to place, depending on slope exposure and other factors. Near Prince William Sound, for example, the timberline is usually between 1,000 and 2,000 feet (300 and 600 m), but sometimes it drops as low as 500 feet (150 m).

Soils.--Icefields and bare rock or rubble make up about 70 percent of the area. The dominant soils are cool, moist Inceptisols.

Fauna.--Due to the glacial character of the region, Sitka deer do not range into the area, nor do many of the large animals of the interior. The only important large mammals are brown and black bears and mountain goats. The principal small mammals are red squirrels, voles, and shrews. Birds include some arctic types of water birds, such as murrelets and puffins. Land birds include sooty grouse, white-tailed ptarmigan, and Steller's jay. There are no reptiles or amphibians.

Pacific Gulf Coastal Forest Province

Land-surface form.--The Alexander Archipelago, with its hundreds of islands formed by the partly submerged western foothills of the Coast Range, makes up most of this province. The larger islands have mountains 3,000-5,000 feet (900-1,500 m) high, with slopes covered by dense forest where they are not too steep. Long, narrow bays carved into the mountains by glaciers create extremely irregular coastlines. Northward, at Prince William Sound and Kodiak Island, the foothills are mixed with coastal lowlands consisting of alluvial fans, uplifted estuaries, morainal deposits, dunes, and river deltas and terraces.

Climate.--Though similar to that of the Pacific Coastal Mountains Province, the climate here is milder due to the region's generally lower elevation. At Sitka, Alaska, average monthly temperatures for January and August are approximately 28F and 50F (2C and 10C), respectively, for an annual temperature range of only 22F (8C). Precipitation, which averages 96 inches (2,450 mm) per year, reaches a maximum in autumn.

Vegetation.--A coastal rainforest of Sitka spruce and western hemlock provides the dominant vegetation. In poorly drained areas, a wetland vegetation of sphagnum moss, sedges, and willows fosters peatland development. Alder, cottonwood, and birch are found in low-lying areas and along major river channels.

Soils.--The dominant soils are Spodosols.

Fauna.--A characteristic large mammal is the Sitka black-tailed deer. Other mammals include the brown bear, black bear, wolf, red squirrel, and moose. The mountain goat is common on mainland mountain heights, but not on the islands. Sea otters and Steller's sea lions are common throughout Prince William Sound.

A conspicuous and characteristic bird is the Alaska bald eagle. A small sea bird, the marbled murrelet, nests in the tall trees of old-growth forests. Water birds are well represented, including loons and ducks, and there are many gulls and other shore birds. Common land birds include the red-breasted sapsucker, Pacific-slope flycatcher, and golden-crowned kinglet, and both the red and white-winged crossbills. The entire population of dusky Canada geese nests within this province. Fish are abundant in the waters, including several species of salmon.

Mediterranean Division

Situated on the Pacific coast between latitudes 30 and 45 N. is a zone subject to alternate wet and dry seasons, the transition zone between the dry west coast desert and the wet west coast.

The division has a temperate rainy climate with the dry, hot summers. The combination of wet winters with dry summers is unique among climate types and produces a distinctive natural vegetation of hardleaved evergreen trees and shrubs called sclerophyll forest. Various forms of sclerophyll woodland and scrub are also typical. Trees and shrubs must withstand the severe summer drought--two to four rainless months--and severe evaporation.

The vegetation of the Mediterranean Ecoregion is dominated by grassland, shrubland, and forestland habitats. Many shrub (chaparral) and forest/woodland plant species have thick, hard, evergreen leaves. The number of wildlife species using shrub habitats is limited by the lack of trees in shrublands. However, wildlife species diversity can also be limited in evergreen woodlands due to the paucity of shrubs in these communities, as shrubs are often unable to compete with trees for the limited moisture.

Because of their tough, leathery texture, the leaves of vegetation in chaparral communities are resistant to wilting, and thus provide cover for wildlife even during the frequent droughts typical of the region. Wildlife found in chaparral tend to be species that nest on the ground or in shrubs, such as ground- and shrub-nesting birds and rodents, or that prey upon ground- and shrub-dwelling species, including coyote, striped skunk, and bobcat.

Although this ecoregion supports a diverse vertebrate fauna, including numerous species of reptiles and rodents, only a limited number of species are closely tied to the chaparral. These include the mountain quail, California thrasher, wrentit, brush rabbit, California mouse, and dusky-footed woodrat.

Mountain quail favor slopes covered with chaparral. They feed on acorn mast, fruits, and seeds in the fall, leafy foods during winter, and bulbs in the spring and summer. Thrashers and wrentits find good food and cover in the chaparral, and are more often seen than heard in the dense vegetation. The brush rabbit does not use burrows regularly like most other species of rabbits, perhaps because of the dense chaparral cover. Woodrats construct stick dens that are also used by the California mouse. Since homes are constructed of sticks, woodrats are vulnerable to fires in chaparral communities.

Chaparral communities are adapted to fire, and wildlife respond by retreating to burrows, hiding in rock crevices, or escaping from the area. After a fire, seed-eating birds, such as mourning doves, move into the area to feed on seeds exposed by fire. Mule deer seek out the temporary community of herbaceous plants that develop during the first year or two after the fire. Many of these plants produce bright flowers that attract nectar-feeding insects and birds.

Deciduous and evergreen woodlands provide vegetation structure and complexity that benefits a variety of wildlife species. The habitat often occurs in a mosaic-like pattern of conifer stands intermixed with deciduous tree stands. The shrub and herbaceous strata are often poorly developed in these woodlands. Mature woodlands are important to cavity nesting birds, and oak mast crops are an important food source for birds and mammals, such as scrub and Steller's jays, acorn woodpecker, wild turkey, mountain quail, California ground squirrel, western gray squirrel, black bear, and mule deer. Amphibians that reside in the forest detritus layers include Mount Lyell salamander, ensatina, and relictual slender salamander.

Oak woodlands serve as important wildlife habitat, supporting over 300 vertebrate species, many of which are special status species such as the California spotted owl and willow flycatcher. Oak trees provide nesting sites for both canopy- and cavity-nesting birds, and the acorns they produce are an autumn food source relied upon by many bird and mammal species.

Annual and perennial grasslands are found in central and coastal California. Annual grassland habitats consist largely of non-native annuals that have displaced native perennials. Habitat structure and wildlife abundance are dependent on a mix of plant species at a site. Sites with western brackenfern exhibit a taller, more diverse structure than sites with shorter grasses. Many wildlife species use grassland habitats, but some require special habitat features, such as cliffs, caves, ponds, or shrubby areas for breeding, resting, and escape cover.

Soils of this Mediterranean climate are not susceptible to simple classification. Alfisols and Mollisols typical of semiarid climates are generally found.

California Coastal Chaparral Forest Shrub Province

Land-surface form.--This province includes the discontinuous coastal plains, low mountains, and interior valleys adjacent to the Pacific Ocean from San Francisco to San Diego. Elevations range from sea level to 2,400 feet (730 m).

Climate.--The climate is characterized by hot, dry summers and rainy, mild winters. Annual temperatures average 50 to 65F (10 to 18C). Annual precipitation ranges from 10 to 50 inches (260 to 1,280 mm), with a pronounced summer drought. This coastal province has a more moderate climate than the interior and receives some moisture from fog in summer. Fire is common, usually set by lightning during the summer dry season.

Vegetation.--Plant communities are well marked in this province. Several tree species are endemic to the region, including the Monterey cypress, Torrey pine, Monterey pine, and Bishop pine. The coastal plains and larger valleys have sagebrush and grassland communities. A riparian forest containing many broadleaf species grows along streams. On the hills and lower mountains, there is sclerophyll forest consisting of low trees with small, leathery leaves that can withstand the lack of summer precipitation. Live oak or white oak woodland is found here. On steep hill and mountain slopes too dry to support oak woodland or oak forest, much of the vegetation is scrub or "dwarf forest" known as chaparral, which varies in composition with elevation and exposure. It consists of chamise and various manzanitas that are adapted to periodic occurrence of fire. Exposed coastal areas support desertlike shrub communities called coastal scrub, dominated by coyote bush, California sagebrush, and bush lupine. Toward southern California, sages become abundant within coastal scrub communities.

Most of the coastal plains and interior valleys have been converted to urban use or irrigated agriculture. Citrus, grapes, avocados, nuts (such as almonds and walnuts), and deciduous fruits are grown extensively. Irrigated alluvial soils are also highly productive of vegetable crops. Bluegum eucalyptus and other species imported from Australia are abundant along roadsides and much of the coastline as well as farther inland.

Soils.--The soils of this region are mostly Alfisols and Mollisols. They are high in bases and quite fertile when soil water is adequate.

Fauna.--The brushy rabbit is common, as is the opossum, North America's only marsupial. Several species of seals and sea lions live along the California coast, and sea otters often float among kelp, feeding on sea urchins. The blue whale, the world's largest animal species, is found in California's coastal waters.

Coastal California is a major migration route for both water and land birds. From midsummer through winter and spring, thousands of shore birds, ducks, and geese inhabit coastal estuaries, lagoons, and mudflats. Other birds include the lesser goldfinch and golden-crowned sparrow.

California Dry Steppe Province

Land-surface form.--This province lies within the Central Valley of California--a flat alluvial plain between the Sierra Nevada and the Coast Ranges. Elevations range from sea level to 500 feet (150 m). This area has broad, nearly level valleys bordered by sloping alluvial fans, slightly dissected terraces and the lower foothills of the surrounding uplands. Large undrained basins lie in the south.

Climate.--Annual temperatures in this climate average 60 to 67F (16 to 19C), but can fall as low as 55F (13C) in the south. Precipitation is largely limited to winter rainfall, which peaks in December, January, and February. Except near the coast, summers are hot and the winters mild--often foggy, with little or no snow. Annual rainfall ranges from approximately six inches (150 mm) in the upper San Joaquin Valley to nearly 30 inches (760 mm) along the coast. Potential evaporation during the warmest months is often much greater than the precipitation. Low rainfall and small streamflow result in water scarcity in many areas.

Vegetation.--Evidence indicates that the Central Valley of California was once dominated by natural grasses that the plow, fire, and grazing have eliminated except in a few remaining stands. These stands suggest that the dominants were bunch grasses on lands similar in appearance to mixed prairie. Apparently, needlegrass was the principal species except near the coast. Today, introduced annual grasses, including various species of avens, brome, fescue, and barley, occupy most of the remaining grassland areas.

The rivers flow through alkaline flats where greasewood, picklewood, salt grass, and shadscale provide the chief cover. Tule marshes border the lower reaches of the San Joaquin and Sacramento Rivers.

Soils.--The soils of this region are mostly Entisols and Alfisols. The Entisols are usually at the lower elevations and the Alfisols at slightly higher elevations, away from the valley floor. A small area of Aridisols occurs in the more arid southern portions of the San Joaquin Valley.

Fauna.--Intensive agricultural development has changed the fauna of the annual grasslands. Larger species, such as the California grizzly bear, wolf, and pronghorn antelope, have been eliminated or pushed up into the hills. Common mammals include the Beechy ground squirrel, cottontail, blacktail jackrabbit, California mouse, and kangaroo rats. Several subspecies of mule deer live in brushy areas. Other species, such as the coyote and bobcat, live in adjacent woodlands, occasionally entering from them. The San Joaquin kit fox is classified as an endangered species.

Common birds include the mourning dove, horned lark, western meadowlark, western kingbird, mockingbird, loggerhead shrike, house finch, lesser goldfinch, red-shafted flicker, and scrub jay. The roadrunner feeds on reptiles and insects.

The California quail is numerous in areas where brush or rock outcrops provide cover. Avian predators include the golden eagle, red-tailed hawk, and Cooper's hawk.

Several species of snakes and lizards are present; rattlesnakes are important predators on rodents.

California Coastal Steppe, Mixed Forest, and Redwood Forest Province

Land-surface form.--Much of this province is composed of low mountains, but in places there is a narrow coastal plain and gently sloping marine terraces. A few broad valleys extend inland through the mountains. Confined to the coast, this region extends no farther inland than 35 miles (56 km), remaining at elevations below 3,000 feet (900 m).

Climate.--Characterized by a cool-summer subtype of the Mediterranean dry-summer subtropical climate, this province is confined to coasts washed by cool currents. The annual temperature cycle is very weak, reflecting the powerful influence of the cold California sea current with its cool marine air layer. Cool summers are typical, and winter temperatures are much milder than those of inland locations at similar latitudes. Annual temperatures average 50 to 55F (10 to 13C). All months are above freezing. Rainfall drops to nearly zero for two consecutive summer months, but rises to substantial amounts in the rainy winter season. Annual rainfall ranges from 40 to 100 inches (1,020 to 2,550 mm). Heavy fogs are common along the coast in summer. This region has a greater mean number of days with dense fogs than any other place in the United States.

Vegetation.--The redwood is characteristic of the fog belt on seaward slopes of coastal northwestern California. Associated with it are Douglas-fir and other conifers such as hemlock and cedar. The redwood forest is a hygrophyllic type of warm-temperate forest. Redwoods, which attain a height of 330 feet (100 m), are taller than the giant sequoia (big tree), which grows only in the Sierra Nevada of California. But redwood trunks remain relatively slender. Although redwoods live 500 years on average, they can reach up to 1,800 years of age. By comparison, 4,000 annual rings have been counted in the trunks of giant sequoia.

Redwood forests typically have a well-developed understory, usually dominated by large and colorful Pacific rhododendrons and western azaleas. Other shrubs, especially salal and California huckleberry, are usually present. Many ferns and flowers grow in the cool shade, such as western sword fern and redwood sorrel.

Headlands tend to be dry, and their outer ends are covered with fescue-oatgrass grasslands. Along the coast in a narrow, patchy belt lies pine-cypress forest. Inland, the southfacing mountain slopes are covered by mixed forest, including tanoak, coast live oak, madrone, and Douglas-fir. Oaks in the area of coastal forest tend to form distinct patches of oak woodland.

Soils.--The dominant soils are Ultisols under forest and Mollisols under grasslands.

Fauna.--Mule deer are common, and the Roosevelt subspecies of elk can be seen in Redwood National Park. Mammals include both Douglas and western gray squirrels, as well as two chipmunk species.

Birds include Anna's hummingbird and Wilson's warbler. The spotted owl can be found in both old-growth and second-growth redwood forest, along with great horned owls, western screech-owls, and northern pygmy-owls. A variety of shore birds and waterfowl occur in the coastal part of the province. Species of concern include marbled murrelet and northern spotted owl.

Salamanders, such as the Pacific giant salamander, are numerous in the cool, moist litter of the redwoods, especially near streams and rivers. The banana slug is also found here. Streams and rivers are used by anadromous fish.

Sierran Steppe--Mixed Forest--Coniferous Forest--Alpine Meadow Province

Land-surface form.--This province covers the southernmost portion of the Cascade Mountains, the northern Coast Range, the Klamath Mountains, and the Sierra Nevada. Most of the area is covered with steeply sloping to precipitous mountains crossed by many valleys with steep gradients. The long west slope of the Sierra Nevada rises gradually from 2,000 feet (600 m) to more than 14,000 feet (4,300 m); the east slope drops abruptly to the floor of the Great Basin, about 4,000 feet (1,200 m). Much of this region has been glaciated.

Climate.--Temperatures average 35 to 52F (2 to 11C), but fall with rising elevation. The base of the west slope receives only about 10 to 15 inches (250 to 380 mm) of rainfall per year and has a long, unbroken dry summer season. At higher elevations, the dry summer season shortens and precipitation rises to as much as 70 inches (1,790 mm), with a larger portion falling as snow. Prevailing west winds influence climatic conditions for the whole region. East slopes are much drier than west slopes. Winter precipitation makes up 80 to 85 percent of the total; at high elevations, it is mostly snow. The greatest total precipitation reported is on slopes between 3,000 and 7,000 feet (900 and 2,100 m), which support the luxuriant mixed conifer forests of the montane zone. The subalpine zone coincides with the altitude of greatest snowfall, where precipitation is 40 to 50 inches (1,020 to 1,280 mm) per year.

Vegetation.--Vegetation zones are exceptionally well marked. The lower slopes and foothills, from about 1,500 to 4,000 feet (460 to 1,200 m), are covered by coniferous and shrub associations. On higher slopes, digger pine and blue oak dominate, forming typical open or woodland stands. Most of the low hills are covered by close-growing evergreen scrub, or chaparral, in which buckbrush and manzanita predominate. Several oaks are common associates.

The montane zone lies between about 2,000 and 6,000 feet (600 and 1,800 m) in the Cascades, 4,000 and 7,000 feet (1,200 and 2,100 m) in the Central Sierras, and 5,000 and 8,000 feet (1,500 and 2,400 m) or more in the south. The most important trees are ponderosa pine, Jeffrey pine, Douglas-fir, sugar pine, white fir, red fir, and incense cedar; but several other conifers are also present. The giant sequoia (big tree) is one of the most spectacular species, but it grows only in a few groves on the western slope. Dense chaparral communities of manzanita, buckbrush, and buckthorn may appear after fire, sometimes persisting for years. Within the Sierran rain shadow, on the dry eastern slopes, Jeffrey pine replaces ponderosa pine. At lower elevations, pine forests are replaced by sagebrush-pinyon forest, part of the Intermountain Desert Province.

The subalpine zone begins at from 6,500 to 9,500 feet (1,980 m to 2,900 m), depending on latitude and exposure, and extends upslope about 1,000 feet (300 m). Mountain hemlock, California red fir, lodgepole pine, western white pine, and whitebark pine are important. Conditions are severe, and timberline varies from about 7,000 feet (2,100 m) in the north to 10,000 feet (3,000 m) in the south. Lodgepole pine is said to have climax characteristics near the upper limits of this zone. The alpine zone covers the treeless areas above timberline.

Soils.--Ultisols are extensive on mountain slopes where air is humid; dry Alfisols predominate at lower elevations. Entisols occupy the narrow floodplains and alluvial fans of the valleys.

Fauna.--Common large mammals include mule deer, mountain lion, coyote, and black bear. Smaller mammals include golden-mantled squirrel, bushytail wood rat, flying squirrel, red fox, fisher, yellow-haired porcupine, long-eared chipmunk, and Trowbridge's shrew.

Common birds are mountain quail, Cassin's finch, Hammond's flycatcher, Lincoln's sparrow, Audubon's warbler, pine siskin, Oregon junco, blue goose, Williamson's sapsucker, and mountain chickadee. Birds of prey include the western screech-owl, Cooper's hawk, northern pygmy-owl, and great gray owl. The California mountain kingsnake also lives here. The bark beetles Ips emarginatus and I. integer infest ponderosa and lodgepole pine.

California Coastal Range Open Woodland--Shrub--Coniferous Forest--Meadow Province

Land-surface form.--This province occupies the central part of the California Coast Ranges and the mountains of southern California. The Coast Ranges are gently to steeply sloping low mountains underlain by shale, sandstone, and igneous and volcanic rocks. Elevations range from 500 to 2,500 feet (150 to 800 m); some peaks rise to 5,000 feet (1,500 m). Stream valleys are narrow and widely spaced. The mountains of southern California are steeply sloping to precipitous; high mountains have unstable slopes and sharp crests; valleys are narrow. Elevations range from 2,000 to 8,000 feet (600 to 2,400 m); some peaks reach 12,000 feet (3,700 m).

Climate.--The climate is characterized by hot, dry summers and rainy, mild winters. Temperatures average 53 to 65F (12 to 18C) in the Coast Range, but are only 32 to 60F (0 to 16C) in the mountains of southern California, always falling with rising elevation. Precipitation, which ranges from 12 to 40 inches (310 to 1,020 mm) per year, is evenly distributed through fall, winter, and spring, and increases with elevation. Most of this is rain; the little snow that falls in winter melts quickly. Frost and short periods of freezing weather occur occasionally in winter. Coastal areas have a more moderate climate than the interior and receive some moisture from fog in summer.

Vegetation.--The montane vegetation of this region consists of species with thick, hard evergreen leaves. One climax association, dominated by trees, is called sclerophyll forest. The other, called chaparral, is a shrub climax. These two associations appear in alternating patches in almost every part of the region, but chaparral occupies the greater area. The forest consistently appears on northfacing slopes and on wetter sites; chaparral occupies southfacing slopes and drier sites.

The most important evergreen trees of the sclerophyll forest are California live oak, canyon live oak, interior live oak, tanoak, California laurel, Pacific madrone, golden chinkapin, and Pacific bayberry. Several deciduous trees, shrubs, and herb associates are also characteristic.

The chaparral community of fire-adapted shrubs extends over a wide area with a diversity of habitats. It includes at least 40 species of evergreen shrubs with varying degrees of dominance and importance. Some are so dense that they practically eliminate understory vegetation; other types support a highly productive understory. The most important species are chamise and manzanita. Other common species are Christmasberry, California scrub oak, mountain mahogany, and many species of ceanothus. At higher elevations and near the ocean, chaparral is often interspersed with, or alternates with, coniferous forests.

The interior valleys have sagebrush and grassland communities. A riparian forest with many broadleaf species grows along streams.

Soils.--The pattern of Alfisols, Entisols, and Mollisols in this region is complex. Mollisols are usually found along the coast; Alfisols occur in the north; and the south consists mostly of Entisols.

Fauna.--Mule deer are the most important large mammals. Other large mammals include the coyote, mountain lion, California bobcat, gray fox, wood rat, and spotted and striped skunks. Small mammals peculiar to chaparral include the Merriam chipmunk, California mouse, and five-toed kangaroo rat.

The most common birds seen in the dry summer season are wrentit, common bushtit, and rufous-sided towhee. In October, white-and-golden-crowned sparrows, several races of fox sparrows, hermit thrushes, ruby-crowned kinglets, and Audubon's warblers are present. The California condor is classified as an endangered species.

Reptiles, including the coast horned lizard and gopher snake, are numerous in all vegetation types. Amphibians appear to be scarce, except for the Pacific treefrog.

DRY DOMAIN

Tropical/ Subtropical Steppe Division

Tropical steppes border the tropical deserts on both the north and south, and in places on the east as well. Locally because of altitude, plateaus and high plains within what would otherwise be desert have a semiarid steppe climate. Steppes on the poleward fringes of the tropical deserts grade into the Mediterranean climate in many places. In the United States, they are cut off from the Mediterranean climate by coastal mountains that allow tropical deserts to extend farther north.

The division has a hot semiarid climate where potential evaporation exceeds precipitation, and where all months have temperatures above 32F.

Steppes typically are grasslands of short grasses and other herbs, and with locally developed shrub- and woodland. On the Colorado Plateau, for example, there is pinyon-juniper woodland. To the east, in Texas, the grasslands grade into savanna woodland or semideserts composed of xerophytic shrubs and trees, and the climate becomes semiarid-subtropical. Cactus plants are present in some places. These areas are able to support limited grazing, but are not generally moist enough for crop cultivation without irrigation. Soils are commonly Mollisols and Aridisols, containing some humus.

The Temperate Steppe Ecoregion is comprised of prairie grasslands, evergreen and deciduous forests, and sagebrush and chaparral shrublands. Prairie grasslands occur in an environment with irregularities in weather patterns, including wet and dry spells, which occur often enough to impose severe stresses on wildlife. Drought years can cause rapid declines in some species, especially birds, as the abundance and quality of vegetation is markedly decreased.

Many grassland species live in burrows, including burrowing owls, prairie dogs, ground squirrels, pocket gophers, black-footed ferrets, and American badgers. Burrows provide a more stable microclimate during hot summers and cold winters, and shelter from predators and grassland fires. Animals that do not utilize burrows have adapted to speed in order to escape predators, including the swift fox and pronghorn. Even quail and grouse often run instead of flying to escape predation, staying close to the ground and using the vegetation as cover.

Grassland animals tend to occur in large social groups and tend to be more social than their forestland counterparts. Prairie dogs live in large, highly organized social units, while their eastern woodland counterpart, the woodchuck, rarely interacts with its own species. Flocking species are also more prevalent in grasslands than in forestlands. Socialization enables the members of a flock to more readily detect predators, but also to convey other information, such as mating status, which is difficult to ascertain in open grassland where sound is muffled and perches are few. Raptors are also more common in grasslands than other habitats, as open spaces favor animals with good vision and provide an abundance of prey items.

Compared with other habitats, grasslands tend to have low bird species diversity and abundance as they are structurally simple and less complex than other habitat types, and thus provide birds with few niches to exploit. Bird species tend to differentiate themselves based on the cover and height of the grassland vegetation, with the horned lark and burrowing owl selecting areas with low, scattered vegetation, and the savanna sparrow and bobolink selecting high, dense herbaceous cover.

Deer, elk, and pronghorn are found in the intermountain grasslands, which can not support Temperate Steppe species that require a supply of green grass year-round. Ground squirrel diversity is especially high in the intermountain grasslands, with 19 of the 22 species of ground squirrels in North America found in this region.

Evergreen and deciduous forests are found at higher elevations and along streams and other aquatic areas. Aspen is an important component of these forests. American beaver use aspen limbs and foliage for food and to build dams and lodges. Snowshoe hare feed on aspen twigs and bark during winter, and aspen buds are important in the winter diet of ruffed grouse. American badger, ground squirrels, and other burrowing animals are common in this habitat.

Colorado Plateau Semidesert Province

Land-surface form.--The Colorado Plateau Province consists of tablelands with moderate to considerable relief in Arizona, New Mexico, and Utah. Elevations of the plateau tops range from 5,000 to 7,000 feet (1,500 to 2,100 m), with local relief ranging from 500 to more than 3,000 feet (150 to 900 m) in some of the deeper canyons that dissect the plateaus (such as the Grand

Canyon of the Colorado River). In some areas, volcanic mountains rise 1,000 to 3,000 feet (300 to 900 m) above the plateau surface. Stream valleys are narrow and widely spaced. The Colorado River, which crosses the northern part of the province, is the region's only large stream. Many other streams flow year-round, but the volume of water fluctuates considerably.

Climate.--Due to the region's generally high altitude, the climate is characterized by cold winters. Summer days are usually hot, but nights are cool; accordingly, the diurnal variation in temperature is considerable. Annual average temperatures are 40 to 55F (4 to 13C), decreasing with rising elevation. Average annual precipitation is about 20 inches (510 mm), except on the higher mountains; some parts of the province receive less than 10 inches (260 mm). Summer rains are thunderstorms, with ordinary rains arriving in winter. Thus, this province differs from the Intermountain Semidesert Province, which generally lacks summer rains.

Vegetation.--Vegetational zones are conspicuous but lack uniformity. In the lowest zone, there are arid grasslands, but the shortgrass sod seldom covers the ground completely, leaving many bare areas. Xeric shrubs often grow in open stands among the grasses, and sagebrush is dominant over extensive areas. A profusion of annuals and perennials blooms during the summer rainy season. At low elevations in the south, several kinds of cactus and yucca are common. Cottonwoods and, more rarely, other trees grow along some of the permanent streams.

The woodland zone is the most extensive, dominated by open stands of two-needle pinyon pine and several species of juniper, often termed a pygmy forest. Between the trees the ground is sparsely covered by grama, other grasses, herbs, and various shrubs, such as big sagebrush and alderleaf cercocarpus.

The montane zone extends over considerable areas on the high plateaus and mountains, but it is much smaller in area than the pinyon-juniper zone. Vegetation in the montane zone varies considerably from area to area. In the south, especially in Arizona, ponderosa pine is the dominant forest tree. Douglas-fir is associated with ponderosa pine or else grows in more sheltered locations or at higher elevations. In Utah, by contrast, lodgepole pine and aspen are dominant.

The subalpine zone is characterized by abundance of Engelmann spruce and subalpine fir. On San Francisco Mountain in northern Arizona, the spruce is often associated with bristlecone pine. Because only a few isolated mountains rise above timberline, the alpine zone is not extensive.

South of the Mogollon Rim in Arizona, toward the American Desert, lies a foothill forest. The principal trees are Mexican pinyon, alligator juniper, and various species of oak. Forests of ponderosa pine and common Douglas-fir carpet moist canyons and northfacing slopes. Pointleaf manzanita is a common evergreen shrub.

Soils.--Entisols occur along the floodplains of major streams. Aridisols cover plateau tops, older terraces, and alluvial fans. Badlands of rough broken land are extensive in the mountains and on plateaus.

Fauna.--Major mammals are the mule deer, mountain lion, coyote, and bobcat; elk are locally important. Pronghorn antelope are the primary large mammal in the arid grasslands. Smaller species include the blacktail jackrabbit, Colorado chipmunk, rock squirrel, wood rat, white-footed mouse, cliff chipmunk, cottontail, porcupine, and gray fox. The ringtail cat and spotted skunk occur rarely.

The most abundant resident birds are the bushtit, pinyon jay, plain titmouse, black-chinned hummingbird, Woodhouse's jay, red-tailed hawk, golden eagle, red-shafted flicker, and rock wren. Summer residents include the chipping sparrow, nighthawk, black-throated gray warbler, northern cliff swallow, lark sparrow, and mourning dove. Common winter residents are the pink-sided junco, Shufeldt's junco, gray-headed junco, red-backed junco, Rocky Mountain nuthatch, mountain bluebird, robin, and Steller's jay. Turkeys are locally abundant during winter. Reptiles include the horned lizard, collared lizard, and rattlesnake.

Southwest Plateau and Plains Dry Steppe and Shrub Province

Land-surface form.--This is a region of flat to rolling plains and plateaus occasionally dissected by canyons at the western end of the Gulf Coastal Plain and the southern end of the Great Plains. The Stake Plains of Texas are included in this province. Elevations range from sea level to 3,600 feet (1,100 m) on the Edwards Plateau and to 6,500 feet (1,980 m) near the Rocky Mountain Piedmont. A mesa-and-butte landscape is characteristic of certain parts.

Climate.--The climate is semiarid. Summers are long and hot, and winters are short and mild. Annual temperatures average 60 to 70F (16 to 21C). The frost-free season ranges from about 130 to considerably more than 300 days. Precipitation, which falls mostly during the growing season, is about 30 inches (770 mm) in the eastern part of the province and decreases to 10 to 15 inches (255 to 380 mm) in the western part. Annual evaporation is 71 to 79 inches (1,800 to 2,000 mm). From May to October, potential evaporation is about twice the precipitation.

Vegetation.--This province is characterized by arid grasslands in which shrubs and low trees grow singly or in bunches. On the plains of northwestern Texas and eastern New Mexico, xerophytic grasses (blue grama and buffalo grass) are the characteristic vegetation. However, in much of this area, mesquite (Prosopis) grows in open stands among the grasses. On the Edwards Plateau, oak and juniper are often mixed with grasses and mesquite, and on steep rocky slopes these trees may form closed stands. Due to low rainfall, they rarely grow higher than 20 feet (6.1 m). The most characteristic tree is Ashe juniper. Over much of the Plateau, the characteristic vegetation is grass, especially prairie three-awn (needlegrass); trees and shrubs are present only in very open stands. On slopes leading down to the Rio Grande, the ceniza shrub dominates. Live oak forest is found along the Gulf Coast. A unique semiarid forest consisting of small trees and shrubs with Mexican affinities occupies the Rio Grande delta. The endangered sabal palm is native here.

Soils.--Soils in this region are varied, but the different orders are well correlated with the different plant communities. The mesquite-live oak savanna, for example, is the only Entisol area in the region. Soils of the mesquite-buffalograss and juniper-oak savannas are almost entirely Mollisols; an island of Alfisols within the area corresponds to the boundaries of the mesquite-oak savanna. In the mesquite-acacia savanna, Mollisols, Alfisols, and Vertisols occur. On sandy soils in the Staked Plains of Texas, a thick growth of low shin oak practically excludes every other type of plant.

Fauna.--The northern limit of distribution of several mammals coincides generally with the northern boundary of this province. The Mexican ground squirrel and gray fox live to the south of this boundary, but not to the north. Whitetail deer are abundant, and armadillo are present. The fox squirrel is hunted in wooded areas along streams. Chief furbearers are the ringtail and raccoon. The Edwards Plateau contains several scattered limestone caverns that support huge populations of Mexican freetail bats.

The threatened golden-cheeked warbler and black-capped vireo inhabit northwestern areas where the Ashe juniper is present. Wild turkey, mourning dove, scaled quail, and bobwhite are common game birds, and several species of hawks and owls are present.

Arizona-New Mexico Mountains Semidesert--Open Woodland--Coniferous Forest--Alpine Meadow Province

Land-surface form.--This area consists mostly of steep foothills and mountains, but includes some deeply dissected high plateaus. Elevations range from 4,500 to 10,000 feet (1,370 to 3,000 m), with some mountain peaks reaching as high as 12,600 feet (3,840 m). In many areas, the relief is higher than 3,000 feet (900 m). Isolated volcanic peaks rise to considerable heights in the northwest.

Climate.--Climate varies considerably with altitude. Average annual temperature is about 55F (13C) in the lower foothills and 40F (4C) on the upper mountain slopes. Average annual precipitation ranges from 10 to 35 inches (260 to 890 mm), increasing with rising elevation. During late spring, there is a moisture deficit until the arrival of summer rains, which appear as thunderstorms. Rains also come in early autumn and winter. In the mountains, most precipitation is snow.

Vegetation.--Vegetational zones resemble those of the Rocky Mountains (described below), but occur at higher elevations. The foothill zone, which reaches as high as 7,000 feet (2,100 m), is characterized by mixed grasses, chaparral brush, oak-juniper woodland, and pinyon-juniper woodland. At about 7,000 feet (2,100 m), open forests of ponderosa pine are found, although pinyon and juniper occupy southfacing slopes. In Arizona, the pine forests of this zone are strongly infused with Mexican species, including Chihuahuan and Apache pine. Pine forest is replaced at about 8,000 feet (2,400 m) on northfacing slopes (a little higher elsewhere) by Douglas-fir. Aspen is common in this zone, and limber pine grows in places that are rockier and drier.

At about 9,000 feet (2,700 m), the Douglas-fir zone merges into a zone of Engelmann spruce and corkbark fir. Limber pines and bristlecone pines grow in the rockier places. An alpine belt covers relatively small areas above 11,000 feet (3,400 m).

Soils.--Detailed information about orders of soils is lacking for much of this area. The Four Corners region is composed mostly of Entisols. Alfisols and Inceptisols dominate upland areas. Stony land and rock outcrops occupy large areas on the mountains and in the foothills.

Fauna.--The most common large mammal is the mule deer. Mammalian predators include mountain lions, coyotes, and bobcats. Small mammals are the deer mouse, longtail weasel, porcupine, golden-mantled ground squirrel, Colorado chipmunk, red squirrel, wood rat, pocket gopher, longtail vole, Kaibab (Abert) squirrel, and cottontail.

Some of the more common birds are the northern pygmy-owl, olive warbler, red-faced warbler, hepatic tanager, mountain bluebird, pygmy nuthatch, white-breasted nuthatch, Mexican junco, Steller's jay, red-shafted flicker and the Rocky Mountain sapsucker. Goshawks and red-tailed hawks are present. The only widely found reptile is the short-horned lizard.

Tropical/ Subtropical Desert Division

South of the Arizona-New Mexico Mountains are the continental desert climates, which have not only extreme aridity, but also extremely high air and soil temperatures. Direct sun radiation is very strong, as is outgoing radiation at night, causing extreme variations between day and night temperatures and a rare nocturnal frost. Annual precipitation is less than 8 inches (200 mm), and less than four inches (100 mm) in extreme deserts. These areas have climates that Trewartha (1968) calls BWh.

The region is characterized by dry-desert vegetation, a class of xerophytic plants that are widely dispersed and provide negligible ground cover. In dry periods, visible vegetation is limited to small hard-leaved or spiny shrubs, cacti, or hard grasses. Many species of small annuals may be present, but they appear only after the rare but heavy rains have saturated the soil.

In the Mojave-Sonoran Deserts (American Desert), plants are often so large that some places have a near-woodland appearance. Well known are the treelike saguaro cactus, the prickly pear cactus, the ocotillo, creosote bush, and smoke tree. But much of the desert of the Southwestern United States is in fact scrub, thorn scrub, savanna, or steppe grassland. Parts of this region have no visible plants; they are made up of shifting sand dunes or almost sterile salt flats.

The Subtropical Desert Ecoregion is composed of the Mohave, Sonoran, and Chihuahuan deserts. In contrast to the cooler deserts of the Temperate Desert Ecoregion, the hotter deserts of the Subtropical Desert Ecoregion tend to have a more diverse flora and fauna. The northern limits of many species common in Mexico are found in this ecoregion, such as brown-crested flycatcher, vermilion flycatcher, black-tailed gnatcatcher, hooded skunk, pocketed free-tail bat, coatimundi, and jaguar. The Sonoran Desert is the most floristically diverse of the three deserts, and as a result, has the greatest diversity of wildlife. The desert tortoise, which is federally listed as a threatened species (in the Mojave Desert only), is found in this ecoregion. Long-lived and once common, desert tortoises have suffered population declines due to adverse impacts associated with human activities. The Sonoran pronghorn is classed as an endangered species; few of these animals are left in southern Arizona. The mashed bobwhite quail is also an endangered species. Large ungulates are mostly absent from this ecoregion. Pronghorn antelope and mule deer are the most widely distributed large game animals.

Wildlife species in the Subtropical Desert have evolved numerous means to deal with water scarcity and other rigors of the hot desert. Presence of standing water in winter and new herbaceous growth in spring provide water and forage for most wildlife. During summer and fall, some species, such as the desert kangaroo rat and other rodents, derive water from the seeds in their diet. However, collared peccaries and many desert rodents can avoid or digest cactus spines and obtain water from the plants' succulent tissues.

Black-throated sparrows secrete highly-concentrated urine and dry feces, and thus need little drinking water. In contrast, most other desert-living bird species show few adaptations for coping with water scarcity and simply fly to water sources to meet their needs. Reptiles and small mammals are active mostly at night and retreat to cool burrows, or seek shelter under vegetation or in rock outcrops to avoid the midday sun and reduce water loss.

Salt balance is an important physiological function in desert animals. Chuckwallas are able to excrete salt from their nostrils by sneezing, without losing much water. Many other lizard species, including Desert Iguanas, also have salt glands for excreting salt.

The structure of live vegetation is probably the most important habitat feature in these deserts. Cacti provide breeding and housing habitats for bats and birds, including elf owl, cactus wren, Gila woodpecker and gilded flicker. Lizards use cacti and shrubs for feeding and breeding and climb creosotebush to escape hot ground temperatures during the day. Small mammals such as the blacktailed jackrabbit, desert cottontail, kangaroo rat, wood rat, toads and reptiles utilize the root systems of the creosote bush and other shrubs as protection for burrow openings and to hide from predators such as coyote, bobcat, golden eagle, great horned owl, red-tailed hawk, and ferruginous hawk.

A dominant pedogenic process is salinization, which produces areas of salt crust where only salt-loving (halophytic) plants can survive. Calcification is conspicuous on well-drained uplands, where encrustations and deposits of calcium carbonate (caliche) are common. Humus is lacking and soils are mostly Aridisols and dry Entisols.

Chihuahuan Desert Province

Land-surface form.--This province is mostly desert. Practically the only permanent streams are a few large rivers that originate in humid provinces. The Rio Grande and the Pecos Rivers and a few of their larger tributaries are the only perennial streams. The area has undulating plains with elevations near 4,000 feet (1,200 m), from which somewhat isolated mountains rise 2,000 to 5,000 feet (600 to 1,500 m). Washes, dry most of the year, fill with water following rains. Basins with no outlets drain into shallow playa lakes that dry up during rainless periods. Small whirlwinds constantly play over these dry playas when they are heated by summer sun. Extensive dunes of silica sand cover parts of the province. In a few places there are dunes of gypsum sand, the most notable being the White Sands near Alamogordo in southern New Mexico. In scattered areas, small beds and isolated buttes of blackish lava occur.

Climate.--Summers are long and hot. Winters are short, but may include brief periods when temperatures fall below freezing. Average annual temperatures range from 50 to 65F (10 to 18C). The climate is distinctly arid; spring and early summer are extremely dry. Mean annual precipitation at El Paso, Texas, is 8.65 inches (221 mm). In July, summer rains usually begin, torrential storms that are mostly local and continue through October. The northern part of the province also receives winter rains, which are more gentle and widespread.

Vegetation.--A number of shrubs, most of them thorny, are typical of the Chihuahuan Desert. They frequently grow in open stands, but sometimes form low, closed thickets. In many places, they are associated with short grass, such as grama. Extensive arid grasslands cover most of the high plains of the province. On deep soils, honey mesquite is often the dominant plant. Cacti are also abundant, particularly prickly pears, but they are smaller in size and fewer in number of species than in the Sonoran Desert. The desert is characterized by yuccas, so much so that one has been adopted as the state flower of New Mexico. A few cottonwoods and other trees grow beside the widely separated rivers. Creosote bush, which covers great areas in characteristic open stands, is especially common on gravel fans. Though creosote bush is the most abundant plant cover of the province, other species like lechuguilla are also abundant. Another distinctive plant is candelilla, or wax plant. On rocky slopes, the ocotillo is conspicuous. Juniper and pinyons, limited to rocky outcrops, are prominent around the Stockton Plateau in western Texas.

Some isolated mountains in the Chihuahuan Province rise high enough to carry a belt of oak and juniper woodland. On a few of the highest mountains, there are pines among the oaks, in some places forming nearly pure stands. Douglas-fir and white fir occupy a few sheltered upper slopes in the Santa Catalina Mountains.

Soils.--In the western and northern portions of this province, the soils are primarily Aridisols. Both Aridisols and Entisols are present in the south.

Fauna.--Pronghorn antelope and mule deer are the most widely distributed large game animals. Whitetail deer inhabit parts of Texas. The collared peccary or javelina is common in the southern part of the region. The blacktail jackrabbit, desert cottontail, kangaroo rat, wood rat, and numerous smaller rodents compete with domestic and wild herbivores for available forage. Mammalian predators include the coyote and bobcat.

The black-throated sparrow is one of the most abundant birds of the province. Greater roadrunner, curve-billed thrasher, and Chihuahuan raven are also common. Scaled quail and Gambel's quail occupy most of the area, and bobwhite populations reach into its eastern portion. Raptors include the golden eagle, great horned owl, red-tailed hawk, ferruginous hawk, and the rare zone-tailed hawk.

The many reptiles include the common chuckwalla, Texas horned lizard, desert spiny lizard, and various species of rattlesnakes.

American Semidesert and Desert Province

Land-surface form.--The American Desert includes the Mojave, Colorado, and Sonoran Deserts. Its topography is characterized by extensive plains, most gently undulating, from which isolated low mountains and buttes rise abruptly. Elevations range from 280 feet (85 m) below sea level to 4,000 feet (1,200 m) in valleys and basins, with some mountain ranges reaching as high as 11,000 feet (3,400 m). The mountains are rocky and rise abruptly from their outwash aprons and alluvial faces. There are areas of interior drainage, such as the Salton Trough, but a large part of the province drains to the sea through underground seepage or through washes that are dry most of the year. The Colorado River, which crosses the eastern part of the province, is the only sizable stream.

Climate.--Summers are long and hot; the highest temperature ever measured in the United States was 134F (57C) in 1913 at Death Valley. The average annual temperature is 60 to 75F (15 to 24C). Though winters are moderate, the entire province is subject to occasional frosts. In winter the rains are widespread and usually gentle, but in summer they are usually thunderstorms. In the Colorado and Mojave Deserts of southeastern California, there are virtually no summer rains. No part of the province has regular rains, and a year or more may pass without measurable rainfall, especially in the region's western part. Average annual precipitation is 2 to 10 inches (50 to 250 mm) in the valleys, but may reach 25 inches (610 mm) on mountain slopes. The evaporation rate in summer is very high.

Vegetation.--Vegetation is usually very sparse, with bare ground between individual plants. Cacti and thorny shrubs are conspicuous, but many thornless shrubs and herbs are also present. On the Sonoran Desert plains, the most widely distributed plant is the creosote bush, which covers extensive areas in nearly pure stands. On some parts of the plains the arborescent cacti (cholla) are also common. Mesquite is less widespread and grows only along washes and watercourses.

At the base of the mountains, on the gentle rocky slopes called bajadas, the vegetation is dominated by paloverde, ocotillo, and saguaro, but bitterbrush is also a common shrub. Vegetation below 3,000 feet (900 m) in the Mojave Desert is mostly creosote bush and various Atriplex (saltbush) species. The desert mountains are exceptionally barren, and many are almost devoid of vegetation.

Along the higher northern edge of the province is a belt where the Joshua tree is prominent. At a still higher level is a belt of junipers and pinyons.

Interior basins characterized by ephemeral shallow playa lakes are a conspicuous feature of the Mojave Desert. Soils near these playas contain alkali in quantities varying with distance from the lake, resulting in a zonation of several species of vegetation according to their tolerance for salts.

Soils.--Gravel or bare rock covers the ground near the bases of some mountains, and much bare rock is exposed on the mountains because the heavy, violent desert rainstorms allow little soil to accumulate on the steep slopes. Entisols occur on the older alluvial fans and terraces and in the better-drained basins. Aridisols dominate throughout the rest of the province.

Fauna.--Large ungulates are almost absent from the desert. Desert mule deer and peccary live chiefly in the paloverde-cactus shrub community. The Sonoran pronghorn antelope is classified as an endangered species; few are left in southern Arizona. Carnivores, including the desert kit fox and coyote, are small and usually nocturnal. The western spotted skunk is common. Nocturnal burrowers, particularly kangaroo rats and pocket mice, dominate. Merriam kangaroo rat is closely associated with creosote bush. Other important species are the longtail pocket mouse and antelope ground squirrel.

Many desert birds are very selective in their type of habitat. Greasewood may furnish a permanent residence for the loggerhead shrike. Areas where tall cacti are plentiful furnish homes for many birds, including the Gila woodpecker, elf owl, and purple marten. Gambel's quail, the cactus wren, and the roadrunner are common in the southern part of the region. The masked bobwhite quail is an endangered species that has been reintroduced.

Reptiles include numerous species of snakes and lizards, such as the Gila monster, the only poisonous lizard in the United States. The desert tortoise is becoming increasingly rare and is everywhere protected.

Endemic species, common in the Mojave Desert, include five species of desert pupfish living in highly saline lakes in Death Valley.

Temperate Steppe Division

Temperate steppes are areas with a semiarid continental climatic regime in which, despite maximum summer rainfall, evaporation usually exceeds precipitation. There is a cool climate with at least one month of average temperatures below 32F (0C). Winters are cold and dry, summers warm to hot. The vegetation is steppe, sometimes called shortgrass prairie, and semidesert. Typical steppe vegetation consists of numerous species of short grasses that usually grow in sparsely distributed bunches. Scattered shrubs and low trees sometimes grow in the steppe; all gradations of cover are present, from semidesert to woodland. Because ground cover is generally sparse, much soil is exposed. Many species of grasses and other herbs occur. Buffalo grass is typical of the American steppe; other typical plants are the sunflower and locoweed.

The semidesert cover is a xerophytic shrub vegetation accompanied by a poorly developed herbaceous layer. Trees are generally absent. An example of semidesert cover is the sagebrush vegetation of the middle and southern Rocky Mountain region and the Colorado Plateau.

In this climatic regime, the dominant pedogenic process is calcification, with salinization on poorly drained sites. Soils contain a large excess of precipitated calcium carbonate and are very rich in bases. Mollisols are typical in steppe lands. The soils of the semidesert shrub are Aridisols with little organic content, pedogenic and (occasionally) clay horizons, and (in some places) accumulations of various salts. Humus content is small because the vegetation is so sparse.

Great Plains- Palouse Dry Steppe Province

Land-surface form.--This region is characterized by rolling plains and tablelands of moderate relief in a broad belt that slopes gradually eastward from an altitude of 5,500 feet (1,520 m) near the foot of the Rocky Mountains to 2,500 feet (760 m) in the Central States. The plains are notably flat, but there are occasional valleys, canyons, and buttes. In the northern section, badlands and isolated mountains break the continuity of the plains. The Palouse region occupies a series of loess-covered basalt tablelands with moderate to high relief, ranging in altitude from 1,200 to 6,000 feet (370 to 1,800 m).

Climate.--This region lies in the rain shadow east of the Cascade Range and the Rocky Mountains. The climate of the Great Plains grasslands is a semiarid continental regime. The average annual temperature is 45F (7C) throughout most of the region, but can reach as high as 60F (16C) in the south. Winters are cold and dry, and summers are warm to hot. The frost-free season ranges from fewer than 100 days in the north to more than 200 days in Oklahoma. Precipitation ranges from 10 inches (260 mm) in the north to more than 25 inches (640 mm) in the south, with maximum rainfall in summer. Evaporation usually exceeds precipitation, and the total supply of moisture is low. When precipitation does occur, it is often in the form of hail or blizzards, and tornadoes and dust storms are frequent.

The climate of the Palouse grassland east of the Cascades is similar to that of the Great Plains grasslands east of the Rockies, except for the timing of precipitation: on the Palouse dry steppe, there is a winter maximum.

Vegetation.--Steppe, sometimes called shortgrass prairie, is a formation class of short grasses usually bunched and sparsely distributed. The steppe in this province is dry, with 6-7 arid months per year. The Great Plains grasslands east of the Rockies have scattered trees and shrubs, such as sagebrush and rabbitbrush, and support all gradations of cover, from semidesert to woodland. Because ground cover is scarce, much soil is exposed.

Many species of grasses and herbs grow in this province. A typical grass is buffalo grass; sunflower and locoweed are typical plants. Other grasses include grama, wheatgrass, and needlegrass. Many wildflower species bloom in spring and summer. The blazingstar and white prickly poppy are usually abundant. The alien Russian-thistle, also know as tumbleweed, is sometimes abundant.

Except for the presence of shrubs, the Palouse grassland resembles the Great Plains shortgrass prairie. The dominant species, however, are distinctive. They include bluebunch wheatgrass, fescue, and bluegrass.

Soil.--In this climatic regime, the dominant pedogenic process is calcification; salinization is dominant on poorly drained sites. Soils contain a large excess of precipitated calcium carbonate and are rich in bases. Mollisols are typical. Humus content is small because vegetation is sparse.

Fauna.--Large herds of buffalo migrated with the seasons across the steppe plains. Now the pronghorn antelope is probably the most abundant large mammal, but mule deer and whitetail deer are common where brush cover is available along stream courses. The whitetail jackrabbit occupies the northern part of the province, with the blacktail jackrabbit in the area south of Nebraska. The desert cottontail is widespread. The lagomorphs, prairie dogs, and several other small rodents are preyed upon by the coyote and several other mammalian and avian predators; one, the blackfooted ferret, is classified as an endangered species. The thirteen-lined ground squirrel is common here; both prairie dogs and ground squirrels are preyed upon by badgers. The Washington and Columbia ground squirrels inhabit large areas of the Palouse grassland.

The lesser prairie chicken, once abundant, is now classified as threatened. Sage grouse, greater prairie chickens, and sharp-tailed grouse are present in the area. Among the many smaller birds are the horned lark, lark bunting, and western meadowlark. Two bird species are unique to the shortgrass prairies east of the Rockies, the mountain plover and McCown's longspur. Mountain plovers, which resemble killdeer, live in small flocks often seen feeding in freshly plowed fields. Construction of stock ponds has created an important "duck factory" in the northern Great Plains.

Southern Rocky Mountain Steppe--Open Woodland--Coniferous Forest--Alpine Meadow Province

Land-surface form.--The Rocky Mountains are rugged glaciated mountains as high as 14,000 feet (4,300 m). Local relief is between 3,000 feet (900 m) and 7,000 feet (2,100 m). Several sections have intermontane depressions ("parks") with floors less than 6,000 feet (1,800 m) in altitude. Many high-elevation plateaus composed of dissected, horizontally layered rocks lie in Wyoming and Utah.

Climate.--The climate is a temperate semiarid steppe regime with average annual temperatures ranging from 35 to 45F (2 to 7C) in most of the region, but reaching 50F (10C) in the lower valleys. Climate is influenced by the prevailing west winds and the general north-south orientation of the mountain ranges. East slopes are much drier than west slopes; individual mountain ranges have similar east-west slope differences region wide. Winter precipitation varies considerably with altitude. Total precipitation is moderate, but greater than on the plains to the east and west. In the highest mountains, a considerable part of annual precipitation is snow, although permanent snowfields and glaciers cover only relatively small areas. Bases of these mountains receive only 10 to 20 inches (260 to 510 mm) of rainfall per year. At higher elevations, annual precipitation increases to 40 inches (1,020 mm), and average temperatures fall.

Vegetation.--A striking feature of the region is its pronounced vegetational zonation, controlled by a combination of altitude, latitude, direction of prevailing winds, and slope exposure. Generally, the various zones are at higher altitudes in the southern part of the province than in the northern, and they extend downward on east facing and north facing slopes and in narrow ravines and valleys subject to cold air drainage. The uppermost (alpine) zone is characterized by alpine tundra and the absence of trees. Directly below it is the subalpine zone, dominated in most places by Engelmann spruce and subalpine fir. Below this area lies the montane zone, characterized by ponderosa pine and Douglas-fir, which frequently alternate--ponderosa pine dominates on lower, drier, more exposed slopes, and Douglas-fir is predominant in higher, moister, more sheltered areas.

After fire in the subalpine zone and in the upper part of the montane zone, the original forest trees are usually replaced by aspen or lodgepole pine.

Grass, often mixed with sagebrush, regularly covers the ground in open ponderosa pine forests and some treeless areas. These treeless openings are usually small, and they often alternate (depending on slope exposure) with ponderosa pine forest. At the lower edge of the montane zone, they may open onto the adjacent grass and sagebrush belt.

Below the montane belt is the foothill (woodland) zone. Dry rocky slopes in this zone often have a growth of shrubs in which mountain-mahogany and several kinds of scrub oak are conspicuous. Along the border of the Colorado Plateau Province, ponderosa pine and pinyon-juniper associations frequently alternate, depending on slope exposure.

Unforested parks are a conspicuous feature of this province. Many are dominated by grasses, but some are covered largely by sagebrush and other shrubs, such as antelope bitterbrush.

Soils.--In the Rocky Mountains, soil orders occur in zones corresponding to vegetation, ranging from Mollisols and Alfisols in the montane zone to Aridisols in the foothill zone. In addition, because of steep slopes and recent glaciation, there are areas of Inceptisols.

Fauna.--Common large mammals include elk, deer, bighorn sheep, mountain lion, bobcat, beaver, porcupine, and black bear. Grizzly bear and moose inhabit the province's northern portions. Small mammals include mice, squirrels, martens, chipmunks, mountain cottontails, and bushytail woodrats.

Common birds include the mountain bluebird, chestnut-backed chickadee, red-breasted nuthatch, ruby-crowned kinglet, pygmy nuthatch, gray jay, Steller's jay, and Clark's nutcracker. Rosy finches are found in the high snowfields. Blue and ruffed grouse are the most common upland game birds. Hawks and owls inhabit most of the region.

Middle Rocky Mountain Steppe--Coniferous Forest--Alpine Meadow Province

Land-surface form.--Most of central Idaho and the Salmon River Mountains are formed by granitic intrusions that collectively make up the Idaho Batholith, with altitudes ranging from 3,000 to 7,000 feet (900 to 2,130 m). The batholith is deeply dissected, with a relief greater than 3,000 ft, and its granite is heavily weathered over large areas. East of the batholith is a basin-and-range area consisting of mountains, alluvial fans at their bases, and floodplains along the streams draining the valleys. To the west lie the Blue Mountains, which seldom exceed 8,000 feet (2,400 m) but have at least one peak 10,000 feet (3,050 m) high. The Snake River crosses the province at the bottom of Hells Canyon, which is deeper than the Grand Canyon. Many of the region's higher reaches have been glaciated.

Climate.--Despite the northerly latitudes and high altitudes of this region, its climates are surprisingly mild due to their proximity to the Pacific Ocean. Mean monthly temperatures at Canyon City, Oregon (near John Day), range from just above freezing to 68F (20C). In the mountain valleys of Montana, January temperatures average as much as 10F (6C) higher and summer temperatures 5 to 10F (3 to 6C) lower than on the Great Plains just to the east. The average length of the growing season is about the same as on the Great Plains, roughly 120 days. Temperature and snowfall, of course, vary greatly with altitude. Winds are from the west, with much of their moisture precipitated where they cross the Pacific ranges. Consequently, most of this portion of the Rocky Mountains is semiarid. Valleys get less than 20 inches (510 mm) of precipitation each year; up to 30 inches (770 mm) falls in the mountains, mostly as snow.

Vegetation.--Altitudinal zones are evident. Below the subalpine zone, Douglas-fir is the climax dominant, with grand fir as an associate west of the continental divide, chiefly on west facing slopes. Lodgepole pines and grasses grow principally in the basins and ranges in the eastern and southeastern part of the province. Below the Douglas-fir belt, ponderosa pine is dominant to the west of the continental divide, constituting a xerophytic forest. The lower slopes of the mountains and the basal plain are dominated by sagebrush semidesert or steppe.

Due to aridity, forests directly east of the Bitterroot Mountains are usually restricted to northern and eastern slopes. Although south- and west facing slopes receive comparable precipitation, they are hotter and evaporation is higher. Consequently, they support few trees and are covered by shrubs and grasses.

Soils.--Soils of the fans and valley floors, most of which lie below 2,000 feet (600 m), are Mollisols. These soils support sagebrush and grass. Above 2,000 feet, under coniferous forest, the soils are Alfisols. Areas recently glaciated or with steep slopes have Inceptisols.

Fauna.--Fauna in the Middle Rocky Mountain Province are like those elsewhere in the Rockies to the north and south. However, parts of the province are filled with mountain ranges that are isolated by stretches of arid territory. Each such range usually contains a group of species peculiar to the region, and some of these species may be found only in a single range.

Northern Rocky Mountain Forest-Steppe--Coniferous Forest--Alpine Meadow Province

Land-surface form.--The Northern Rocky Mountain Province consists of high, rugged mountains rising to more than 9,000 feet (2,700 m), with a local relief in excess of 3,000 feet (900 m). Most of the region has been glaciated. In the several Rocky Mountain trenches, there are flat or nearly flat valleys, some of which are several miles wide.

Climate.--Severe winters are usual. The average temperature of the coldest month is below 32F (0C), and the average temperature of the warmest month is below 72F (22C). Summer days are often hot and nights cool. Precipitation averages 20 to 40 inches (510 to 1,020 mm) per year and is concentrated in fall, winter, and spring. Summers are usually dry, because westerly air masses draw the dry climate of the Pacific coast across the area. As a result, there is a distinct climatic gradient from north to south and east to west. Snowfall in winter is heavy, but permanent snowfields and glaciers cover only rather small areas.

Vegetation.--Mixed evergreen-deciduous forest predominates; Douglas-fir forest and cedar-hemlock-Douglas-fir forest are the two major types.

Well-marked life belts are a striking feature of the province. In the uppermost (alpine) belt, trees are absent. The subalpine belt is dominated in most places by Engelmann spruce and subalpine fir. In the Bitterroot Range, mountain hemlock is said to be the climax tree of the subalpine belt. Western redcedar and western hemlock are characteristic of the montane belt. Associated trees include Douglas-fir (found throughout the region), along with western white pine, western larch, grand fir, and western ponderosa pine (found in the south). In these forests, areas that have been burned or cut are invaded first by larch, a deciduous conifer. White pine may crowd out the larch, then be replaced by hemlock, redcedar, and lowland white fir. Depending on latitude, the lower part of the montane belt may be interspersed with grass and sagebrush.

Soils.--Soils are mostly cool, moist Inceptisols. A variety of igneous, sedimentary, and metamorphic rocks form the mountain masses. But compared to other parts of the Rocky Mountains, the shallowness and stoniness of soils play a relatively minor role in forest distribution. In the foothills of the Rockies and to the south of the glacial border, the loess and volcanic ash deposited on the slopes have helped to form excellent soils.

Fauna.--Large mammals in this province include black bear, deer, elk, mountain goat, mountain lion, and bobcat. Smaller mammals include Columbia ground squirrel, flying squirrel, marten, redtail chipmunk, and bushytail woodrat.

Some familiar birds are hawks, jays, chestnut-backed chickadees, red-breasted nuthatches, and great gray owls. Blue and ruffed grouse are the most common game birds.

Temperate Desert Division

Temperate deserts of continental regions have low rainfall and strong temperature contrasts between summer and winter. In the intermountain region of the Western United States between the Pacific coast and Rocky Mountains, the temperate desert has characteristics of a sagebrush semidesert, with a very pronounced drought season and a short humid season. Most precipitation falls in winter, despite a peak in May. Aridity increases markedly in the rain shadow of the Pacific mountain ranges. Even at intermediate elevations, winters are long and cold, with temperatures falling below 32F (0C).

These deserts differ from those at lower latitudes chiefly in their far greater annual temperature range and much lower winter temperatures. Unlike the dry climates of the tropics, dry climates in the middle latitudes receive part of their precipitation as snow.

Temperate desert climates support the sparse xerophytic shrub vegetation typical of semidesert. One example is the sagebrush vegetation of the Great Basin and northern Colorado Plateau. Recently, semidesert shrub vegetation seems to have invaded wide areas of the Western United States that were formerly steppe grasslands, due to overgrazing and trampling by livestock. Soils of the temperate desert are Aridisols low in humus and high in calcium carbonate. Poorly drained areas develop saline soils, and dry lake beds are covered with salt deposits.

Northern, cooler desert regions, such as the Great Basin Desert, support far fewer wildlife species than southern, warmer deserts found in the Subtropical Desert Division due to a shorter growing season which results in lower plant productivity and a lower diversity and abundance of animal prey. Thermal regimes in northern deserts also limit the activity of wildlife, especially cold-blooded animals such as amphibians and reptiles, to short periods each year.

The Great Basin Desert, which is the largest desert in North America, is characterized by sagebrush and saltbush. This desert supports large populations of pronghorn antelope, and also provides critical habitat for sage-grouse species that use sagebrush for food and cover.

Similarly to the Subtropical Desert division, wildlife of the Temperate Desert has adapted to survive under extreme environmental conditions, including low, erratic rainfall, and highly variable temperatures. Spadefoot toads have a special appendage on their hind foot that allows them to burrow into the soil to avoid daytime heat, and breeding activities are timed to occur during periods with summer thunderstorms. Many small mammals are able to survive on metabolically-produced water and secret hyper-concentrated urea. Despite these adaptations, riparian areas are especially important in the desert. For example, of the 148 species of breeding birds in the Great Basin Desert, 131 are dependent upon riparian areas for all or part of their life requisites.

Reptiles such as the common garter snake, western rattlesnake and sagebrush lizard are found among the talus slopes, cliffs and rock outcroppings, which provide thermal and escape cover, nesting and feeding habitat. Bats use caves and rock outcroppings as root and nursery sites. Deep, rugged cliffs are used by desert bighorn sheep for lambing, escape, and thermal cover. Raptors, including golden eagles and several species of hawks use cliffs and rock outcrops as nest and perch sites. The canyon walls of Snake River provide habitat for one of the highest densities of raptors in the world.

Due to the conversion of lands to agricultural and urban uses, species associated with native perennial bunchgrass communities, including the Columbian sharp-tailed grouse, kit fox, and Idaho ground squirrel, have declined in numbers more than other species' groups in the region. These species rely on grassland vegetation for plant and insect forage, nesting and brood-rearing habitat, and hiding cover.

Intermountain Semidesert and Desert Province

Land-surface form.--The Intermountain Desert Province covers the physiographic section called the Great Basin and the northern Colorado Plateau in Utah. Much of this area is made up of separate interior basins; only a small part of it drains to the sea. The lower parts of many basins have heavy accumulations of alkaline and saline salts. Streams are rare and few are permanent. Many mountains rise steeply from the semiarid, sagebrush-covered plains. These mountains are generally well covered by vegetation, and their upper elevations usually bear sparse conifer forests.

Climate.--Summers are hot, but winters are only moderately cold. The average annual temperature ranges from 40 to 55F (4 to 13C). Spring comes early, except at higher elevations. Annual precipitation averages only 5 to 20 inches (130 to 490 mm), often falling as winter snow. Almost no rain falls during the summer months except in the mountains.

Vegetation.--Sagebrush dominates at lower elevations. Other important plants in the sagebrush belt are antelope bitterbrush, shadscale, fourwing saltbush, rubber rabbitbrush, spiny hopsage, horsebrush, and short-statured Gambel oak. All these shrubs tolerate alkali to varying degrees, essential to their survival on the poorly drained soils widespread in the region. On soils with the highest concentrations of salt, even these shrubs are unable to grow; they are replaced by plant communities dominated by greasewood or saltgrass.

Although sagebrush now dominates this zone, it may not represent climax growth, but rather a disclimax produced by overgrazing. In plots protected from fire, grasses typical of the Palouse grassland or mixed-grass steppe gradually become dominant.

Above the sagebrush belt lies a woodland zone dominated by pinyon pine and juniper, similar to the pinyon-juniper woodland of the Colorado Plateau.

In the montane belt above the woodland zone, ponderosa pine generally occupies the lower and more exposed slopes and Douglas-fir the higher and more sheltered ones. In the subalpine belt, the characteristic trees are subalpine fir and Engelmann spruce. Only a few mountains rise high enough to support an alpine belt.

Soils.--Aridisols dominate all basin and lowland areas; forest soils are found at higher elevations. Narrow bands of Entisols lie in stream floodplains and rocky landscapes. Salt flats and playas without soils are extensive in the lower parts of basins with interior drainage.

Fauna.--Few large mammals live in this province, but mule deer, mountain lion, bobcat, and badger occasionally venture into it. Sagebrush provides ideal habitat for pronghorn antelope and whitetail prairie dog. The most common species are such small mammals as ground squirrels, jackrabbits, kangaroo mice, wood rats, and kit foxes. In the lower life belts, some ground squirrels--especially the Belding and Townsend ground squirrels--become dormant during the hot, dry summer.

Bird species range from the burrowing owl to such specialized species as sage sparrow and sage thrasher, both found only in sagebrush habitat. Raptors include the American kestrel and golden eagle, along with the ferruginous hawk and various other species of western hawks. In early spring, groups of sage grouse engage in elaborate courtship displays.

Intermountain Semidesert Province

Land-surface form.--This province covers the plains and tablelands of the Columbia-Snake River Plateaus and Wyoming Basin. The plateaus include most of the Northwest's lava fields. Lying at about 3,000 feet (900 m), the plateaus are surrounded by lavas that have been folded or faulted into ridges. To the south, the plateaus grade into the basins and ranges of the Intermountain Desert Province. The Wyoming Basin consists of plains at elevations of 6,000-8,000 feet (1,800-2,400 m) broken by isolated hills and low mountains 1,000-2,000 feet (300-600 m) higher. In the south, broad intermountain basins and isolated small mountain ranges merge into a dissected plateau. Sloping alluvial fans at the edges of the basins merge into flat plains in the center. Badlands are typical of the dissected areas along the region's outer edges.

Climate.--The climate of the plateaus is semiarid and cool, with an average annual temperature of about 50F (10C). Average annual precipitation ranges from less than 10 inches (260 mm) in the west (in the rain shadow of the Cascade Range) to 20 inches (510 mm) in the east. Precipitation is fairly evenly distributed throughout the year, except during the summer months, when there is little rain.

The higher overall elevation of the Wyoming Basin gives it slightly lower average temperatures and precipitation than on the plateaus. Winters are cold, and summers are short and hot. Average annual temperatures range from 40 to 52F (4 to 11C), and the average growing season has fewer than 100 days in the south and 140 days in the north and east. Average annual precipitation ranges from 5 to 14 inches (130 to 360 mm), and is fairly evenly distributed throughout the year.

Vegetation.--The chief vegetation, sometimes called sagebrush steppe, is made up of sagebrush or shadscale mixed with short grasses. Moist alkaline flats support alkali-tolerant greasewood. Along streams in and near the mountains where the water is good, valley bottoms are lined with willows and sedges, which give way to greasewood and other alkali-tolerant plants as one moves away from the mountains. Lands in the Columbia River Basin with more than 10 inches (260 mm) of rainfall per year have an open cover of bunchgrass, and are excellent for raising wheat. A woodland of western juniper covers parts of central Oregon that get little rain.

Soils.--This province has extensive alluvial deposits in the floodplains of streams and in the fans at the foot of mountains. Dry lake beds are numerous, and there are extensive eolian deposits, including both dune sand and loess. In the Columbia River Basin, loess deposits are up to 150 feet (46 m) thick, and soils developed from them are correspondingly complex. Aridisols dominate all basin and lowland areas; Mollisols are found at higher elevations.

Soils in the Wyoming Basin are alkaline Aridisols. Subsoils contain a layer enriched with lime and/or gypsum, which may develop into a caliche hardpan. Because the basin is semiarid and weathering is therefore slight, soil texture and composition are governed by parent materials. Entisols are found in the Bighorn basin.

Fauna.--Because of its wilderness character, this region supports a great variety of wildlife species. In winter, seasonal changes force many birds and mammals to move from the mountains into the sagebrush semidesert, where they find suitable habitat alongside the area's permanent residents.

Major mammals are coyote, pronghorn antelope, mountain lion, and bobcat. Smaller species include Wyoming ground squirrel, whitetail prairie dog, deer mouse, whitetail jackrabbit, and porcupine. During severe winters, elk and mule deer move into the desert. Moose are locally important in the dense willow thickets along the desert watercourses of eastern Idaho and western Wyoming.

This region is an important breeding and resting ground for migrating waterfowl. Mallards, pintails, green-winged teal, and gadwalls are most common. Canada geese are locally important. Sage grouse are the most abundant upland game bird. The numerous raptors here include Swainson's hawk, ferruginous hawk, rough-legged hawk, red-tailed hawk, marsh hawk, prairie falcon, great horned owl, and burrowing owl.

Reptiles include sagebrush lizard, horned lizard, and prairie rattlesnake.

Nevada-Utah Mountains Semidesert--Coniferous Forest--Alpine Meadow Province

Land-surface form.--This province covers the highest areas of the Great Basin and Colorado Plateau, including valleys that are 5,000 feet (1,500 m) in elevation. Although some valleys are closed, none contain perennial lakes. Streams are rare and few are permanent. Many linear mountain ranges rise steeply from the semiarid plains, reaching altitudes up to 13,000 feet (3,960 m). They are composed mostly of folded and faulted sedimentary rocks block faulted to produce basins and ranges. To the east, on the Colorado Plateau, the mountains are formed from high-elevation plateaus composed of dissected, horizontally layered rocks.

Climate.--This region has a high-altitude variation of the temperate desert climate, with a very pronounced drought season and a short humid season. Most precipitation falls in winter, despite a peak in August. Winters are long, and climate varies considerably with altitude. Average annual temperatures range from about 38F (3C) 50F (10C) in the valleys to 50F (10C) 38F (3C) on upper mountain slopes. Average annual precipitation ranges from 5 to 8 inches (130 to 200 mm) in the valleys to 25 to 35 inches (640 to 890 mm) at higher elevations. A considerable portion of winter precipitation is snow, and summer afternoon thunderstorms are common on the Colorado Plateau.

Vegetation.--Sagebrush dominates at lower elevations. Other important plants in the sagebrush belt are shadscale, fourwing saltbush, rubber rabbitbrush, spiny hopsage, and horsebrush. All tolerate alkali to varying degrees, essential to their survival on the poorly drained soils widespread in the region. Where salt concentrations are very high, even these shrubs are unable to grow; they are replaced by plant communities dominated by greasewood or saltgrass.

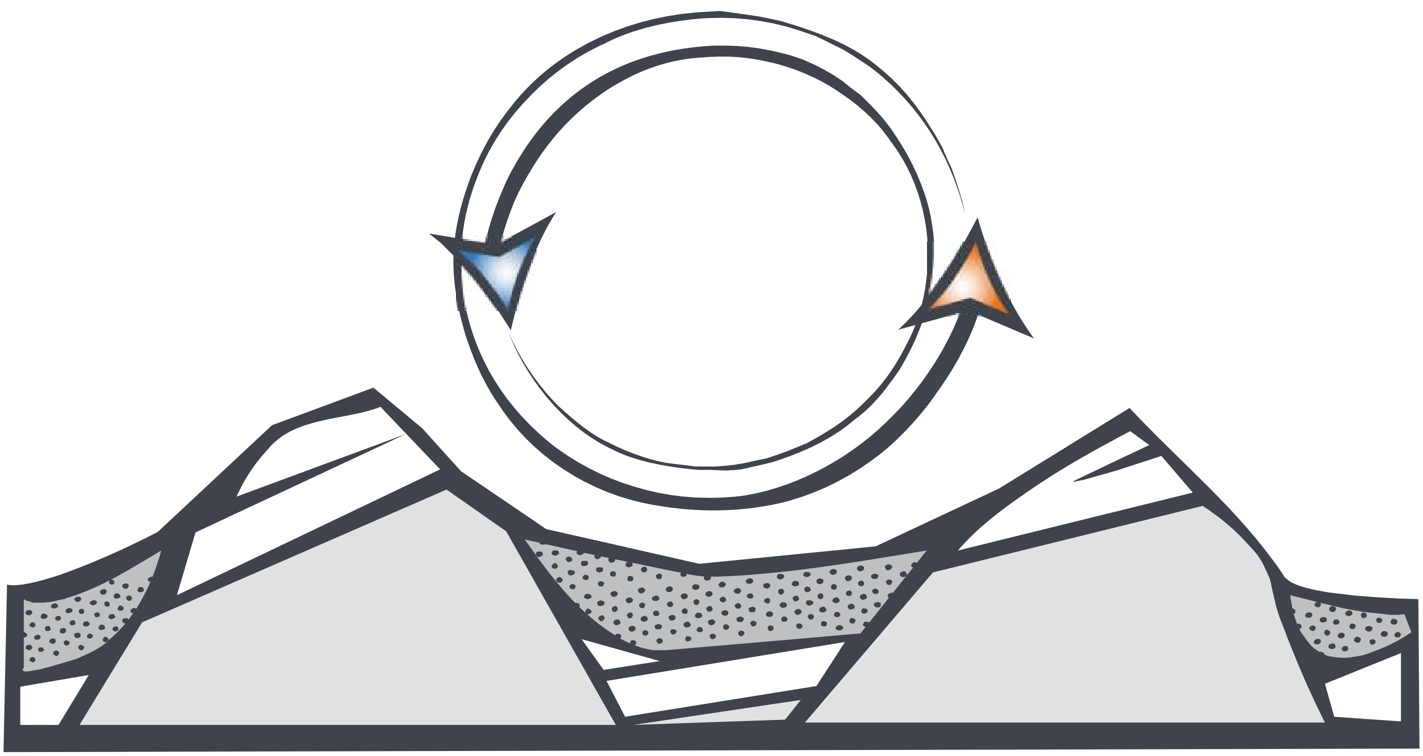
The woodland belt above the sagebrush zone is similar to the corresponding belt on the Colorado Plateau, with juniper and pinyon occupying lower mountain slopes. The belt is frequently interrupted as mountains give way to plains.

In the montane zone above the woodland belt, ponderosa pine generally occupies the lower and more exposed slopes and Douglas-fir the higher and more sheltered ones. Typical species of the subalpine belt are alpine fir and Engelmann spruce. Great Basin bristlecone pine, with some individuals more than 1,000 years old, occupies widely scattered peaks. Only a few mountains in this province rise high enough to support an alpine meadow belt.

Soils.--Aridisols dominate all basin and lowland areas; Mollisols and Alfisols are found at higher elevations in the mountains. Salt flats and playas without soil are extensive in the Great Basin.

Fauna.--Sagebrush shrublands provide ideal habitat for pronghorn antelope and whitetail prairie dog. Golden-mantled squirrels inhabit the region's ponderosa pine forests, and snowshoe hares along with red squirrels are found throughout the spruce-fir forests of Utah.

The sagebrush shrublands contain many species of birds, ranging from burrowing owls to such specialized species as sage sparrow and sage thrasher, both found in no other type of habitat. Various raptors prey on jackrabbits, including the American kestrel, ferruginous hawk, and golden eagle. The pinyon jay is typical of the pinyon-juniper forest, which also supports the plain titmouse and black-throated gray warbler, along with flocks of bushtits. Ponderosa pine forests contain the Steller's jay and dark-eyed junco. Many reptiles can be found; collared lizards are common.



Appendix H

Federally Listed Species

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Scientific Name	Common Name	Listing Status[a]	State in which Species could Occur	Designated Critical Habitat	Recovery Plan
Plants					
Abronia alpina	Ramshaw Meadows sandverbena	C	CA	N	N
Acanthomintha ilicifolia	San Diego thornmint	T	CA	N	N
Acanthomintha obovata duttonii	San Mateo thornmint	E	CA	N	Y
Allium munzii	Munz's onion	E	CA	N	N
Alopecurus aequalis var. sonomensis	Sonoma alopecurus	E	CA	N	N
Ambrosia pumila	San Diego ambrosia	E	CA	N	N
Amsinckia grandiflora	Large-flowered fiddleneck	E	CA	Y	Y
Amsonia kearneyana	Kearney's blue-star	E	AZ	N	Y
Arabis mcdonaldiana	McDonald's rock-cress	E	CA	N	Y
Arctomecon humilis	Dwarf bear-poppy	E	UT	N	Y
Arctostaphylos glandulosa crassifolia	Del Mar manzanita	E	CA	N	N
Arctostaphylos hookeri var. ravenii	Presidio manzanita	E	CA	N	Y
Arctostaphylos morroensis	Morro manzanita	T	CA	N	Y
Arctostaphylos myrtifolia	Ione manzanita	T	CA	N	N
Arctostaphylos pallida	Pallid manzanita	T	CA	N	Y
Arenaria paludicola	Marsh sandwort	E	CA	N	Y
Arenaria ursina	Bear Valley sandwort	T	CA	N	N
Argemone pleiacantha pinnatisecta	Sacramento prickly poppy	E	NM	N	Y
Artemisia campestris var. wormskioldii	Northern wormwood	C	OR, WA	N	N
Asclepias welshii	Welsh's milkweed	T	AZ, UT	Y	Y
Astragalus albens	Cushenbury milk-vetch	E	CA	Y	Y
Astragalus ampullarioides	Shivwits milk-vetch	E	UT	Y	Y
Astragalus applegatei	Applegate's milk-vetch	E	OR	N	Y
Astragalus brauntonii	Braunton's milk-vetch	E	CA	Y	Y
Astragalus clarianus	Clara Hunt's milk-vetch	E	CA	N	N
Astragalus cremnophylax var. cremnophylax	Sentry milk-vetch	E	AZ	N	Y
Astragalus desereticus	Deseret milk-vetch	T	UT	N	N
Astragalus holmgreniorum	Holmgren milk-vetch	E	AZ, UT	Y	Y
Astragalus humillimus	Mancos milk-vetch	E	CO, NM	N	Y
Astragalus jaegerianus	Lane Mountain milk-vetch	E	CA	Y	N
Astragalus lentiginosus var. coachellae	Coachella valley milk-vetch	E	CA	Y	N
Astragalus lentiginosus var. piscinensis	Fish Slough milk-vetch	T	CA	N	Y
Astragalus magdalenae var. peirsonii	Peirson's milk-vetch	T	CA	Y	N
Astragalus montii	Heliotrope milk-vetch	T	UT	N	Y
Astragalus osterhoutii	Osterhout milk-vetch	E	CO	N	Y
Astragalus phoenix	Ash Meadows milk-vetch	T	NV	Y	Y
Astragalus pycnostachyus var. lanosissimus	Ventura Marsh milk-vetch	E	CA	Y	N
Astragalus tener var. titi	Coastal dunes milk-vetch	E	CA	N	Y
Astragalus tortipes	Sleeping Ute milk-vetch	C	CO	N	N
Astragalus tricarinatus	Triple-ribbed milk-vetch	E	CA	N	N
Atriplex coronata var. notatior	San Jacinto Valley crownscale	E	CA	N	N
Baccharis vanessae	Encinitas baccharis	T	CA	N	N
Berberis nevinii	Nevin's barberry	E	CA	N	N

Scientific Name	Common Name	Listing Status[a]	State in which Species could Occur	Designated Critical Habitat	Recovery Plan
Blennosperma bakeri	Sonoma sunshine	E	CA	N	N
Brodiaea filifolia	Thread-leaved brodiaea	T	CA	Y	Y
Brodiaea pallida	Chinese Camp brodiaea	T	CA	N	N
Calochortus persistens	Siskiyou mariposa lily	C	CA	N	N
Calochortus tiburonensis	Tiburon mariposa lily	T	CA	N	Y
Calyptridium pulchellum	Mariposa pussypaws	T	CA	N	N
Calystegia stebbinsii	Stebbins' morning-glory	E	CA	N	Y
Camissonia benitensis	San Benito eveningprimrose	T	CA	N	Y
Carex albida	White sedge	E	CA	N	N
Carex specuicola	Navajo sedge	T	AZ, UT	Y	Y
Castilleja affinis neglecta	Tiburon paintbrush	E	CA	N	Y
Castilleja campestris succulenta	Fleshy owl's-clover	T	CA	Y	Y
Castilleja christii	Christ's paintbrush	C	ID	N	N
Castilleja cinerea	Ash-grey paintbrush	T	CA	N	N
Castilleja levisecta	Golden paintbrush	T	WA	N	Y
Castilleja mollis	Soft-leaved paintbrush	E	CA	N	Y
Caulanthus californicus	California jewelflower	E	CA	N	Y
Ceanothus ferrisae	Coyote ceanothus	E	CA	N	Y
Ceanothus ophiochilus	Vail Lake ceanothus	T	CA	N	N
Ceanothus roderickii	Pine Hill ceanothus	E	CA	N	Y
Centaurium namophilum	Spring-loving centaury	T	CA, NV	Y	Y
Chamaesyce hooveri	Hoover's spurge	T	CA	Y	N
Chlorogalum purpureum	Purple amole	T	CA	Y	N
Chorizanthe howellii	Howell's spineflower	E	CA	N	Y
Chorizanthe orcuttiana	Orcutt's spineflower	E	CA	N	N
Chorizanthe parryi var. fernandina	San Fernando Valley spineflower	C	CA	N	N
Chorizanthe pungens var. hartwegiana	Ben Lomond spineflower	E	CA	N	Y
Chorizanthe pungens var. pungens	Monterey spineflower	T	CA	Y	Y
Chorizanthe robusta	Robust spineflower	E	CA	Y	Y
Chorizanthe valida	Sonoma spineflower	E	CA	N	Y
Cirsium fontinale var. fontinale	Fountain thistle	E	CA	N	Y
Cirsium fontinale var. obispoense	Chorro Creek bog thistle	E	CA	N	Y
Cirsium hydrophilum var. hydrophilum	Suisun thistle	E	CA	Y	N
Cirsium loncholepis	La Graciosa thistle	E	CA	Y	N
Cirsium vinaceum	Sacramento Mountains thistle	T	NM	N	Y
Clarkia franciscana	Presidio clarkia	E	CA	N	Y
Clarkia imbricata	Vine Hill clarkia	E	CA	N	N
Clarkia speciosa immaculata	Pismo clarkia	E	CA	N	Y
Clarkia springvillensis	Springville clarkia	T	CA	N	N
Cordylanthus maritimus maritimus	Salt marsh bird's-beak	E	CA	N	Y
Cordylanthus mollis mollis	Soft bird's-beak	E	CA	Y	Y
Cordylanthus palmatus	Palmate-bracted bird's beak	E	CA	N	Y
Cordylanthus tenuis capillaris	Pennell's bird's-beak	E	CA	N	Y
Coryphantha robbinsorum	Cochise pincushion cactus	T	AZ	N	Y
Coryphantha scheeri var. robustispina	Pima pineapple cactus	E	AZ	N	N

Scientific Name	Common Name	Listing Status[a]	State in which Species could Occur	Designated Critical Habitat	Recovery Plan
Coryphantha sneedii var. leei	Lee pincushion cactus	T	NM	N	Y
Coryphantha sneedii var. sneedii	Sneed pincushion cactus	E	NM	N	Y
Cupressus abramsiana	Santa Cruz cypress	E	CA	N	Y
Cupressus goveniana goveniana	Gowen cypress	T	CA	N	Y
Cycladenia jonesii	Jones cycladenia	T	AZ, UT	N	Y
Deinandra conjugens	Otay tarplant	T	CA	Y	Y
Deinandra increscens villosa	Gaviota tarplant	E	CA	Y	N
Delphinium bakeri	Baker's larkspur	E	CA	Y	N
Delphinium luteum	Yellow larkspur	E	CA	Y	N
Dodecahema leptoceras	Slender-horned spineflower	E	CA	N	N
Dudleya abramsii parva	Conejo dudleya	T	CA	N	Y
Dudleya cymosa. marcescens	Marcescent dudleya	T	CA	N	Y
Dudleya cymosa. ovatifolia	Santa Monica Mountains dudleyea	T	CA	N	Y
Dudleya setchellii	Santa Clara Valley dudleya	E	CA	N	Y
Dudleya stolonifera	Laguna Beach liveforever	T	CA	N	N
Dudleya verityi	Verity's dudleya	T	CA	N	Y
Echinocactus horizonthalonius var. nicholii	Nichol's Turk's head cactus	E	AZ	N	Y
Echinocereus fendleri var. kuenzleri	Kuenzler hedgehog cactus	E	NM	N	Y
Echinocereus triglochidiatus var. arizonicus	Arizona hedgehog cactus	E	AZ	N	Y
Echinomastus erectocentrus var. acunensis	Acuna cactus	C	AZ	N	N
Enceliopsis nudicaulis var. corrugata	Ash Meadows sunray	T	NV	Y	N
Eremalche kernensis	Kern mallow	E	CA	N	Y
Eriastrum densifolium sanctorum	Santa Ana river woolly-star	E	CA	N	N
Erigeron decumbens var. decumbens	Willamette daisy	E	OR	N	N
Erigeron lemmonii	Lemmon fleabane	C	AZ	N	N
Erigeron maguirei	Maguire daisy	T	UT	N	Y
Erigeron parishii	Parish's daisy	Y	CA	Y	Y
Erigeron rhizomatus	Zuni fleabane	Y	AZ, NM	N	Y
Eriodictyon altissimum	Indian Knob Mountain balm	E	CA	N	Y
Eriodictyon capitatum	Lompoc yerba santa	E	CA	Y	N
Eriogonum apricum	Ione buckwheat	E	CA	N	N
Eriogonum codium	Umtanum desert buckwheat	C	WA	N	N
Eriogonum corymbosum car. Nilesii	Las Vegas buckwheat	C	NV	N	N
Eriogonum diatomaceum	Churchill Narrows buckwheat	C	NV	N	N
Eriogonum gypsophilum	Gypsum wild-buckwheat	T	NM	Y	Y
Eriogonum kelloggii	Red Mountain buckwheat	C	CA	N	N
Eriogonum kennedyi var. austromontanum	Southern mountain wildbuckwheat	T	CA	N	N
Eriogonum ovalifolium var. vineum	Cushenbury buckwheat	E	CA	Y	Y
Eriogonum ovalifolium var. williamsiae	Steamboat buckwheat	E	NV	N	Y
Eriogonum pelinophilum	Clay-loving wild-buckwheat	E	CO	Y	Y
Eriophyllum latilobum	San Mateo woolly sunflower	E	CA	N	Y
Eryngium aristulatum var. parishii	San Diego button-celery	E	CA	N	Y
Eryngium constancei	Loch Lomond coyote thistle	E	CA	N	Y
Erysimum capitatum var. angustatum	Contra Costa wallflower	E	CA	Y	Y
Erysimum menziesii	Menzies' wallflower	E	CA	N	Y

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Erysimum teretifolium	Ben Lomond wallflower	E	CA	N	Y
Eutrema penlandii	Penland alpine fen mustard	T	CO	N	N
Fremontodendron californicum decumbens	Pine Hill flannelbush	E	CA	N	Y
Fremontodendron mexicanum	Mexican flannelbush	E	CA	N	N
Fritillaria gentneri	Gentner's fritillary	E	OR	N	Y
Galium californicum sierrae	El Dorado bedstraw	E	CA	N	Y
Gaura neomexicana var. coloradensis	Colorado butterfly plant	T	CO, WY	V	N
Gilia tenuiflora arenaria	Monterey gilia	E	CA	N	Y
Gilia tenuiflora hoffmannii	Hoffmann's slenderflowered gilia	E	CA	N	Y
Grindelia fraxino-pratensis	Ash Meadows gumplant	T	CA,NV	Y	Y
Hackelia venusta	Showy stickseed	E	WA	N	Y
Hazardia orcuttii	Orcutt's hazardia	C	CA	N	N
Hedeoma todsenii	Todsen's pennyroyal	E	NM	Y	Y
Helianthus paradoxus	Pecos sunflower	T	NM	N	Y
Hesperolinon congestum	Marin dwarf-flax	T	CA	N	Y
Holocarpha macradenia	Santa Cruz tarplant	T	CA	Y	N
Howellia aquatilis	Water howellia	T	CA, ID, MT, OR, WA	N	Y
Ipomopsis polyantha	Pagosa skyrocket	C	CO	N	N
Ipomopsis sancti-spiritus	Holy Ghost ipomopsis	E	NM	N	Y
Ivesia kingii var. eremica	Ash Meadows ivesia	T	NV	Y	Y
Ivesia webberi	Webber ivesia	C	CA, NV	N	N
Lasthenia burkei	Burke's goldfields	E	CA	N	N
Lasthenia conjugens	Contra Costa goldfields	E	CA	Y	Y
Layia carnosa	Beach layia	E	CA	N	Y
Lepidium barnebyanum	Barneby ridge-cress	E	UT	N	Y
Lesquerella congesta	Dudley Bluffs bladderpod	T	CO	N	N
Lesquerella kingii bernardina	San Bernardino Mountains bladderpod	E	CA	Y	Y
Lesquerella tumulosa	Kodachrome bladderpod	E	UT	N	Y
Lessingia germanorum	San Francisco lessingia	E	CA	N	Y
Lilaeopsis schaffneriana var. recurva	Huachuca water-umbel	E	AZ	Y	N
Lilium occidentale	Western lily	E	CA, OR	N	Y
Lilium pardalinum pitkinense	Pitkin marsh lily	E	CA	N	Y
Limnanthes floccosa californica	Butte County meadowfoam	E	CA	Y	Y
Limnanthes floccosa grandiflora	Large-flowered woolly meadowfoam	E	OR	N	Y
Limnanthes vinculans	Sebastopol meadowfoam	E	CA	N	Y
Lomatium bradshawii	Bradshaw's desert-parsley	E	OR, WA	N	Y
Lomatium cookii	Cook's lomatium	E	OR	N	Y
Lupinus nipomensis	Nipomo Mesa lupine	E	CA	N	N
Lupinus sulphureus kincaidii	Kincaid's lupine	T	OR, WA	N	N
Lupinus tidestromii	Clover lupine	E	CA	N	Y
Mentzelia leucophylla	Ash Meadows blazingstar	T	NV	Y	Y
Mirabilis macfarlanei	Macfarlane's four-o'clock	T	ID, OR	N	Y
Monardella linoides viminea	Willowy monardella	E	CA	N	N

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Monolopia congdonii	San Joaquin wooly-threads	E	CA	N	Y
Navarretia fossalis	Spreading navarretia	T	CA	N	Y
Navarretia leucocephala pauciflora	Few-flowered navarretia	E	CA	N	Y
Navarretia leucocephala plieantha	Many-flowered navarretia	E	CA	N	Y
Neostapfia colusana	Colusa grass	T	CA	Y	Y
Nitrophila mohavensis	Amargosa niterwort	E	CA, NV	Y	Y
Oenothera avita eurekensis	Eureka Valley eveningprimrose	E	CA	N	Y
Oenothera deltoides howellii	Antioch Dunes eveningprimrose	E	CA	Y	Y
Opuntia treleasei	Bakersfield cactus	E	CA	N	Y
Orcuttia californica	California orcutt grass	E	CA	N	Y
Orcuttia inaequalis	San Joaquin orcutt grass	T	CA	Y	Y
Orcuttia pilosa	Hairy orcutt grass	E	CA	Y	Y
Orcuttia tenuis	Slender orcutt grass	T	CA	Y	Y
Orcuttia viscida	Sacramento orcutt grass	E	CA	Y	Y
Oxytheca parishii var. goodmaniana	Cushenbury oxytheca	E	CA	Y	Y
Parvisedum leiocarpum	Lake County stonecrop	E	CA	N	Y
Pediocactus bradyi	Brady pincushion cactus	E	AZ	N	Y
Pediocactus despainii	San Rafael cactus	E	UT	N	Y
Pediocactus knowltonii	Knowlton cactus	E	CO, NM	N	Y
Pediocactus peeblesianus peeblesianus	Peebles Navajo cactus	E	AZ	N	Y
Pediocactus peeblesianus fickeiseniae	Fickeisen plains cactus	C	AZ	N	N
Pediocactus sileri	Siler pincushion cactus	T	AZ, UT	N	Y
Pediocactus winkleri	Winkler cactus	T	UT	N	Y
Penstemon debilis	Parachute beardtongue	C	CO	N	N
Penstemon penlandii	Penland beardtongue	E	CO	N	Y
Penstemon scariosus albifluvis	White River beardtongue	C	CO, UT	N	N
Pentachaeta bellidiflora	White-rayed pentachaeta	E	CA	N	Y
Pentachaeta lyonii	Lyon’s pentachaeta	E	CA	Y	Y
Phacelia argillacea	Clay phacelia	E	UT	N	Y
Phacelia formosula	North Park phacelia	E	CO	N	Y
Phacelia stellaris	Brand’s phacelia	C	CA	N	N
Phacelia submutica	Debeque phacelia	E	CO	N	N
Phlox hirsuta	Yreka phlox	E	CA	N	Y
Physaria obcordata	Dudley Bluffs twinpod	T	CO	N	Y
Physaria tuplashensis	White Bluffs bladderpod	C	WA	N	N
Piperia yadonii	Yadon’s piperia	E	CA	N	Y
Plagiobothrys hirtus	Rough popcornflower	E	OR	N	Y
Plagiobothrys strictus	Calistoga allocarya	E	CA	N	N
Poa atropurpurea	San Bernardino bluegrass	E	CA	N	N
Poa napensis	Napa bluegrass	E	CA	N	N
Pogogyne abramsii	San Diego mesa-mint	E	CA	N	Y
Pogogyne nudiuscula	Otay mesa-mint	E	CA	N	Y
Polygonum hickmanii	Scotts Valley polygonum	E	CA	Y	N
Polystichum aleuticum	Aleutian shield fern	E	AK	N	Y
Potentilla basaltica	Soldier Meadows cinquefoil	C	NV	N	N

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Potentilla hickmanii	Hickman's potentilla	E	CA	N	Y
Primula maguirei	Maguire primrose	T	UT	N	Y
Pseudobahia bahiifolia	Hartweg's golden sunburst	E	CA	N	N
Pseudobahia peirsonii	San Joaquin adobe sunburst	T	CA	N	N
Purshia subintegra	Arizona cliff-rose	E	AZ	N	Y
Ranunculus aestivalis	Autumn buttercup	E	UT	N	Y
Rorippa gambellii	Gambel's watercress	E	CA	N	Y
Rorippa subumbellata	Tahoe yellow cress	C	CA, NV	N	N
Schoenocrambe argillacea	Clay reed-mustard	T	UT	N	Y
Schoenocrambe barnebyi	Barneby reed-mustard	E	UT	N	Y
Schoenocrambe suffrutescens	Shrubby reed-mustard	E	Y	N	Y
Sclerocactus glaucus	Uinta Basin hookless cactus	T	CO, UT	N	Y
Sclerocactus mesae-verdae	Mesa Verde cactus	T	CO,UT	N	Y
Sclerocactus wrightiae	Wright fishhook cactus	E	UT	N	Y
Sedum eastwoodiae	Red Mountain stonecrop	C	CA	N	N
Senecio franciscanus	San Francisco Peaks groundsel	T	AZ	Y	Y
Senecio layneae	Layne's butterweed	T	CA	N	Y
Sidalcea keckii	Keck's checker-mallow	E	CA	Y	N
Sidalcea nelsoniana	Nelson's checker-mallow	T	OR, WA	N	Y
Sidalcea oregana valida	Kenwood marsh checkermallow	E	CA	N	N
Sidalcea oregana var. calva	Wenatchee Mountains checker-mallow	E	WA	Y	Y
Sidalcea pedata	Pedate checker-mallow	E	CA	N	Y
Silene spaldingii	Spalding's catchfly	T	ID, MT, OR, WA	N	Y
Spiranthes delitescens	Canelo hills ladies'-tresses	E	AZ	N	N
Spiranthes diluvialis	Ute ladies'-tresses	T	CO, ID, MT, NV, UT, WA, WY	N	Y
Stephanomeria malheurensis	Malheur wire-lettuce	E	OR	Y	Y
Streptanthus albidus albidus	Metcalf Canyon jewelflower	E	CA	N	Y
Streptanthus niger	Tiburon jewelflower	E	CA	N	Y
Suaeda californica	California seablite	E	CA	N	N
Swallenia alexandrae	Eureka dune grass	E	CA	N	Y
Taraxacum californicum	California taraxacum	E	CA	N	N
Thelypodium howellii spectabilis	Howell's spectacular thelypody	T	OR	N	Y
Thelypodium stenopetalum	Slender-petaled mustard	E	CA	N	Y
Thlaspi californicum	Kneeland Prairie pennycress	E	CA	Y	Y
Townsendia aprica	Last chance townsendia	T	UT	N	Y
Trichostema austromontanum compactum	Hidden Lake bluecurls	T	CA	N	N
Trifolium amoenum	Showy Indian clover	E	CA	N	N
Trifolium trichocalyx	Monterey clover	E	CA	N	Y
Tuctoria greenei	Greene's tuctoria	E	CA	Y	Y
Tuctoria mucronata	Solano grass	E	CA	Y	Y

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Verbena californica	Red Hills vervain	T	CA	N	N
Verbesina dissita	Big-leaved crownbeard	T	CA	N	N
Yermo xanthocephalus	Desert yellowhead	T	WY	Y	N
Invertebrates					
Ambrysus amargosus	Ash Meadows naucorid	T	NV	Y	Y
Ambrysus funebris	Nevares Spring naucorid bug	C	CA	N	N
Apodemia mormo langei	Lange's metalmark butterfly	E	CA	N	Y
Assiminea pecos	Pecos assiminea snail	E	NM	Y	N
Boloria acrocnema	Uncompahgre fritillary butterfly	E	CO	N	Y
Branchinecta conservatio	Conservancy fairy shrimp	E	CA	Y	Y
Branchinecta longiantenna	Longhorn fairy shrimp	E	CA	Y	Y
Branchinecta lynchi	Vernal pool fairy shrimp	T	CA, OR	Y	Y
Branchinecta sandiegonensis	San Diego fairy shrimp	E	CA	Y	Y
Callophrys mossii bayensis	San Bruno elfin butterfly	E	CA	N	Y
Cicindela limbata albissima	Coral pink sand dunes tiger beetle	C	UT	N	N
Cicindela ohlone	Ohlone tiger beetle	E	CA	N	N
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	T	CA	Y	Y
Elaphrus viridis	Delta green ground beetle	T	CA	Y	Y
Euphilotes battoides allyni	El Segundo blue butterfly	E	CA	N	Y
Euphilotes enoptes smithi	Smith's blue butterfly	E	CA	N	Y
Euphydryas editha bayensis	Bay checkerspot butterfly	T	CA	Y	Y
Euphydryas editha quino	Quino checkerspot butterfly	E	CA	Y	Y
Euphydryas editha taylori	Taylor's checkerspot	C	OR, WA	N	N
Euproserpinus euterpe	Kern primrose sphinx moth	T	CA	N	Y
Gammarus desperatus	Noel's amphipod	E	NM	N	N
Glaucopsyche lygdamus palosverdesensis	Palos Verdes blue butterfly	E	CA	Y	Y
Haliotis sorenseni	White abalone	E	CA	N	N
Helminthoglypta walkeriana	Morro shoulderband snail	E	CA	Y	Y
Hesperia leonardus montana	Pawnee montane skipper	T	CO	N	Y
Heterelmis stephani	Stephan's riffle beetle	C	AZ	N	N
Icaricia icarioides fenderi	Fender's blue butterfly	E	OR	N	N
Icaricia icarioides missionensis	Mission blue butterfly	E	CA	N	Y
Juturnia kosteri	Koster's springsnail	E	NM	N	N
Lanx sp.	Banbury springs limpet	E	ID	N	Y
Lepidurus packardi	Vernal pool tadpole shrimp	E	CA	Y	Y
Lycaeides argyrognomon lotis	Lotis blue butterfly	E	CA	N	Y
Oreohelix peripherica wasatchensis	Ogden mountainsnail	C	UT	N	N
Oxyloma haydeni kanabensis	Kanab ambersnail	E	AZ, UT	N	Y
Pacifastacus fortis	Shasta crayfish	E	CA	N	Y
Physa natricina	Snake River physa snail	E	ID	N	Y
Polites mardon	Mardon skipper	C	CA, OR, WA	N	N
Polyphylla barbata	Mount Hermon june beetle	E	CA	N	Y
Popenaias popei	Texas hornshell	C	NM	N	N

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Pseudocopaeodes eunus obscurus	Carson wandering skipper	E	CA, NV	N	Y
Pyrgulopsis bernardina	San Bernardino springsnail	C	AZ	N	N
Pyrgulopsis bruneauensis	Bruneau hot springsnail	E	ID	N	Y
Pyrgulopsis chupaderae	Chupadera springsnail	C	NM	N	N
Pyrgulopsis gilae	Gila springsnail	C	NM	N	N
Pyrgulopsis idahoensis	Idaho springsnail	E	ID	N	Y
Pyrgulopsis morrisoni	Page springsnail	C	AZ	N	N
Pyrgulopsis neomexicana	Socorro springsnail	E	NM	N	Y
Pyrgulopsis roswellensis	Roswell springsnail	E	NM	N	N
Pyrgulopsis thermalis	New Mexico springsnail	C	NM	N	N
Pyrgulopsis thompsoni	Huachuca springsnail	C	AZ	N	N
Pyrgulopsis trivialis	Three Forks springsnail	C	AZ	N	N
Pyrgus ruralis lagunae	Laguna Mountains skipper	E	CA	Y	N
Rhaphiomidas terminatus abdominalis	Delhi sands flower-loving fly	E	CA	N	Y
Speyeria callippe callippe	Callippe silverspot butterfly	E	CA	N	N
Speyeria zerene behrensii	Behren's silverspot butterfly	E	CA	N	Y
Speyeria zerene hippolyta	Oregon silverspot butterfly	T	CA, OR, WA	Y	Y
Speyeria zerene myrtleae	El Segundo blue butterfly	E	CA	N	Y
Stagnicola bonnevillensis	Bonneville pondsnail	C	UT	N	N
Streptocephalus woottoni	Riverside fairy shrimp	E	CA	Y	Y
Syncaris pacifica	California freshwater shrimp	E	CA	N	Y
Taylorconcha serpenticola	Bliss rapids snail	T	ID	N	Y
Thermosphaeroma thermophilus	Socorro isopod	E	NM	N	Y
Trimerotropis infantilis	Zayante band-winged grasshopper	E	CA	Y	Y
Tryonia alamosae	Alamosa springsnail	E	NM	N	Y
Valvata utahensis	Utah valvata snail	E	ID	N	Y
Fish					
Acipenser transmontanus	White sturgeon	E	ID, MT	Y	Y
Catostomus discobolus yarrowi	Zuni bluehead sucker	C	AZ, NM	N	N
Catostomus microps	Modoc sucker	E	CA	Y	Y
Catostomus santaanae	Santa Ana sucker	T	CA	Y	N
Catostomus warnerensis	Warner sucker	E	OR	Y	Y
Chasmistes brevirostris	Shortnose sucker	E	CA, OR	N	Y
Chasmistes cujus	Cui-ui	E	NV	N	Y
Chasmistes liorus	June sucker	E	UT	Y	Y
Crenichthys baileyi baileyi	White River springfish	E	NV	Y	Y
Crenichthys baileyi grandis	Hiko White River springfish	E	NV	Y	Y
Crenichthys nevadae	Railroad Valley springfish	T	NV	Y	Y
Cyprinella formosa	Beautiful shiner	T	AZ, NM	Y	Y
Cyprinodon diabolis	Devils Hole pupfish	E	NV	Y	Y
Cyprinodon macularius	Desert pupfish	E	AZ, CA	Y	Y
Cyprinodon nevadensis mionectes	Ash Meadows amargosa pupfish	E	NV	Y	Y
Cyprinodon nevadensis pectoralis	Warm Springs pupfish	E	NV	N	Y

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Cyprinodon radiosus	Owens pupfish	E	CA	N	Y
Deltistes luxatus	Lost River sucker	E	CA, OR	N	Y
Empetrichthys latos	Pahrump poolfish	E	NV	N	Y
Eremichthys acros	Desert dace	T	NV	Y	Y
Etheostoma cragini	Arkansas darter	C	CO	N	N
Eucyclogobius newberryi	Tidewater goby	E	CA	Y	Y
Gambusia nobilis	Pecos gambusia	E	NM	N	Y
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	E	CA	N	Y
Gila bicolor mohavensis	Mohave tui chub	E	CA	N	Y
Gila bicolor snyderi	Owens tui chub	E	CA	Y	Y
Gila bicolor ssp.	Hutton tui chub	T	OR	N	Y
Gila boraxobius	Borax Lake chub	E	OR	Y	Y
Gila cypha	Humpback chub	E	AZ, CO, UT, WY	Y	Y
Gila ditaenia	Sonora chub	T	AZ	Y	Y
Gila elegans	Bonytail chub	E	AZ, CA, CO, NV, UT, WY	Y	Y
Gila intermedia	Gila chub	E	AZ, NM	Y	N
Gila nigra	Headwater chub	C	AZ, NM	N	N
Gila nigrescens	Chihuahua chub	T	NM	N	Y
Gila purpurea	Yaqui chub	E	AZ	Y	Y
Gila robusta jordani	Pahranagat roundtail chub	E	NV	N	Y
Gila seminuda	Virgin River chub	E	AZ, NV, UT	Y	Y
Hybognathus amarus	Rio Grande silvery minnow	E	NM	Y	Y
Hypomesus transpacificus	Delta smelt	T	CA	Y	Y
Ictalurus pricei	Yaqui catfish	T	AZ	Y	Y
Lepidomeda albivallis	White River spinedace	E	NV	Y	Y
Lepidomeda mollispinis pratensis	Big Spring spinedace	T	NV	Y	Y
Lepidomeda vittata	Little Colorado spinedace	T	AZ	Y	Y
Meda fulgida	Spikedace	T	AZ, NM	Y	Y
Moapa coriacea	Moapa dace	E	NV	Y	Y
Notropis girardi	Arkansas River shiner	T	NM	Y	N
Notropis simus pecosensis	Pecos bluntnose shiner	T	NM	Y	Y
Oncorhynchus aguabonita whitei	Little Kern golden trout	T	CA	Y	Y
Oncorhynchus apache	Apache trout	T	AZ	N	Y
Oncorhynchus clarkii henshawi	Lahontan cutthroat trout	T	CA, NV, OR, UT	N	Y
Oncorhynchus clarkii seleniris	Paiute cutthroat trout	T	CA	N	Y
Oncorhynchus clarkii stomias	Greenback cutthroat trout	T	CO	N	Y
Oncorhynchus gilae	Gila trout	T	AZ, NM	N	Y
Oncorhynchus keta	Chum salmon[b]	T	OR	Y	N
Oncorhynchus kisutch	Coho salmon[b]	PT, T[c], E[c]	CA, OR, WA	Y	N

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Oncorhynchus mykiss	Steelhead[b]	T[c], E[c]	CA, ID, OR, WA	Y	N
Oncorhynchus nerka	Sockeye salmon[b]	E	ID, WA	Y	N
Oncorhynchus tshawytscha	Chinook salmon[b]	T[c], E[c]	CA, OR, WA	Y	N
Oregonichthys crameri	Oregon chub	E	OR	N	Y
Plagopterus argentissimus	Woundfin	E	AZ, UT	Y	Y
Poeciliopsis occidentalis	Gila topminnow	E	AZ, NM	N	Y
Ptychocheilus lucius	Colorado pikeminnow	E	AZ, CA, CO, NM, NV, UT, WY	Y	Y
Rhinichthys osculus lethoporus	Independence Valley speckled dace	E	NV	N	Y
Rhinichthys osculus nevadensis	Ash Meadows speckled dace	E	NV	Y	Y
Rhinichthys osculus oligoporus	Clover Valley speckled dace	E	NV	N	Y
Rhinichthys osculus ssp.	Foskett speckled dace	T	OR	N	Y
Rhinichthys osculus thermalis	Kendall Warm Springs dace	E	WY	N	Y
Salvelinus confluentus	Bull trout	T	ID, MT, NV, OR, WA	Y	Y
Scaphirhynchus albus	Pallid sturgeon	E	MT	N	Y
Thymallus arcticus	Fluvial Arctic grayling	C	MT, WY	N	N
Tiaroga cobitis	Loach minnow	T	AZ, NM	Y	Y
Xyrauchen texanus	Razorback sucker	E	AZ, CA, CO, NM, NV, UT, WY	Y	Y
Amphibians					
Ambystoma californiense	California tiger salamander	T[c], E[c]	CA	T	N
Ambystoma tigrinum stebbinsi	Sonora tiger salamander	E	AZ	Y	Y
Batrachoseps aridus	Desert slender salamander	E	CA	N	Y
Bufo baxteri	Wyoming toad	E	WY	N	Y
Bufo californicus	Arroyo toad	E	CA	Y	Y
Bufo canorus	Yosemite toad	C	CA	N	N
Rana aurora draytonii	California red-legged frog	T	CA	Y	Y
Rana chiricahuensis	Chiricahua leopard frog	T	AZ, NM	N	Y
Rana luteiventris	Columbia Spotted frog	C	NV	N	N
Rana muscosa	Mountain yellow-legged frog	E[c], C[c]	CA, NV	Y	N
Rana onca	Relict leopard frog	C	AZ, NV, UT	N	N
Rana pretiosa	Oregon spotted frog	C	CA, OR, WA	N	N
Hyla wrightorum	Arizona treefrog[b]	C	AZ	N	N
Reptiles					

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Crotalus willardi obscurus	New Mexican ridge-nosed rattlesnake	T	AZ, NM	Y	Y
Gambelia silus	Blunt-nosed leopard lizard	E	CA	N	Y
Gopherus agassizii	Desert tortoise	T	AZ, CA, NV, UT	Y	Y
Kinosternon sonoriense longifemorale	Sonoyta mud turtle	C	AZ	N	N
Masticophis lateralis euryxanthus	Alameda whipsnake	T	CA	Y	Y
Sceloporus arenicolus	Sand dune lizard	C	NM	N	N
Thamnophis gigas	Giant garter snake	T	CA	N	Y
Thamnophis sirtalis tetrataenia	San Francisco garter snake	E	CA	N	Y
Uma inornata	Coachella Valley fringe-toed lizard	T	CA	Y	Y
Mammals					
Antilocapra americana sonoriensis	Sonoran pronghorn	E	AZ	N	N
Aplodontia rufa nigra	Point Arena mountain beaver	E	CA	N	N
Brachylagus idahoensis	Pygmy rabbit	E	OR, WA	N	N
Canis lupus	Gray wolf	E	AZ, CO, ID, MT, NM, NV, OR, UT, WA, WY	Y	Y
Cynomys parvidens	Utah prairie dog	T	UT	N	Y
Dipodomys heermanni morroensis	Morro Bay kangaroo rat	E	CA	Y	Y
Dipodomys ingens	Giant kangaroo rat	E	CA	N	Y
Dipodomys merriami parvus	San Bernardino Merriam's kangaroo rat	E	CA	Y	N
Dipodomys nitratoides exilis	Fresno kangaroo rat	E	CA	Y	Y
Dipodomys nitratoides nitratoides	Tipton kangaroo rat	E	CA	B	Y
Dipodomys stephensi	Stephens' kangaroo rat	E	CA	N	Y
Herpailurus yagouaroundi tolteca	Sinaloan jaguarundi	E	AZ	N	Y
Leopardus pardalis	Ocelot	E	AZ	N	Y
Leptonycteris curasoae yerbabuenae	Lesser long-nosed bat	E	AZ, NM	N	Y
Leptonycteris nivalis	Mexican long-nosed bat	E	NM	N	Y
Lynx canadensis	Canada lynx	T	AK, CO, ID, OR, UT, WA, WY	Y	N
Martes pennanti	West coast fisher	C	CA, OR, WA	N	Y
Microtus californicus scirpensis	Amargosa vole	E	CA	N	Y
Microtus mexicanus hualpaiensis	Hualapai Mexican vole	E	AZ	N	Y
Mustela nigripes	Black-footed ferret	E	AZ, CO, MT, UT, WY	N	Y
Neotoma fuscipes riparia	Riparian woodrat	E	CA	N	Y
Odocoileus virginianus leucurus	Columbian white-tailed deer	E	OR, WA	N	Y

Scientific Name	Common Name	Listing Status[a]	State in which Species could Occur	Designated Critical Habitat	Recovery Plan
Ovis canadensis	Peninsular bighorn sheep	E	CA	Y	Y
Ovis canadensis californiana	Sierra Nevada bighorn sheep	E	CA	N	Y
Panthera onca	Jaguar	E	AZ, NM	N	Y
Perognathus longimembris pacificus	Pacific pocket mouse	E	CA	N	Y
Rangifer tarandus caribou	Woodland caribou	E	ID, WA	N	Y
Reithrodontomys raviventris	Salt marsh harvest mouse	E	CA	N	Y
Sorex ornatus relictus	Buena Vista Lake ornate shrew	E	CA	Y	Y
Spermophilus brunneus brunneus	Northern Idaho ground squirrel	T	ID	N	Y
Spermophilus brunneus endemicus	Southern Idaho ground squirrel	C	ID	N	N
Spermophilus tereticaudus chlorus	Palm Springs round-tailed ground squirrel	C	CA	N	N
Spermophilus washingtoni	Washington ground squirrel	C	OR, WA	N	N
Sylvilagus bachmani riparius	Riparian brush rabbit	E	CA	N	Y
Tamiasciurus hudsonicus grahamensis	Mount Graham red squirrel	E	AZ	Y	Y
Thomomys mazama glacialis	Roy Prairie pocket gopher	C	WA	N	N
Thomomys mazama louiei	Louie's western pocket gopher	C	WA	N	N
Thomomys mazama melanops	Olympic pocket gopher	C	WA	N	N
Thomomys mazama pugetensis	Olympia pocket gopher	C	WA	N	N
Thomomys mazama couchi	Shelton pocket gopher	C	WA	N	N
Thomomys mazama tacomensis	Tacoma western pocket gopher	C	WA	N	N
Thomomys mazama tumuli	Tenino pocket gopher	C	WA	N	N
Thomomys mazama yelmensis	Yelm pocket gopher	C	WA	N	N
Ursus arctos horribilis	Grizzly bear	T[d]	ID, MT, NM, NV, OR, UT, WA, WY	N	Y
Vulpes macrotis mutica	San Joaquin kit fox	E	CA	N	Y
Zapus hudsonius preblei	Preble's meadow jumping mouse	T	CO, WY	Y	N
Zapus hudsonius luteus	New Mexico meadow jumping mouse	C	AZ, NM	N	N
Birds					
Brachyramphus brevirostris	Kittlitz's murrelet	C	AK	N	N
Brachyramphus marmoratus	Marbled murrelet	T	CA, OR, WA	Y	Y
Centrocercus urophasianus	Greater sage-grouse	C	OR, WA	N	N
Charadrius alexandrinus nivosus	Western snowy plover	T	CA, OR, WA	Y	Y
Charadrius melodus	Piping plover	T	CO, MT	Y	Y
Coccyzus americanus	Western yellow-billed cuckoo	C	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY	N	N

Scientific Name	Common Name	Listing Status[a]	State in which Species could Occur	Designated Critical Habitat	Recovery Plan
Colinus virginianus ridgwayi	Masked bobwhite	E	AZ	N	Y
Empidonax traillii extimus	Southwestern willow flycatcher	E	AZ, CA, CO, NM, UT	Y	Y
Eremophila alpestris strigata	Streaked horned lark	C	OR, WA	N	N
Falco femoralis septentrionalis	Northern Aplomado falcon	E	NM	N	Y
Grus americana	Whooping crane	E	CO, MT	Y	Y
Gymnogyps californianus	California condor	E	AZ, CA, UT	Y	Y
Numenius borealis	Eskimo curlew	E	AK, MT, NM, NV, OR, UT, WA, WY	N	N
Phoebastria (=Diomedea) albatrus)	Short-tailed albatross	E	AK	N	Y
Pipilo crissalis eremophilus	Inyo California towhee	T	CA	Y	Y
Polioptila californica californica	Coastal California gnatcatcher	T	CA	Y	N
Rallus longirostris levipes	Light-footed clapper rail	E	CA	N	Y
Rallus longirostris obsoletus	California clapper rail	E	CA	N	Y
Rallus longirostris yumanensis	Yuma clapper rail	E	AZ, CA	N	Y
Polysticta stelleri	Steller's Eiderb	T[c]	AK	Y	Y
Somateria fischeri	Spectacled Eider	T	AK	Y	Y
Sterna antillarum	Interior least tern	E	CO, MT, NM	N	Y
Sterna antillarum browni	California least tern	E	CA	N	Y
Strix occidentalis caurina	Northern spotted owl	T	CA, OR, WA	Y	Y
Strix occidentalis lucida	Mexican spotted owl	T	AZ, CO, NM, UT	Y	Y
Synthliboramphus hypoleucus	Xantus's murrelet	C	CA	N	N
Tympanuchus pallidicinctus	Lesser prairie-chicken	C	CO, NM	N	N
Vireo bellii pusillus	Least Bell's vireo	E	CA	Y	Y

[a] C = candidate for listing, E = listed as endangered, PT = proposed for listing as threatened, T = listed as threatened.

[b] Includes one or more "evolutionarily significant units" that spawn in different river basins or at different times of year and that have been assigned separate listing status.

[c] More than one listing category indicates that the species has different status in different states.

[d] Grizzley bears in the Yellowstone District Population Segment in Idaho, Montana, and Wyoming are considered recovered and have been delisted.

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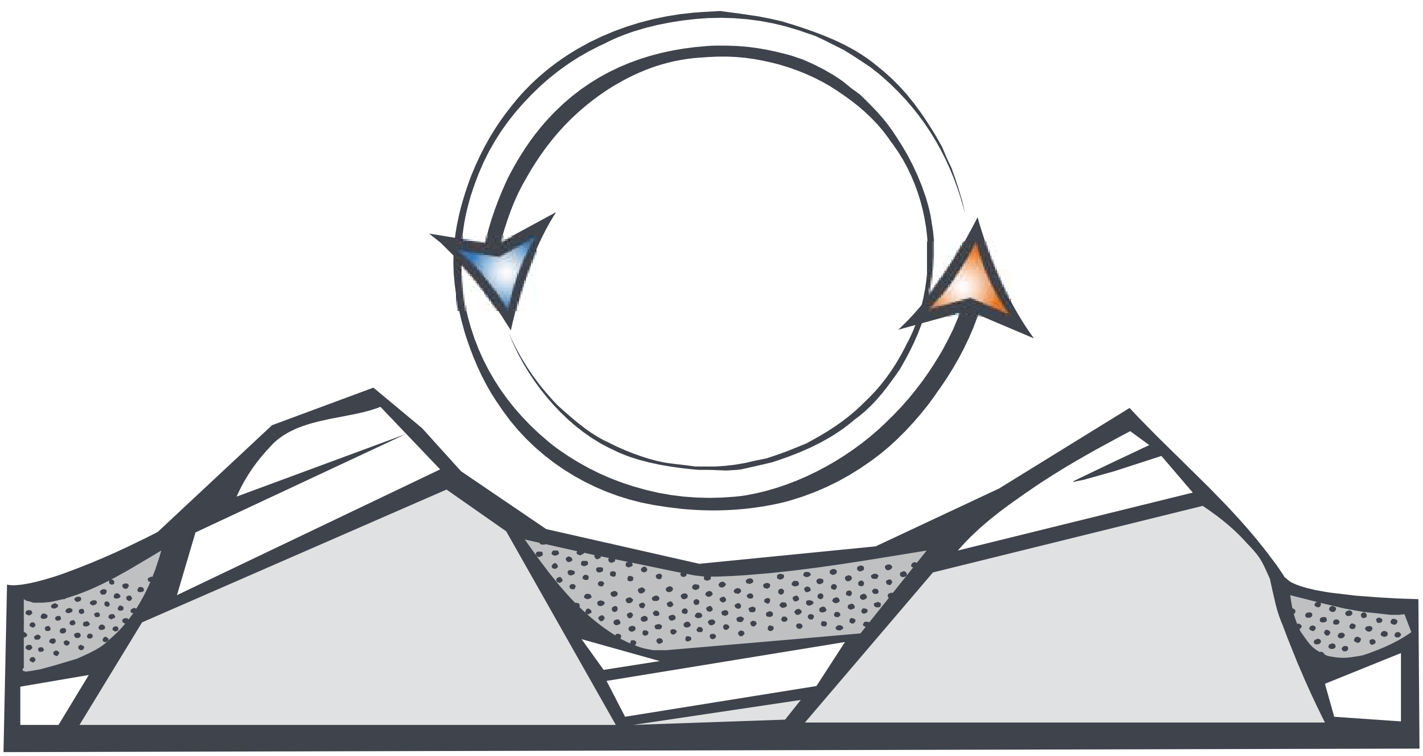

Appendix I

Cultural Resources Regional Ethnohistory

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APPENDIX I
CULTURAL RESOURCE REGIONAL ETHNOHISTORY

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic archaeological sites, structures, natural features, and biota which are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices, and are associated with community values and institutions. These traditional cultural resources are addressed in a separate chapter on ethnographic resources and tribal trust assets (Chapter 3.15). Cultural resources addressed here include the physical remains of prehistoric and historic cultures and activities, such as archaeological sites, historic trails, and boom towns. Historic properties are a subset of these kinds of cultural resources that meet specific eligibility criteria found at 36 CFR 60.4 for listing on the National Register of Historic Places (NRHP).

In this chapter, cultural resources have been organized into prehistoric and historic resources. Further, they are discussed according to established culture regions: Alaska, Northwest Coast, Plateau, Great Basin, Great Plains, California, and Southwest. These are regions where there is continuity across the landscape in cultural adaptations and traditions. For consistency, maps defining these regions and the cultural groups within them are derived from the respective volumes of the Smithsonian Handbook of the American Indian and reflect the choices of the authors and editors of this series. These maps are generally depict territorial assumptions existing at the approximate time of Native contact with Euro-Americans and may not encompass territorial ranges or ancestral lands as recognized by tribes or archaeologists. For example, important Ancestral Puebloan occupations in Southwestern Colorado are found outside of the tribal ranges for the Southwest region. This is a programmatic level overview and should not be considered a detailed source for the extent of regional cultural influence or tribal interest.

Culture resources of these regions have been organized into prehistoric and historic resources. Prehistoric resources refer to any material remains, structures, and items used or modified by people before Euro- Americans established a presence in the region. Historic resources include material remains and the landscape alterations that have occurred since the arrival of Euro-Americans.

Discussions of prehistory within each region are focused on chronological periods that have been established based on the prehistoric archaeology of the region. It should be noted that for many of these regions there are area-specific culture chronologies that have been developed where cultural practices were unique within the larger region. Discussion of such specific time periods is avoided here given the programmatic nature of this document and for ease of discussion. Discussions of the history within each region are organized by overall themes of the region. This includes such things as westward expansion, transportation, and mineral development. Since this approach leads to a very general discussion of the culture regions, an effort was made to work with the USFS and BLM regional and district offices within the project area to identify areas sensitive for cultural resources.

OVERVIEWS BY REGION

Alaska (Arctic and Subarctic)

Alaska is divided into two culture regions, the Arctic and Subarctic, which are combined into the Alaska culture region for purposes of discussion here (Figure 3-15). The physiographic boundary between the two culture regions is essentially the tree-line (Damas 1984a; Neusius and Gross 2007). Culturally, the boundary is defined by areas occupied by the Inuit or Eskimo and the Aleut and those areas occupied by other Native American groups. Within the project area, the Arctic extends from the Yukatat Bay along the Alaska coast to the Bering Sea and includes the coast and adjacent tundra of the Yukon. Note that the portion of Alaska south of Yukatat Bay is considered part of the Northwest Coast culture region. The Aleutian Islands are included in the Arctic culture region as well. The Subarctic culture region is inland from the Arctic and encompasses interior Alaska (Damas 1984a; Helm 1981a; Neusius and Gross 2007). The southern boundary is marked by the boundary between the boreal forest and mixed deciduous-coniferous forests (Helm 1981a). The Arctic and Subarctic regions also include areas of Canada, Nunavut, and Greenland (Damas 1984a; Helm 1981a; Neusius and Gross 2007). However, since these areas are outside of the project area they are not discussed here.

USFS regions in the Alaska culture region include most of Region 10. BLM District Offices included in the region include all or portions of the Fairbanks and Anchorage offices.

Table I-1 identifies the Alaska culture region languages and tribes that have been documented within the project area, as well as the specific culture region, Arctic or Subarctic, they are associated with. Culturally, the Alaska culture region considered here is bordered by the Northwest Coast to the south.

Table I-1
Languages and Tribes of the Alaska (Subarctic and Arctic) Culture Region in the Project Area

Language (Linguistic Phylum; Culture Region)	Tribes
Athapascan (Na-Dene; Subarctic)	Holikachuk, Ingalik, Kolchan, Tanaina, Koyukon, Kutchin, Tanana, Ahtna, Han
Eskimaleut (American Arctic/Paleo-Siberian; Arctic)	Pacific Eskimo, Aleut, Mainland Southwest Alaska Eskimo, Nunivak Eskimo, St. Lawrence Island Eskimo, Bering Strait Eskimo, Kotzebue Sound Eskimo, Interior North Alaska Eskimo, North Alaska Coast Eskimo, Mackenzie Delta Eskimo

Source: Damas 1984b; Helm 1981b; Waldman 2000

Although the standard Handbook of North American Indians for the Alaska culture regions (Damas 1984c; Helm 1981c) offer region-specific chronologies for the Arctic and Subarctic, a more generalized chronology relevant to cultural patterns found in Alaska, which encompasses only a small percentage of the overall regions, is used in this discussion. Much of Alaska was ice free during the last glacial period (Clark 1981; Neusius and Gross 2007) and one would expect to find the earliest evidence for people crossing the Bering land bridge from Asia to be found in western Alaska. However, Pre-Clovis evidence for occupation of Alaska is debatable and the early coastline has been greatly altered from rising sea levels. The earliest agreed upon evidence is for a microblade tradition in the Paleoindian Subarctic similar to that of the Archaic Northwest Coast. The following outlines a general chronology used here for the culture regions of Alaska (Neusius and Gross 2007). One will note that many of the cultural traditions outlined below occurred concurrently in different regions. Such cultural patterns were too highly varied to accommodate a single general cultural period and are thus addressed separately.

- Paleoarctic: pre-8000 BP
- Archaic: 8000 – 500 BP
- Northern/Central Alaska

- Northern Archaic Tradition: 8300 – 500 BP
- Arctic Small Tool Tradition: 4500 – 3000 BP
- Norton Tradition: 3000 – 1200 BP
- Thule Tradition: 2000 BP – Modern Times
- Pacific Coast Alaska
- Ocean Bay Tradition: 7000 – 4500 BP
- Kodiak Tradition: 4500 BP – Modern Times
- Aleutian Tradition: 5500 BP – Modern Times

The Historic period then follows the Archaic Period, but as one can see many of the Archaic cultural practices continue today with minor adaptations to modern influences.

CULTURAL HISTORY

Prehistoric

Paleoarctic: As discussed above the evidence for Pre-Clovis occupations in Alaska are ambiguous, particularly in the far northern areas. However it would be in western Alaska that we would expect to find the earliest evidence of human occupation of North America if peoples migrated to the area via the Bering Land Bridge. As such, the archaeology of the area is considered likely to provide important information pertaining to early North American human settlement (Neusius and Gross 2007). Fluted points have been found, but like other culture regions, these are typically found as isolated surface finds or in uncertain associations, many just east of the state line in Canada (Dumond 1984; Helm 1981; Neusius and Gross 2007); unlike other areas, it appears fluted points were made later in Alaska than they were to the south and have some technological differences. Although these points are not commonly found in direct association with bone of game in Alaska, blood residue analyses have indicated their use on such resources (Neusius and Gross 2007).

The earliest sites in Alaska are contemporaneous with Clovis sites found further south (Neusius and Gross 2007). The most confident of these early sites are comprised of stone tools and detritus (Dumond 1984). These are found western Alaska and are associated with the Nenana and Denali, dated to between 12,000 and 11,000 BP and between 11,000 and 8000 BP, respectively. The Nenana complex is a blade and biface industry, but is without microblades. Technology used to create Nenana tools is similar to that found in parts of the Southwest (Neusius and Gross 2007). The Denali complex is part of the Paleoarctic tradition seen elsewhere with inland hunters and includes microblades, wedge-shaped microblade cores, bifaces, and burins. Such toolkits are seen well into later periods of the region. It is believed that the microblade technologies are derived from Asia (Clark 1981; Neusius and Gross 2007).

Archaic: Archaic patterns in Alaska vary greatly across the region and differences between the Pacific Coast of Alaska and Interior Alaska begin to become more evident. In the northern and central regions of Alaska the Northern Archaic Tradition developed in the interior, giving way in some parts to the Arctic Small Tool Tradition and then the Norton and Thule Traditions. The first maritime adaptations are recognized along the Pacific coast in the Ocean Bay, Kodiak, and Aleutian Traditions. Throughout just about all of the Alaska region the Archaic persisted until historic times (Dumond 1984; Neusius and Gross 2007).

Central and Northern Alaska Traditions

The Northern Archaic Tradition (8000 – 500 BP) does not include microblades, but does include projectile points, bifacial tools, scrapers, and other lithic tools (Clark 1981; Dumond 1984; Neusius and Gross 2007). What little subsistence and settlement data there is would indicate that those practicing this tradition were generalized foragers who hunted on land and fished along rivers (Dumond 1984; Neusius and Gross 2007). Tracking these technologies across time and space has led researchers to believe that this tradition spread south and east following its development in interior Alaska. However, there is some indication that the tradition may have been the result of interaction with northern cultures of the Great Plains. Ultimately, the tradition appears to have been an antecedent to cultural practices of the Na-Dene or Athapaskan speakers of later times (Neusius and Gross 2007).

The Arctic Small Tool Tradition fully developed around 4000 and 3900 BP in northern Alaska midway through the Northern Archaic Tradition (Neusius and Gross 2007), ushering in a period of uniformity followed yet again by diversification of adaptations (Clark 1981; Damas 1984a). It is notably absent from the Aleutians and may have developed directly out of the Paleoarctic tradition of Siberia, migrating into Alaska. Originators of this tradition spread quickly throughout the Arctic and were the first to colonize the Arctic Ocean coast of North America, although the only known house sites are situated away from seacoast and toward the interior tundra. It is characterized blades that are smaller than those produced previously (Dumond 1984; Neusius and Gross 2007), as well as microblades, burins, adzes, oil lamps, as well as bone and antler tools (Clark 1981; Neusius and Gross 2007). Caribou hunting appears to have been the primary activity at sites of the Arctic Small Tool Tradition, but some on the Alaska Peninsula also appear to have been located so as to take advantage of salmon runs. In places where it remained, the tradition is believed to have continued until the Historic Period, appearing concurrently with other cultural traditions of the region (Neusius and Gross 2007).

In the western Arctic culture region the Norton Tradition developed and is dated to between 3000 and 1200 BP. Its tool assemblage is similar to that of the Arctic Small Tool Tradition, but incorporates ceramics. A series of three cultures, the Choris, Norton, and Ipiutak, characterize the Norton Tradition (Dumond 1984; Neusius and Gross 2007).

The Choris culture existed north of the Bering Strait between 3000 and 2500 BP and is characterized by new point styles resembling Paleoindian points of the Plains, chipped adze blades, burins, oval houses, and feather-tempered pottery. Technologies employed in Choris pottery appears to have been adopted from another region, most likely Asia, as a developed technology, as opposed to being locally invented (Dumond 1984; Neusius and Gross 2007).

The Norton complex appears around 2500 BP, apparently developing from the Choris complex. Occurring along the Alaska Peninsula and over to the northeastern border of the state and Canada, the Norton complex is characterized by caribou hunting, sealing, net fishing for salmon, and whale hunting as well as artifacts such as check-stamp design pottery, use of ceramic and stone lamps, end and side blades, knives, including some made of ground slate, burin-like tools, scrapers, and net sinkers (Dumond 1984; Neusius and Gross 2007).

The Ipiutak complex existed in northern Alaska above the Bering Strait and first appeared around 2000 BP, sharing several traits with the Choris and Norton complexes, but lacking lamps and pottery. The tradition is best known for its art, which incorporates elaborate carvings of animal and human figures, linked chains, and entangled objects. In addition to its art, the Ipiutak complex includes a variety of utilitarian objects such as harpoons, snow goggles, ground slate tools, and houses with entry ramps (Dumond 1984; Neusius and Gross 2007).

The Thule Tradition developed out of the Norton Tradition around 2000 BP and has continued through the Historic period (Dumond 1984; Neusius and Gross 2007). It covers several cultural complexes within Alaska. The tradition is likely best known for new hunting technologies to be used in open waters, especially for whaling (Neusius and Gross 2007). This is not to say though that the capabilities of Thule terrestrial hunters were not as sophisticated as those of marine and riverine hunters. In fact, the two skills were very well matched (Dumond 1984).

Early sites of the Thule Tradition are attributed to the Old Bering Sea and Okvik cultures (2200 – 1250 BP) of St. Lawrence and adjacent islands, as well as the Asian coast (Dumond 1984; Neusius and Gross 2007). The tradition is presumed to have developed about the same time the Ipiutak complex was developing on the mainland. Artifact forms of these Old Bering Sea and Okvik cultures are very similar and are only distinguished by their decorative art styles. The toolkit of these cultures in this part of the region included bone, antler, and ivory tools. Pottery was also used for cooking pots and lamps. Sea mammal hunting constituted the primary subsistence endeavor. It is thought that this was done from the ice edge, but was also likely done on open water with the use of harpoon lines and large open boats called *umiaks*. However, kayak artifacts and models provide evidence of the use of closed boats as well. Additionally, winter seal hunting is suggested by the presence of ice picks, fishing by the presence of hooks and spears, and the bow and arrow suggest terrestrial mammal hunting. Sleds were used to transport materials and kills; however, these were not the dog sleds commonly associated with Alaskan cultures (Neusius and Gross 2007).

The Birnirk culture developed in northern coasts of Alaska and spanned the same time period as the Old Bering Sea and Okvik cultures. Hunting activities and tools were similar to those of the more southern Alaska cultures, including use of kayaks and *umiaks*, but are distinguished by the use of flat toggling harpoon heads. Sleds were used for the same purposes and by the same means. Utilitarian pottery pieces, such as lamps, were marked with impressed circular designs. Houses were square with driftwood or whalebone above-ground walls, plank-lined floors, and sod-covered roofs (Neusius and Gross 2007).

From the Birnik culture developed the Thule culture which existed between 1050 BP and 400/250 BP. The complex of material culture attributed to this culture is also associated with the historic Eskimo and Inuit. Like the other cultures in the Thule Tradition, artifacts that characterize the Thule culture include bone, antler, and ivory tools, such as arrows, spears, and harpoon heads. However, in the Thule tradition the ratio of groundstone to other artifacts rose significantly to include about half of all stone tools found. Pottery was also used, but was tempered with gravel instead of the fibers used previously (Neusius and Gross 2007). The culture spread rapidly from northern Alaska across the Arctic, marked by the Sicco-type harpoon head, eventually reaching Greenland and once again displaying a cultural continuity for the majority of the Arctic culture region, similar to the Arctic Small Tool Tradition (Damas 1984a; Neusius and Gross 2007). The expansion was likely a result of people following bowhead whales. Dogsleds first appear with this culture, possibly as a result of open water hunting of bowheads which allowed for groups to amass large stores of food that would need to be transported back for storage at a settlement. In addition to whale hunting, seals, walruses, and birds were hunted from kayaks using *atlatls* and darts (Neusius and Gross 2007).

Pacific Coastal Alaska Traditions

The Ocean Bay Tradition (7000 – 4500 BP) is certainly present on Kodiak Island and possibly on the Alaskan Peninsula and Pacific Coast. It may be related to materials found on the Aleutian Islands. Ocean Bay sites are considered to be the earliest representations of maritime adaptations along the Alaska Pacific coast. It is notable for the use of tools made of ground slate, which were introduced into an assemblage dominated by flaked stone. The subsistence economy of peoples practicing this tradition was based on hunting of marine mammals and the pattern of site locations, situated on coastlines and near the ocean, is consistent with this activity (Neusius and Gross 2007).

The Kodiak and Aleutian Traditions developed out of the Ocean Bay Tradition around 4500 – 5000 BP and 5500 BP, respectively, and continued into modern times (Dumond 1984; Neusius and Gross 2007). The Aleutian Tradition developed west of the Kodiak Tradition. Ground slate tools are absent in this tradition, at least until very late in the period, around 500 BP. Instead flaked tools are primarily relied upon. The tradition does share the use of oil lamps and similar bone tools with the Kodiak Tradition. Sea mammal hunting appears to have been important given their commonality at sites, along with land mammals, marine invertebrates, fish, and migrating and resident birds. Aleutian Tradition sites are typically large middens along the coast that were inhabited on a semipermanent basis. Given the archaeological evidence, it is believed that the people practicing the Aleutian Tradition are the ancestors of the modern Aleuts (Neusius and Gross 2007).

As insinuated by its name, the Kodiak Tradition is centered on the Kodiak Island area and is characterized by the use ground slate, differentiating it from the Aleutian Tradition (Dumond 1984). It is separated into two stages: the Takli stage (4500 – 3500 BP) followed by the Kachemak stage (3500 – 1000 BP). In the Takli stage the toolkit included slate lance or dart points, formed initially by sawing, oil lamps, and chipped stone similar to that of the Ocean Bay Tradition. Subsistence activities focused on hunting land and sea mammals as well as fishing, and settlements are situated in areas conducive to these activities. In the Kachemak stage ground slate tools continue to be used, but are instead initially formed by chipping. In addition to slate tools, oil lamps continue to be present in sites as well as labrets of stone and bone. A variety of bone tools occur, including the toggling harpoon which improved the success of maritime hunting (Neusius and Gross 2007).

Historic

Historic continuity of earlier cultural practices is prevalent in Alaska (Clark 1981; Neusius and Gross 2007). In fact, through the 19th century, some Arctic groups had not yet had contact with Europeans (Neusius and Gross 2007). Russian exploration of the region led to the fur trade with historic Alaskan native peoples (Damas 1984; Neusius and Gross 2007) and Russian Orthodox missionaries followed. The effect of these missionaries was not as extensive as the effect of Spanish missionaries further south. As the whaling industry grew in the region and ships began wintering in the Arctic, contact between the native Alaskans and Europeans increased. This in turn led to increased trade and ultimately dependence on the fur trade to obtain European goods. Such adaptations are only one of a few historic changes in the native economies of Alaska (Neusius and Gross 2007). Mining and oil development by Europeans of the Alaskan interior began during the historic period and have continued to affect the cultures of the region into modern times (Helm 1981a; Neusius and Gross 2007).

Euro American Contact

Vitus Bering, a Danish sailor, was commissioned by Peter the Great, the Czar of Russia, in 1725 to explore the region that is present-day Alaska. Bering explored Greenland and the southwest coast, but did not explore present-day Alaska. His expeditions did heighten interest in the region because of the news he brought back to Europe of the wealth of furs and possibility of trading (Borneman 2003).

The Spanish were also interested in the region, partly out of concern that the Russians were going to settle that part of the continent. Spain also sent expeditions to the region but did not establish permanent settlement in Alaska (Borneman 2003).

The English were also early European explorers to the Alaska region. In 1776 Captain James Cook sailed the northwest coast of North America, mapping the inlet he discovered (named the Cook Inlet by George Vancouver) (Borneman 2003).

The first European settlement in Alaska was the Russian-American Company, established in 1784. The company was at the center of fur trade in Alaska, even though however the Russians never fully colonized the region.

Trade

Fur trade. Fur trapping and trading was one of the primary reasons Europeans were attracted to the region. The French, British, and Russians were all part of the fur trade in Alaska. The Hudson Bay Company and the Northwest Company had fur trading posts throughout Alaska, which lasted from the 1720s until it dwindled in the 1850s because of a diminishing animal populations (Neusius and Gross 2007; Borneman 2003).

Commercial Whaling and Fishing. Shore-based Eskimo whaling was long a tradition in coastal communities. Eskimo whalers were limited to taking whales near their villages when the animals migrated past on their annual round. Because of the huge quantity of meat and oil that successful whale hunting provided to a coastal village as well as the danger involved in a whale's pursuit, whaling and whalers had special significance for such communities. Ship-based whaling flourished during the 17th-19th centuries. Scandinavian, Dutch, English, Scottish, Russian and American whale fleets pursued the whales in the 19th century. Oil reduced from blubber and baleen were the primary commodities produced by this worldwide whaling industry (National Science Foundation 2007).

Salmon fishing was a mainstay to the Alaskan economy, with the first commercial salmon cannery built in 1878. Canneries were built throughout the southeast portion of Alaska, as well as in Cook Inlet and Bristol Bay (Borneman 2003). Salteries, which processed the salmon, packed and imported it in barrels, were also established. By 1911, the salmon population in Alaska was reduced, but by the 1920s, fishing was still considered the bedrock of the Alaskan economy (Borneman 2003). Commercial fishing continues to be an important part of the local economy.

Missionaries. Russian Orthodox missionaries followed the fur explorers and traders to the region during the 1740s-1780s. They were most successful in southern Alaska, and their activities lasted into the 1800s (Neusius and Gross 2007).

Gold Mining. Although gold was first discovered in 1850 on the Kenai Peninsula by a Russian mining engineer, the discovery was not widely publicized (Borneman 2003). In 1897, the Klondike River was the site of another gold discovery which led to a major gold rush into eastern Alaska and the Yukon Territory. Many settlers and gold miners came to the area, establishing trails or sailing routes in order to reach the area. The gold boom also struck in other parts of Alaska, such as Fairbanks and Nome (Borneman 2003). Other minerals, such as copper and molybdenum were mined as well.

Oil. Oil was claimed in Alaska on the Iniskin peninsula in the 1890s. In 1898, the first Alaska wells drilled oil there, however there was not enough to support a full-scale, long-term production of oil (Alaska History and Cultural Studies 2008).

The first productive drilling of oil occurred at Katalla, just south of the Copper River Delta. In 1911, new wells in the area began to produce a significant amount of oil, which was recovered then processed at a refinery at Katalla. The cost of transportation and operating costs were high, but the yield of oil proved worthwhile. In the 1960s, oil companies bought exploration leases for work in the Cook Inlet and production of oil began (Alaska History and Cultural Studies 2008). Oil exploration, production and transportation continues to be the most important industry in Alaska.

Trans-Alaska Pipeline System. The system began in 1968 as a joint venture between British Petroleum, Atlantic Richfield, and Humble. It was completed in 1977 and is an 800-mile pipeline that transports oil from Prudhoe Bay south to Hickel Highway, across the Yukon and to Livengood and Fairbanks. It then crossed the Alaska Range at Isabel Pass and the Chugach mountains at Thompson Pass before dropping into the port of Valdez through the Keystone Canyon (Borneman 2003).

EuroAmerican Expansion

In 1812, the Russian hold on Alaska was becoming weak, as American hunters and trappers were encroaching on Russian territory. The settlement that gave Americans the right to trade fur only below the 55°N latitude was generally ignored, making the Russian position in Alaska even weaker. Eventually, the Russian American Company entered an agreement with the Hudson's Bay Company to allow British sailors passage through Russian territory. Russia decided to sell its lands to North America, and in 1867, William H. Seward, the US Secretary of State, secured the purchase of Alaska from the Russians. Alaska became a state in 1959 (Borneman 2003).

Railroads. The Copper River and Northwestern Railroad, which was originally constructed to bring ore from the Wrangell Mountains to the Guggenheim smelter in Tacoma, Washington, constructed in 1911 (Borneman 2003). The railroad went through Kennecott, Bennett, and other cities that underwent a major growth spurt and a "boom" as they served the copper mines, miners, and served as railroad stops. The Great Depression and the fall in prices of copper, the railroad shut down and was no longer in use. The line was in use for only twenty-seven years (Borneman 2003).

The Alaska Railroad was established in April 1915**.** The line was to extend from Seward to Fairbanks, a seventy-two mile stretch. Completed in 1922, the rail line brought freight and passenger traffic to Alaska and serviced some of the most populated cities in Alaska, such as Seward, Anchorage, and Fairbanks. The line was instrumental in transporting military and civilian supplies and materials during World War II. The line has been upgraded several times and continues to be a transportation link (Alaska Railroad 2008).

Alaska Marine Highway. The period after World War II was a period of expansion for Alaska. One example is the Alaska Marine Highway. By 1963, three ships in the southeast region went into service, creating the Alaska Marine Highway, which ran regularly scheduled trips to the major towns along the Inside Passage (Borneman 2003).

Trails

Iditarod Trail. The Iditarod trail was a path originally used by Native American hunters and Russian explorers. In the twentieth century, gold seekers used the trail to reach the mines, and the trail was improved. Several towns such as Seward, Iditarod, and Nome grew up around the mining districts, where miners would buy supplies from local stores and markets and stay overnight in tents prior to going off to the mines. The trail begins in two places, at Seward and at Nome, and eventually met at the Iditarod Mining District. It was officially surveyed by the U.S. Army's Alaska Road Commission in 1908. It was heavily used until 1924, but its use diminished as the use of airplanes became more common. In the 1960s, interest in dog sledding and use of the trail was revived and the first Iditarod race took place in 1967 (Bureau of Land Management 2007). The trail is now part of the National Trails Service of the National Parks System.

NORTHWEST COAST

The Northwest Coast culture region covers areas between the crest of the Cascades and the ocean from the Copper River delta and Yakutat Bay in Alaska south to the Winchuck River and Cape Mendocino in California (Figure 3-19).

The region does include parts of Canada, but since this part of the Pacific coast is not included in the project area, it is not discussed here. The region is highly varied and is divided into three subareas for purposes of discussion: North, South, and Central (Neusius and Gross 2007; Suttles 1990a). The project area encompasses part of the Northern subarea and all of the South and Central subareas.

USFS regions included in the Northwest Coast region include portions of Regions 5, 6, and 10. BLM District Offices included in the region include all or portions of the Medford, Coos Bay, Roseburg, Eugene, Salem, Spokane, and Anchorage offices.

Table I-2 identifies the Northwest Coast culture region languages and tribes that have been documented within the project area. Culturally, the Northwest Coast culture region is bordered by the Arctic to the north, the Plateau to the east, California to the south, and the Subarctic to the north and east.

Table I-2
Languages and Tribes of the Northwest Culture Region in the Project Area

Languages (Linguistic Phylum; Culture Region)	Tribes
Athapaskan (Na-Dene)	Kwalhioqua, Clatskanie, Umpqua
Tlingit (Na-Dene)	Tlingit
Chinookian (Penutian)	Chinookans
Kalapuyan (Penutian)	Kalapuya
Kusan (Penutian)	Coosans
Takelman (Penutian)	Takelma
Yakonan (Penutian)	Alsea, Siuslaw
Wakashan (Undetermined linguistic phylum)	Makah
Salishan (Undetermined linguistic phylum)	Southwestern Coast Salish, Central Coast Salish, Southern Coast Salish, Tillamook
Chimakuan (Undetermined linguisticphylum)	Quilete, Chemakum

Source: Suttles 1990b; Neusius & Gross 2007; Waldman 2000

A general chronology of the Northwest Coast has been developed based on developments in lithic technology and social organization (Neusius and Gross 2007). Similar to California and other coastal regions, the early prehistory of the Northwest Coast has been dramatically affected by post-glacial sea level rise, resulting in inundation of the coastline and altering coastal environments. The entirety of the Northwest Coast was ice-free as of 12,000 years ago (Neusius and Gross 2007; Suttles 1990a), although lands immediately adjacent to the Pacific Ocean were never glaciated. The region though is unique in that its moist nature has led to excellent preservation in many saturated sites. Although a few sites and surface finds have been attributed to Paleoindian occupations, these are not definitive points of evidence for an early occupation of the Northwest Coast. The following outlines the general chronology of Northwest Coast (Neusius and Gross 2007).

- Paleoindian: pre-10,000 BP
- Archaic: 10,000 – 6400 BP
- Pacific: 6400 – 175 BP
- Early Pacific: 6400 – 3800 BP
- Middle Pacific: 3800 – 1800/1500 BP
- Late Pacific: 1800/1500 – 175 BP
- The Historic period then follows the Late Pacific Period.

CULTURAL HISTORY

Prehistoric

Paleoindian: Due to the above mentioned effects of deglaciation, much of the critical coastal areas where one would expect the earliest sites representing migration through the Northwest Coast into North America are under water (Neusius and Gross 2007). However, in general, sites older than 5000 BP are not considered abundant (Carlson 1990). Some Clovis points have been found in the region, but these are typically isolated surface finds, which makes their association with other artifacts questionable. The nearest accepted evidence of Paleoindian activity is a cache of points in the Plateau region on the opposite side of the Cascade Range (Neusius and Gross 2007). As in California, the scarcity of such artifacts in the Northwest Coast may be due to the rise of sea level and subsequent submersion of the coastline.

Archaic: Archaeological evidence suggests that Northwest Coast peoples of the Archaic Period existed in small, mobile populations with large territories. This results in primarily ephemeral sites for this period. Both terrestrial and marine resources, including salmon a basis of later diets, were exploited (Neusius and Gross 2007).

Four major technological complexes characterize the Archaic Period in the Northwest Coast culture region. These complexes occur concurrently in different areas as well as successively in the same area. These are: the Fluted and Stemmed Point Traditions, which spread between 10,950 – 9950 BP toward the coast along the Columbia River from interior North America, and the Pebble Tool and Microblade Traditions which spread southward along the coast and inland up river valleys, first appearing in the Northwest Coast between 9950 and 8950 BP (Neusius and Gross 2007; Carlson 1990).

The Fluted Point Tradition is poorly represented in this culture region, and as it is in other culture regions, is mostly documented via isolated and surface finds of fluted points. Unlike other regions, they are rarely associated with faunal remains or other artifacts. Given the relative lack of evidence for this tradition, it would appear that it did not last for very long in the Northwest Coast culture region. It is most likely derived from the Great Basin and transferred or migrated down the Columbia River and its tributaries (Carlson 1990).

The earliest sites in the Tlingit and Haida regions of northern Northwest Coast have Microblade Tradition components (Carlson 1990). Ground Hog Bay 2 and Hidden Falls are two sites within the project area in the Northwest Coast that are attributed to this tradition, the former, on the Chilkat Peninsula, being the oldest concurred upon site of the Microblade Tradition. It is thought that these two sites represent the spread of microblade technology from interior Alaska south (Neusius and Gross 2007). The technology continued to move southward through the Archaic and subsequent Pacific Period (Carlson 1990). Some sites in the region however may represent spread in the opposite direction, from the south to the north. The Microblade Tradition is characterized by microblades, microblade cores, pebble tools, and flakes, with bifaces being rarities (Neusius and Gross 2007). Sites with components representing this tradition are typically located where access and survival demanded developed water transport technologies and use of marine resources. Additionally, the inclusion of other point types and technologies in tool kits of some sites suggest influence from the Plateau to the east (Carlson1990).

In the project area the Pebble Tool Tradition is present in archaeological sites from the Puget Sound south to the lower reaches of coastal rivers, however in totality the tradition reaches further north into Canada near the Queen Charlotte Islands. This tradition also has various local expressions that are referred to by other names (Carlson 1990). Bifaces, particularly stemmed leaf-shaped points, accompanied by pebble tools characterize this tradition (Carlson 1990; Neusius and Gross 2007). Additionally a bone and antler industry is present while microblades are absent. Some sites indicate an interface between the Pebble Tool and the Stemmed Point Traditions (Carlson 1990). Overall however, the Pebble Tool Tradition is more similar to assemblages found in the Plateau, Great Basin, California, and Southwest regions. One of the most important archaeological sites of this tradition is within the project area in The Dalles, Oregon along the Columbia River. This is a fishing site that spans the Archaic and all subsequent periods, into modern times, indicating the significant time depth of fishing in this area (Neusius and Gross 2007). The Pebble Tool Tradition began as a marine-adapted culture that spread upriver and into the mountains and interior of the Northwest Coast, most likely following salmon runs. Sites are typically situated along rivers where fishing, particularly of salmon, and terrestrial mammal hunting would have provided the major forms of subsistence resources, supplemented by marine resources. In general, occupations of the Pebble Tool Tradition suggest a fishing and sea mammal hunting culture with sufficient technology to construct and use watercraft early on (Carlson 1990).

The Stemmed Point Tradition is primarily situated along the Columbia River and emanating from interior North America. In fact, there are several early Archaic Period sites along the eastern Northwest Coast boundary with the Plateau culture region. Representation of the technological tradition along the coast is rare. It is characterized by chipped stone crescents and long stemmed points. A focus on hunting typifies the associated cultural activities (Carlson 1990).

Several of the above patterns persisted into historic times. The disparate technologies suggest different cultural traditions with their own technologies existed within the cultural region of the Northwest Coast. However, between the time of their initial appearance in the region and 4950 BP (Early Pacific Period) the differences among the cultures using these early traditions were being homogenized as people adapted to the environment, populations grew, and relationships between groups expanded (Carlson 1990).

Pacific: During the Pacific Period the Northwest Coast region developed a variety of characteristics that distinguish it from neighboring culture areas and several of the Archaic technological traditions continue (Carlson 1990; Neusius and Gross 2007). This includes increases in populations leading to increased sedentism with cyclical rounds of permanent village sites with pithouses and later the characteristic wooden plank house. Economies were focused on aquatic resources particularly salmon in some areas. Storage of resources became important and the notable woodworking and art styles of the region developed during this period. All these developments point to an increasing social complexity of Northwest Coast tribes during the Pacific Period.

The Early Pacific Period is characterized by a lack of microblade cores seen during the Archaic, and use of bone and antler tools. Groundstone tools were replaced by chipped stone tools in many areas. Midden sites are larger in size and are denser in their assemblages compared to the earlier ephemeral Archaic sites. Economies were diverse, but a focus on seafood is apparent when looking at faunal assemblages and isotopic analyses of human bone from burials, which are commonly found for this period. Other evidence points to a developing emphasis on riverine resources as well. Burials and grave goods also provide evidence of achieved status of elites in populations. Other burial data suggest violence and conflict between groups, which is supported by the location of some sites in the northern subarea on bluff tops and other such defensible locations (Neusius and Gross 2007).

During the Middle Pacific Period, certain activities were intensified, especially fishing with the extensive use of nets and large fish weirs. Wooden storage boxes are first seen during this period signaling the importance of food storage as populations continued to expand substantially. The characteristic wooden plank house makes its first appearance too during this time. Planks could be removed and re-established in other areas allowing some form of residential mobility. Incidence of violence continued to increase in the northern subarea of the region, while it appears to have been much less common in the southern areas. Social hierarchies developed throughout the region on individual and village levels and was now based on ascribed status, rather than achieved. There are even possible indications of slavery during this time. Art is rare during this time, but those examples that have been found foreshadow the characteristic styles recorded for the region (Neusius and Gross 2007).

If the Middle Pacific Period saw the early beginnings of historically recorded lifestyles of the Northwest Coast, the Late Pacific Period saw their full development and a peak in population numbers, represented by a high number of sites. Flaked stone tools are entirely replaced by bone, antler, and groundstone tools. Subsistence economies continued to become intensified, but not all were focused on salmon fishing. Groups appear to have focused on what was locally important to them. Throughout however, storage continued to be a mainstay of economies with continued use of wooden boxes and also baskets. There was greater use of nearshore and offshore resources as indicated by an array of fishing implements and tools for sea mammal hunting, including nets, weirs, traps, tackle with hooks, weights, lines, and toggling harpoons. Tools for woodworking are also prominent in archaeological assemblages, presumably a result of the focus on house construction, although they would have also been used for construction of bentwood storage boxes and canoes. Remains of plank houses are more common during this period as well, including whole ones at the Meier site near Portland, Oregon within the project area. Evidence for individual social stratification is not as apparent as previous periods based on the lack of in-site burials along the coast. Instead evidence for village hierarchies is based on the presence or lack of village-associated burial mounds, such as those in the Fraser River and Willamette Valley areas. It should be noted however, that there is evidence for social ranking within houses. Burials and village locations in defensive areas, such as bluff tops and built fortifications, provide evidence of increased violence throughout the Northwest Coast region. The distinctive Northwest Coast art style was fully developed in the Late Pacific Period, although there are fewer art objects found (Neusius and Gross 2007).

Historic

Early explorers were the first non-Native contacts in the Northwest Coast culture region. In particular, the fur trade brought much interaction between Europeans and native Northwest Coast populations. Trading posts were established in the region to facilitate such trade between the Native Americans, Russians, and other Europeans. A variety of artifacts are found in archaeological sites that were received as part of the fur trade. However, relations between the tribes and the new settlers were often hostile (Neusius and Gross 2007).

Euro American Contact
Spain and England sent explorers to the northwest coast region, during the 1770s. Russia also led expeditions to the region in 1741. Captain James Cook, a British sailor, landed in Northwest Coast region, and attracted fur traders and trappers with news of fur resources in area (Schwantes 1989; Hayes 1999). Fur traders and trappers from the America and Canada also found new overland routes to the Northwest Coast region from the east and north through various trails.

Trade
Fur. The discovery of sea otters during the explorations of the Northwest Coast region spurred a period of fur trading for export to Asian and European markets that lasted until 1850 (Neusius and Gross 2007). Permanent trading posts were established in 1799, first by the Russians at Tlingit, and then by the Americans, who established a post on the lower Columbia in 1811. Many fur trappers and traders from the United States and Canada found new routes to the region.

Mining. The discovery of gold in the Coast Range of Oregon and Washington in the 1850s brought settlers and gold miners to the area. In addition to gold, mined resources in the northwest included silver, copper, sand, salt, gravel, phosphate, and coal (Schwantes 1989). There was a significant coal mining industry east of the Seattle and Tacoma area and west of Ellensburg during the 1870s and 1880s. This coal mining industry in Pierce and King Counties, in the foothills of Mount Rainiere, had a typical boom and bust cycle that most other mining settlements of the time shared (Washington 2008).

Fishing, Timber, and Agriculture. The economic foundation of the Northwest Coast region came from the fishing, timber and agricultural industries. Commercial fishing became popular during the late-nineteenth century, with salmon being the most desired fish product. Canneries and salteries were established along the Columbia River.

The vast forests of the region were attractive to the timber industry. California mines, cities, and ships required huge amounts of lumber, and the deep waters and forested shorelines of Pacific Northwest offered the most convenient place to get these commodities. The availability of cheap river and ocean transportation allowed entrepreneurs access to world and domestic markets through Portland, Seattle and other ports. Docks and sawmills appeared to deliver wood products to the ships that sailed away to San Francisco and other Pacific ports Farm products from the Willamette Valley, minerals from Idaho, and wheat from around Walla Walla all traveled to market via riverboats to the port cities.

Western Expansion

<u>Trails</u>

Oregon Trail. The Oregon Trail was a major route for trappers, traders and settlers traveling to the Pacific Northwest from the east. The Trail began as an unconnected series of trails used by the Native Americans. Fur traders expanded the route to bring pelts to trading posts in the early 1800s. The route extends roughly 2,000 miles west from Missouri toward the Rocky Mountains to the Willamette Valley. A trail to California digressed from the route in Idaho (Bureau of Land Management 2007). Several groups followed the route over time including large populations of settlers, moving from the eastern portion of the US to settle the west between 1800 and 1880s. (Bureau of Land Management 2007).

Missionaries used the trail during the 1830s, traveling along the Platte and Snake Rivers to settle churches in the Northwest. Mormons, headed toward Salt Lake in Utah, used the trail beginning in 1847, and the discovery of gold in California caused many gold miners to use the trail in 1849. It is estimated that four thousand emigrants followed the trail west in 1847 (Schwantes 1989), many in small caravans of wagons. Military posts and spur roads were established off the Oregon Trail. It was used as a cattle driving trail eastward for a brief time as well. The construction of the Central Pacific Railroad, connecting California to the rest of the continent in 1869, decreased use of the Oregon Trail and by the early 20th century, the trail was no longer used as a major transportation corridor, as railroad lines paralleled the trail (Bureau of Land Management 2007, Schwantes 1989).

Applegate Trail. This trail was used originally to link the Northwest Coastal area to Oregon. It crosses the Black Rock Desert, the High Rock Canyon, and into the Warner Mountains to Central California. The trail ends in Oregon (Bureau of Land Management 2007). This southern route of the Oregon Trail, established in 1846 by the Applegate brothers was considered a safer route to Oregon as it bypassed and avoided the obstacles of the Burnt River Canyon, the Blue Mountains, and the Columbia River (Webtrail 2007).

Cowlitz Trail. This trail is not on BLM or Forest Service land and has not been designated as a National Historic trail. It was used in 1839, to connect the Willamette Valley with the Puget Sound Basin. The trail was a muddy footpath in 1845, used to connect Fort Vancouver to South Puget Sound. Hudson's Bay Company traders used it as had Native Americans before them. The trail has disappeared throughout the years with the construction of roads over it (City of Tumwater, Washington 2005)

Lewis and Clark. This trail runs along the explorations of Meriwether Lewis and William Clark. The trail follows the Missouri River upstream, eventually reaching the Pacific Ocean at the mouth of the Columbia River. The route goes through Idaho and western Montana (USDA Forest Service 2003).

Railroads
The Northern Pacific Railroad was constructed in 1873, and by 1883, it was connected to Minnesota and the remainder of the eastern portion of the U.S. This rail line increased settlement and immigration to the area, as well as enabled railroad communities to be established. The railroad enabled the lumber and agriculture industries as raw materials could be transported from the Northwest Coast to more easterly regions of the United States.

Rivers and Ports
Large rivers and port towns of the northwest provided a crucial link between these remote territories and the outside world. The access provided by the Columbia River and its tributaries enabled shipment of goods to and from inland settlements. In the 1850s, timber mill towns began to develop in the Puget Sound area because of the deepwater anchorage that protected ships from Pacific storms (Schwantes 1989). These waterways enabled the industries of the northwest to supply the California coastal cities until the railroad boom of the 1880s.

Plateau

The Plateau culture region comprises the area drained by the Columbia and Fraser Rivers, with the exception of some areas within the Great Basin (Figure 3-20). In general, the area covers parts of British Columbia, eastern Washington, western and northern Oregon, the Idaho panhandle, and western Montana.

USFS regions included in the Plateau region include portions of Regions 1, 4, 5, and 6. BLM Offices included in the region include all or portions of the Spokane, Vale and Prinevale District Offices and Coeur d'Alene, Cottonwood, Missoula, Dillon and Butte Field Offices.

Table I-3 identifies the Plateau culture region languages and tribes that have been documented within the project area. Generally, Salish speakers are associated with the Northern Plateau, Sahaptin speakers with the south, Chinookan speakers with the west, Klamath-Modoc speakers with the southwest, and the Cayuse and Molala speakers with isolated areas of the region (Neusius and Gross 2007). Culturally, the Plateau culture region is bordered by the Northwest Coast on the west, the Plains on the east, the Great Basin on the south, and the Subarctic on the north. The Southern and Eastern Plateau subareas are within the U.S., while the Northern area is primarily in Canada.

The Plateau region has typically experienced cool climates since glaciers cleared from the area around 11,000 BP. However, the area has witnessed a period of warming since 2800 BP (Neusius and Gross 2007). Human occupation of the Plateau culture region began around the time of glacial retreat. A cultural chronology consisting of Early, Middle, and Late Periods, the Middle and Late

Table I-3
Languages and Tribes of the Plateau Culture Region in the Project Area

Language (Linguistic Phylum)	Tribes
Salish (Undetermined linguistic phylum)	Coeur d'Alene, Flathead and Pend d'Oreille, Kalispel, Middle Columbia River Salishans, Northern Okanagan, Lakes, and Colville, Spokane, Thompson
Sahaptian (Penutian)	Umatilla, Walla Walla, Nez Perce, Palouse, Western Columbia River Sahaptins, Yakima and Neighboring Groups
Chinookan (Penutian)	Wasco, Wishram, Cascades
Klamath-Modoc isolate (Penutian)	Klamath, Modoc
Molalla isolate (Penutian)	Molala
Cayuse isolate (Penutian)	Cayuse
Kutenai isolate (Macro-Algonquian)	Kootenai

Source: Neusius and Gross 2007; Waldman 2000; Walker, Jr. 1998a

Periods being divided into subperiods, has been developed based on archaeological and ethnographic research (Chatters and Pokotylo 1998; Neusius and Gross 2007).

- Early Period: 11,500 – 8000 BP
- Middle Period: 8000 – 4000 BP
- Early Middle Period: 8000 – 5300 BP
- Late Middle Period: 5300 – 4000 BP
- Late Period: 4000– 230 BP
- Early Late Period: 4000 – 2500 BP
- Middle Late Period: 2500 – 1500/1000 BP
- Late Late Period: 1500/1000 – 230 BP

Area-specific culture chronologies for the Southern Plateau include Period I (11,500 – 6950/5950 BP), Period II (6950/5950 – 3850 BP), and Period III (3850 – 230 BP) (Ames, et al 1998). Within the Eastern Plateau, prehistory has been divided into a three-phased chronology including Early Prehistoric Period (pre-9950 – 6950 BP), Middle Prehistoric Period (6950 – 1450 BP), and Late Prehistoric Period (1450 – 230 BP) (Roll and Hackenberger 1998). It should be noted that areas within these subregions exemplify their own characteristics during these periods and researchers have developed additional subperiods and phases.

Archaeological research has uncovered specific common cultural patterns in this region including (Neusius and Gross 2007; Waldman 2000; and Walker, Jr. 1998b):

- Linear settlement patterns along rivers;
- Diverse subsistence base of fish, game, and roots;
- Complex fishing technology;
- Intermarriage and cooperative use of subsistence resources among groups;
- Institutionalized trading throughout the area;
- Village and band levels of social organization; and
- Relatively uniform mythology, art styles, and religious practices.

CULTURAL HISTORY

Prehistoric

Early Period: There is little archaeological evidence for very early human occupation of the Plateau culture region compared to subsequent time periods. In fact, only one extensive Paleoindian Clovis (11,500 – 10,800 BP) archaeological site has been found. All other archaeological evidence of human occupation during this period is found in surface scatters of artifacts and single, isolated artifacts (Chatters and Pokotylo 1998; Neusius and Gross 2007).

Post-Clovis Early Period inhabitants of the Plateau region appear to have lived in small, mobile hunter-gatherer groups (Chatters and Pokotylo 1998; Neusius and Gross 2007). Groups were organized into semi-permanent villages with temporary subsistence camps at higher elevations. Winter villages were typically located along main rivers, while summer villages were established at the higher elevations (Chatters and Pokotylo 1998; Waldman 2000; Walker, Jr. 1998b). A wide variety of subsistence resources were used including riverine resources and large game. Within most sites located along rivers, fishing is demonstrated by artifact assemblages to be the most important subsistence activities. The majority of sites from the Early Period are open sites where large game and hunting implements dominate the artifact assemblage. However, fish bones are still quite common in these assemblages (Neusius and Gross 2007).

Projectile points are also very common artifacts within the region. Specific styles can provide excellent temporal markers for Plateau archaeological sites and they vary spatially (Neusius and Gross 2007). Other artifacts that are common to Plateau region Early Period archaeological sites include a variety of stone tools (cobbles, bifaces, scrapers, gravers, burins, and bola stones), bone tools (points, awls, and needles), beads, and antler wedges. Sometimes millingstones, anvil stones, abraders, and antler flakers are also found (Neusius and Gross 2007).

There is spatial variation of settlement and artifacts patterns within the Early Period. Typically, sites in the northern portion of the Plateau region have limited assemblages that include microblades and flake tools. Meanwhile southern Plateau region sites appear to be short-term occupations with small, low-density artifact assemblages lacking microblades. Towards the end of the Early Period, a pattern of increased numbers of expedient tools emerges (Chatters and Pokotylo 1998; Neusius and Gross 2007).

Middle Period: Settlement patterns during the Middle Period are mostly within low-elevations. However, near the end of the period there is evidence in the eastern Plateau of limited collecting activities in higher elevations (Neusius and Gross 2007).

The Early Middle Subperiod is largely a continuation of Early Period cultural patterns with some distinct variations (Chatters and Pokotylo 1998; Neusius and Gross 2007). In the northern Plateau people practiced a foraging strategy hunting for deer, elk, and other game, as well as fish and birds. Given this dominant subsistence pattern, it is no surprise that pithouses are absent from northern Plateau sites of this age. There is also evidence in the northern Plateau of local populations being replaced by Salishan speakers from the coast, possibly a result of these coastal populations following salmon upstream (Neusius and Gross 2007). Meanwhile, in the southern Plateau region tool technology became more simplistic and expedient (Chatters and Pokotylo 1998; Neusius and Gross 2007). Subsistence remains from sites indicate use of an optimal foraging strategy, where more productive foods are obtained over less productive ones (Neusius and Gross 2007). Throughout the region a new burial pattern, the Western Idaho burial complex, appears between 6000 and 4000 BP. The pattern incorporates multiple interments in a single burial, and sometimes includes cremations. The burials are located away from habitation sites and include a wide variety of grave goods that appear to indicate long-distance trade (Neusius and Gross 2007).

The mobile hunter-gatherers of the Early Middle Subperiod became more sedentary during the subsequent Late Middle Subperiod (Chatters and Pokotylo 1998; Neusius and Gross 2007). Artifact assemblages and other patterns of the Early Middle Subperiod are generally the same during this later subperiod. The occurrence of pithouses at Middle Period sites and their location in areas where a majority of resources can be collected are considered indicative of sedentism. Most often the pithouses will be found close to the steppe-forest margins of the lowlands (Chatters and Pokotylo 1998; Neusius and Gross 2007). A drop in sites with pithouses occurs however near the end of the Late Middle Subperiod, possibly indicating a drop in the population, particularly in the southern Plateau region. Throughout the period though there is an increase faunal diversity, riverine resources, and trade goods compared to the Early Middle Subperiod. In fact, salmon storage begins to appear in the northern Plateau, indicating a very high reliance on riverine resources (Neusius and Gross 2007).

Late Period: The ethnographically recorded traits of Plateau tribes formed during the Late Period. The period also witnessed the introduction of the horse to the region.

Once again, sedentism in the Plateau region increases during the Early Late Subperiod, signified by the presence of food storage at permanent camps with pithouses and intensive use of resources such as salmon (Chatters and Pokotylo 1998; Neusius and Gross 2007). In the southern Plateau region, this was the first reappearance of pithouses after several centuries (Chatters and Pokotylo 1998). Studies of human skeletons from this time period have shown that more than half the protein in individual's diets came from marine resources (Neusius and Gross 2007). This change in subsistence patterns may partially be due to a changed environment during this subperiod. With cooler, moister climate at this time, salmon availability increased as well as forest cover, which led to less large game populations. It should be noted that the people of the Eastern Plateau remained somewhat mobile (Neusius and Gross 2007). Reliance on trade may have decreased during this time, as indicated by an increase in stone tools of locally available materials and the development of local regional styles of projectile points (Chatters and Pokotylo 1998; Neusius and Gross 2007).

Sedentism continued to increase during the following Middle Late Subperiod. Also occurring during this time was the development of a hierarchical social organization. Traded exotic items are found in concentrations in some elaborate burials of this time, indicating the developing social hierarchy, along with other luxury items, distinct variations in house size, and incidents of violence. Large pithouse villages are most common in the lower reaches of large rivers (Neusius and Gross 2007). Although salmon fishing remained a staple of people's diets, the importance of root crops increased during the Middle Late Subperiod and people expanded their collection activities into the uplands (Chatters and Pokotylo 1998; Neusius and Gross 2007). A boom in bison populations in the Columbia Basin may have attracted Plateau peoples to this arid part of the region where large bison kill sites are found (Neusius and Gross 2007). The bow and arrow was adopted during this subperiod between 2400 and 2100 BP in the south and around 1500 BP in the north (Chatters and Pokotylo 1998;Neusius and Gross 2007).

Many of the Middle Late Subperiod archaeological characteristics continue into the Late Late Subperiod of the Plateau region. However, evidence points to a decline in population, with the exception of the Upper Columbia River, and perhaps an evening out of the social hierarchy (Chatters and Pokotylo 1998, Neusius and Gross 2007). Use of the uplands appears to have diminished during this time as well (Chatters and Pokotylo 1998). There is also evidence of population migrations within the region during this late time, establishing the historically recorded tribal territories. Such movements are most often indicated by changes in house form and artifacts (Chatters and Pokotylo 1998; Neusius and Gross 2007).

Historic

Euroamerican influences began to have a major effect on the native cultures in the Plateau region between 1600 and 1750 AD. Explorers and traders brought disease, new trade goods, market economies, introduction of the horse, and missionization. Epidemics appear to have infiltrated the Plateau from the Northwest Coast as explorers moved inland. Trade and kin relations between the regions and within the Plateau only encouraged the spread of the diseases. Burial patterns were altered in response to these widespread deaths, including cremation, canoe burials, and burials in cedar cists, fenced enclosures, and log enclosures (Neusius and Gross 2007; Walker, Jr. 1998b).

Native trade became more long range during the historic period, mostly due to the introduction of the horse. Plateau peoples even traded with non-Native Americans in New Mexico, along the Upper Missouri River, and in the California Central Valley. Trading within the Plateau culture region typically took place at major trading locales, like The Dalles and Kettle Falls, where trade was important prehistorically (Neusius and Gross 2007). The horse also led to increased warfare among tribes and culture regions as mounted warriors had a distinct advantage over those on foot. Warfare was most common along the boundary between the Plateau and the Plains culture regions where war chiefs and warrior societies developed (Neusius and Gross 2007).

Euro American Contact

European contact with Native Americans in the Plateau region may have occurred as early as the sixteenth century with Russian and Spanish explorers. An early documented contact between the Euro-American and Native Americans was the expedition of Lewis and Clark in 1805 (Walker and Sprague 1998). Missionaries were also among the early non-Native settlers to the region. The first permanent missionaries established in the Oregon area were Presbyterian, who converted the Nez Perce tribe from 1836 to 1847. Jesuit missionaries arrived in 1838, and Mormon missionaries in Idaho by spring 1860. Catholic missionaries also set up churches in the region, beginning in 1838, and by 1855, there were Mormon missions in the Plateau region (University of Washington 2007).

Trade

The Fur Trade. Fur trading attracted Euro-American settlers to the region from the 1790s until 1846. (Schwantes 1989). The fur trade began as maritime fur trading and then land-based fur trade reached the region by the mid-1890s (University of Washington 2007). The fur trade played an important role in the history of the region as it facilitated contact between Russian, French and British traders and Native Americans. Native Americans participated in this industry by selling or bartering pelts to the European traders who then resold them in other markets, such as China (University of Washington 2007).

One of the oldest and most best known fur trading companies in the area was the British Hudson's Bay Company, established as early as 1670 which controlled the fur trade throughout much of North America. The most popularly traded fur was the beaver and sea otter. Fur trading companies such as the Hudson's Bay Company established forts and posts and devised interior routes of travel which had lasting impacts for settlers to the region. Fur traders also used local natural resources such as timber, fish, and farmland which showed future settlers how the area could be used for sustenance. The Hudson's Bay Company guided the policies of the area, and most native American plateau peoples were under the administration of the company until that time, although the region did not have many Euro-American settlers until 1846 (Walker 1998). Thousands of settlers came to the region by 1846.

Competing fur trading companies established themselves in the area in the 1780s (Schwantes 1989). For example, the North West Company had a fort where the Columbia and Walla Walla Rivers met in 1818, sending fur trappers into the Snake River region until 1821 (Schwantes 1989). The company successfully opened the interior of Oregon but was eventually absorbed by the Hudson's Bay Company (Schwantes 1989).

Mining. Mining has been a part of the Plateau region history since the 1850s when gold was discovered in several locations in Southern Oregon (Schwantes 1989). Discoveries of gold in Idaho and Montana in the 1860s gave way to a large flow of settlers to the region. Gold was discovered in the Plateau region on Gold Creek, a tributary of the Clark Fork River in Montana in1860 (US Forest Service 2007). The discovery of gold triggered an influx of miners into the Plateau region in large numbers, mining for not only gold but silver, led, iron, copper, salt, sulpher, mica, marble and sandstone in areas such as present-day Idaho, Washington, and Montana (Idaho State Historical Society 2007).

Agriculture and Fishing. Farming, fishing, logging, and ranching were other economic mainstays in the Plateau region. Hudson's Bay Company was among the first to develop the region's agriculture, timber and marine resources (Schwantes 1989). Logging became an economic mainstay Thousands of acres were dedicated to orchards producing prunes, walnuts, filberts, and other fruit and nut crops.

Salmon was the primary product for fisheries in the region, although oysters, clams, shrimp and halibut were also caught and sold commercially (Schwantes 1989). During the 1820s through the 1860s, numerous fisheries and canneries were established along the Columbia River. Eventually, the salmon population was depleted because of over-fishing. In the twentieth century, the salmon population was further inhibited by the construction of the Grand Coulee Dam in 1941, which was constructed without fish ladders, and the Bonneville Dam, constructed in the 1930s, which altered the fisheries and opened new areas to agriculture and ranching through irrigation and flood control (Schwantes 1989). Although conservation measures were put into place in later years, the salmon population was not fully restored because of overfishing, agricultural diversion and hydroelectric (damming) activities (Schwantes 1989).

Agricultural production of wheat and ranching of cattle were other economic activities in the region. Crops such as wheat, nuts, fruit, and hops were among those grown in the area, beginning in the mid-1800s. Western Oregon saw the planting of a wider range of crops such as hops for beer brewing, flax for making linen, and hemp for rope and paper. Irrigation and transportation improvements allowed expansion of agriculture and the development of large-scale fruit orchards between 1905 and 1915 (Oregon Secretary of State 2007). Logging was also an economic mainstay, and with the advent of the railroad, lumber could be hauled to steam-operated mills along the railways. The region was shipping large portions of its timber by railroad to a quickly growing U.S. population by the late 1800s (Oregon Secretary of State 2007). The flat farmlands of the region were also used for cattle and sheep raising, and cattle were run from California, through the Willamette Valley and over the Oregon Trail (Schwantes 1989). Cattle were raised in eastern Oregon to provide meat to feed gold miners in the 1860s (Oregon Secretary of State 2007).

Western Expansion

Originally Spain, Great Britain, Russia, and the United States each claimed the land encompassing the Plateau and northwest coast regions. Claims were settled by treaties and diplomacy over the course of 30 years in the first half of the 19th century. A continuous flow of American settlers to the region led to the establishment of the Oregon Territory in 1848. This was followed by the Washington Territory in 1853, Idaho Territory in 1863 and Montana Territory in 1864(Schwantes 1989). These territories secured American position in the region. Military presence increased in the Plateau region with the establishment of several forts including: Fort Dalles (1850), Fort Cascades (1853), Fort Walla Walla (1856) and Fort Klamath (1863) (Beckham 1998). The Plateau region was further settled after 1859 when treaties opened the area east of the Cascade Mountains for settlement.

Oregon Trail. The Oregon Trail was used by settlers traveling to the Plateau Region or to pass through the area on their way to more westerly points. The Trail began as an unconnected series of trails used by the Native Americans. Fur traders expanded the route to bring pelts to trading posts in the early 1800s. The route extends roughly 2,000 miles west from Missouri toward the Rocky Mountains to the Willamette Valley. A trail to California digressed from the route in Idaho (Bureau of Land Management 2007). Several groups followed the route over time including large populations of settlers, moving from the eastern portion of the US to settle the west between 1800 and 1880s (Bureau of Land Management 2007).

Missionaries used the trail during the 1830s, traveling along the Platte and Snake Rivers to settle churches in the Northwest. Mormons, headed toward Salt Lake in Utah, used the trail beginning in 1847, and the discovery of gold in California caused many gold miners to use the trail in 1849. It is estimated that four thousand emigrants followed the trail west in 1847 (Schwantes 1989), many in small caravans of wagons. Military posts and spur roads were established off the Oregon Trail. The trail was the major connection between the east and western portions of the US. It was used as a cattle driving trail eastward for a brief time as well. The construction of the Central Pacific Railroad, connecting California to the rest of the continent in 1869, decreased use of the Oregon Trail and by the early 20th century, the trail was no longer used as a major transportation corridor, as railroad lines paralleled the trail (Bureau of Land Management 2007; Schwantes 1989).

Railroads. The completion of the Northern Railroad in 1883 furthered population growth and economic development of the Plateau region. The farming and agriculture industries benefited from the construction of the railroad because it allowed for transportation of crops to eastern states, and farming equipment manufactured in the eastern states were shipped to the Plateau territories. The construction of the railroad supported the logging industry as well because steam engines were used to export lumber to mills and logging could be done in rugged areas that were inaccessible prior to the railroad (Oregon Secretary of State 2007).

GREAT BASIN

The cultural region of the Great Basin is based on the hydrographic region of the same name, but is extended to include the area between the Sierra Nevada and the Rocky Mountains (Figure 3-17). In general, the area covers most of Nevada and Utah, parts of Oregon and Idaho, eastern California, western Colorado, and western Wyoming. Like other culture regions, the Great Basin is varied in landform and climate with high peaks overlooking deep valleys with broad and arid floors. These different environments within the region require a variety of adaptations that have resulted in diverse cultural traditions (Neusius and Gross 2007).

USFS regions included in the Great Basin region include portions of Regions 1 though 6. BLM Offices in the region include all or portions of the Elko, Ely, Battle Mountain, Carson City, Winnemucca, Las Vegas, Vale, Burns, Lakeview and Prinville District Offices as well as Salt Lake, Filmore, Ceder City, Eagle Lake, Surpise, Bishop, Jarbidge, Owhee, Bruneau, Burley, Pocatello, Shoshone, Challis and Upper Snake Field Offices.

All ethnographically recorded Great Basin culture region tribes spoke languages of the Uto-Aztecan family (Aztec-Tanoan Phylum) (D'Azevedo 1986a; Waldman 2000). The one exception are the Washo of northern Nevada and northeastern California whose language is often classified as Hokan (Neusius and Gross 2007), but bears no strong relation with any other language. Numic is the branch of the Uto-Aztecan language family that includes many of the languages spoken by Native American peoples traditionally living in the Great Basin, Colorado River basin, and southern Great Plains. Culturally, the Great Basin culture region is bordered by the Plateau to the north, California to the west, Southwest to the south, and the Great Plains to the east.

A general chronology of the Great Basin has been developed, however the region exemplifies an Archaic stage for nearly all of prehistory. The following outlines a general chronology of the Great Basin culture region (Neusius and Gross 2007).

- Pre-Archaic: pre-9000 BP
- Archaic: 9000 – 500 BP
- Early Archaic: 9000 – 4000 BP
- Middle Archaic: 4000 – 1500 BP
- Late Archaic: 1500 – 500 BP
- The Protohistoric and Historic period then follows the Late Archaic.

CULTURAL HISTORY

Prehistoric

Pre-Archaic: As in other culture regions, evidence is sparse and scattered for early occupations prior to the Archaic in the Great Basin culture region. Such data are found primarily in the form of isolated fluted points, similar in form to Paleoindian evidence in the Great Plains, on the ground surface, particularly in Utah and the western Great Basin (Jennings 1986; Neusius and Gross 2007). Only one big game kill site has been confidently identified and attributed to this period and that was in Idaho (Jennings 1986). Several important, pre-Archaic sites representing other activities have been found in caves of the region. Other forms of data are less credible and comprised of the bones of extinct animals without direct association to man-made artifacts. The accepted forms of evidence suggest that sheep hunting in the Great Basin culture region has a time depth at least as far back as the pre-Archaic. Additionally, lithic sourcing of tools from this period suggest that mobility and foraging patterns were established at this early time, although they did change throughout time with changes in resource distributions (Neusius and Gross 2007).

Archaic: Much of the early work on Archaic Great Basin occupation focused on cave sites and led to a biased inventory and understanding of the region's prehistory. Once researchers began to focus on other topographic areas, new patterns of distributions and typologies began to surface. Surveys in Surprise Valley of northeast California for instance, demonstrated that semi-subterranean pithouses in substantial base camps were situated in valleys while temporary camps were found in varying settings from lakeshores to mountains.

The Western Pluvial Lakes Tradition developed in during the later years of the pre-Archaic and into the Early Archaic of the western Great Basin between 12,000 and 7000 BP. Sites of this tradition are typically located along pluvial lake margins, such as Lake Mohave in southern California and Lake Lahonton in northern Nevada. However, points associated with this tradition have been found in other environmental settings, suggesting the suitability of their use in other areas. Some researchers believe that the Western Pluvial Lakes Tradition represents adaptations suited to acquiring lakeside or riverine resources left over from the Pleistocene, before the lakes and associated rivers of the culture region dried. Others believe the tradition is a more focused hunting way of life (Neusius and Gross 2007).

In the southwestern Great Basin, the Pinto Period of the Early Archaic developed between 7000 and 4000 BP, immediately following the drying of the region's pluvial lakes. Although generally being seen as subsequent to the Western Pluvial Lakes Tradition, some artifacts of the Pinto Period resemble the form of those attributed to the earlier tradition. This suggests at least some continuity in the region. It should be noted however that several artifact types were added to Pinto site assemblages. The Lahontan Basin includes many Early Archaic sites of this kind. Many are cave sites that were used when water was available in Lahontan Lake. Very few are believed to be residential sites; most were used for burials and caches. Food caches such as these served as forms of storage, eliminated the need for transport, and helped to even out the availability of food across the desert landscape (Neusius and Gross 2007).

The Early Archaic of the eastern Great Basin is divided into three subperiods: Bonneville (11,000 – 9500 BP), Wendover (9500 – 6000 BP), and Black Rock (6000 – 1500 BP). Only a few sites have been found to have been occupied during the Bonneville subperiod. However, what evidence has been found seems to point to a connection to the Western Pluvial Lakes Tradition to the west. Some researchers have suggested that Bonneville sites may represent a transition period between big-game hunting and more plant-oriented subsistence strategies.

More sites have been found and attributed to the Wendover subperiod. Sites are found in a wide variety of environments, indicating a very mobile settlement pattern at this time, likely changing locations with the seasons and using a greater variety of plants. Cave sites from this period include well-preserved plant remains and evidence of the continued use of large game, killed using the *atlatl.*

There was an increase in the number of sites during the Black Rock subperiod corresponding with an increasingly arid environment. There was also a shift in site locations to upland areas that were previously less frequently occupied. It is thought that the changes exhibited during this period can be attributed to the change in climatic conditions of the eastern Great Basin. The Black Rock subperiod extends into and through the subsequent Middle Archaic (Neusius and Gross 2007).

During the Middle Archaic, an increase in the amount of local obsidian in archaeological sites is thought to indicate a decrease in mobility during this period. In southwestern Great Basin the Gypsum Period developed in a climate that was moister, leading to the filling of some desert lakes and extensive marshlands. This was a time of intensive occupation in the Mojave Desert and diversification of subsistence activities. The area east of Barstow in the Mojave Desert has yielded important archaeological sites that have provided data leading to greater understanding of this period. Split-twig figurines are an interesting artifact found in northern Arizona, Nevada, Utah, and California. Made of split twigs, the figurines are of stylized quadrupeds thought to be used in hunting rituals. Rock art depicting quadrupeds and found in the same regions are also thought to be a part of such rituals. The Coso Range is well known for such depictions (Neusius and Gross 2007).

As noted above, the Black Rock subperiod continued from the Early Archaic through the Late Archaic in eastern Great basin. The bow and arrow was introduced in this region during the Middle Archaic years of this period. By the end of this period the region had returned to more moist conditions (Neusius and Gross 2007).

Once the Late Archaic commenced the climate had returned to more arid conditions. In southwestern Great Basin the Saratoga Springs (1500 – 800 BP) and Shoshonean Periods (800 BP – contact) developed. The Saratoga Springs Period is similar to the earlier Gypsum Period, but with smaller projectile points. This is thought to indicate the introduction of the bow and arrow in the region. Various parts of the southwestern Great Basin exhibit influences from their neighboring culture regions during this time. One of the more notable interactions occurred in southern Nevada and southeastern California with the Southwestern Anasazi. Influence of the Anasazi is seen in pottery of the Mojave Desert. Evidence of their physical presence in the region between 1300 and 1100 BP has been found at the turquoise mines of Halloran Spring which were then used by the Hakataya of the Southwest and then the Southern Paiute of the Great Basin (Neusius and Gross 2007).

The Shoshonean Period is marked by the introduction of Desert Side Notched points and brownware pottery. This would be concurrent with the end of the Anasazi occupation of southern Nevada. Trade with coastal people becomes evident. Many Antelope Valley and upper Mojave River village sites appear to have been positioned along trade routes and played a major role in the movement of goods. The Shoshonean Period also marks the spread of Numic speakers out of the southwestern Great Basin. However, there is debate as to whether the Late Archaic Shoshoneans are the same as the Numic-speakers that occupied almost all of the Great Basin at the time of European contact. This is because of a noted discontinuity between ethnographically recorded Numic speakers and the archaeological sites of the Shoshoneans (Neusius and Gross 2007).

In northwestern Great Basin, Rose Springs and Eastgate points, indicating adoption of the bow and arrow, are seen as markers of the Late Archaic. Lithic technology also changed to focus on expedient production of simple flake tools made from local materials. Subsistence activities became more diversified here during this time as more ecological zones and resources were exploited. Additionally, smaller game became increasingly important (Neusius and Gross 2007).

The Late Archaic of the eastern Great Basin is attributed to what is called the Fremont Period. Although Fremont patterns are first seen in the last 100 years of the Middle Archaic the majority of the time it covers (1600 – 700 BP) is in the Late Archaic. Sites attributed to this cultural period are found in the area between southern Idaho in the north, the Colorado River in the south, northwestern Colorado in the east, and eastern Nevada in the west. Generally sites of this area during the Fremont include growth of maize, sometimes associated with irrigation ditches, plain grey ceramics, small-sized projectile points, one-rod-and-bundle coiled basketry, Utah metates, broad-shouldered anthropomorphic figures found as clay figurines or in rock art, and moccasins. Village sites are often comprised of pithouses and adobe architecture and caves were also used for habitation and storage. For some sites, hunting and gathering continued to be a primary source of subsistence rather than concentrating on maize cultivation. It is thought that the people of the Fremont region and period may have combined with the later Numic speakers of the Great Basin, but there is significant evidence that would suggest the Fremont peoples moved into the Great Plains as Numic speakers expanded into the Great Basin (Neusius and Gross 2007).

Influence from both the Southwest and the Great Plains culture regions are often seen in the area of the Fremont. Five regional variants have been identified for the Fremont Period: Uinta, San Rafael, Parowan, Sevier, and Great Salk Lake. The Uinta variant of the Uinta Basin on the Colorado Plateau of northeastern Utah appeared between 1350 and 1050 BP. Sites of this region are characterized by pithouses with isolated storage rooms built on rock ledges being the only aboveground structures. Subsistence focused on hunting small and large game and collecting plants. Uinta Fremont sites are typically located on knolls, buttes, and creek slopes (Neusius and Gross 2007).

The San Rafael Fremont variant is situated on the Colorado Plateau just south of the Uinta variant and east of the Wasatch Range. Sites are typically small, but with the same habitation and storage features, often made of stone, as seen in the Uinta region. Small caves and rockshelters are also sometimes used for storage or habitation. It appears maize occupied a more prominent place in the San Rafael Fremont subsistence spectrum, but wild foods were also important (Neusius and Gross 2007).

To the west of the San Rafael region is the Parowan Fremont in southwestern Utah. Settlements are large and consist also of pithouses and storage features, but here made of adobe. Such sites are typically found on valley floors of the region where water is available. Instead, projectile point styles and several types of bone artifacts distinguish the variant from its neighbors. Like the San Rafael, maize cultivation with irrigation appears to have been central to subsistence practices, but supported with hunting and wild plant gathering (Neusius and Gross 2007).

The Sevier Fremont regional variant is north of the Parowan variant and east of the Uinta variant, in central western Utah and adjacent parts of Nevada. Sites on the eastern edge of the region are thought to have been permanent settlements near marshes while sites in the western portion of the region are thought to have been seasonal sites or camps. The sites in the region of Sevier Fremont are typically small and comprised of a few pithouses with adobe surface rooms. However, architecture and artifact styles are variable throughout the region (Neusius and Gross 2007).

North of the Sevier region is the Great Salt Lake Fremont variant around the Great Salt Lake and north into southern Idaho. Artifact types of this variant differ from those found in other Fremont sites. Most sites of the Great Salt Lake variant were seasonal and lacked masonry. Caves were often used as campsites. Wild crops instead of maize were emphasized along with hunting (Neusius and Gross 2007).

The spread of the Numic speakers into the eastern Great Basin is marked by distinctive brownware pottery and utilization of a variety of wild seeds. Environmental modifications by humans have also been documented, including making bow staves by scoring juniper trees, which would then leave a scar on the tree, and creating controlled burns to promote production of seed plants. Many researchers believe this spread was rapid and began as recently as 950 BP. It would have originated in the southwestern Great Basin culture region in the vicinity of southeastern California, but did not expand into the eastern areas until after Fremont characteristics disappeared. However, the why and how of this spread is not well understood by archaeologists (Neusius and Gross 2007).

Historic

The Great Basin region was one of the last areas to experience contact between Native American populations and Spanish and European explorers. Euroamerican populations were comparatively small following contact so that Native American lifeways were able to continue relatively uninfluenced. The introduction of the horse however brought about some of the most notable changes, similar to other culture regions. The horse allowed for more efficient transportation across the region and into neighboring regions. However, in areas where vegetation was too sparse to support grazing horses, the animals were instead seen as a source of food. European contact did increase somewhat as the fur trade and migrants headed west entered the region. Conflicts were sometimes violent, but often the more important impacts of these contacts were on the productive habitats and traditional subsistence practices of the region (Neusius and Gross 2007).

Euro American Contact

The Great Basin region remained largely unexplored by Europeans until 1776 and 1777 when Spanish priests, Fathers Dominguez and Escalante, explored Utah and the Colorado Plateau. The area was not explored in any major way again until the 1840s, after a long period of nominal Spanish and Mexican rule. The vast arid expanse and lack of conspicuous resources inhibited interest in settlement and development. However, large numbers of settlers and travelers passed through the Great Basin on their way to California or Oregon, especially after gold was discovered in the 1848. The migration of Mormon settlers to Utah beginning in 1846 brought the first large numbers of American settlers to the Great Basin region (Neusius and Gross 2007).

Trade

Mining. The discovery of gold during the historic period first occurred in the Great Basin area in 1859 at the Comstock Lode near Virginia City in Nevada. Silver was discovered in the Humboldt Mountains in 1860 (Neusius and Gross 2007). Mining opportunities of gold, silver, copper, coal, and tungsten spurred immigration to the Great Basin as well as travel through the area on the way to California.

Ranching and farming. Ranching and farming has historically been a strong economic staple to the Great Basin region. Extensive ranching and farming began as an economic alternative to mining. Several legislative acts such as the Homestead Act of 1862, Desert Land Act of 1877, and the Taylor Grazing Act of 1934 attracted setters with the promise of inexpensive land. The Homestead Act alone transferred more than 270 million acres of land from Federal to private ownership (National Park Service 2006). In 1877, the Desert Land Act was passed by Congress to encourage and promote the economic development of the arid and semiarid public lands of the Western United States. Through the Act, individuals could apply for a desert-land entry to reclaim, irrigate, and cultivate arid and semiarid public lands (Bureau of Land Management 2004). The Taylor Grazing Act of 1934 assisted farmers and ranchers in acquiring land or increasing their land holdings through the ability to graze on public lands by way of permit. The Taylor Grazing Act was more favorable to beef ranchers than sheep raisers and cattle ranching became dominant in the region. Ranching continues to be an important economic activity in the region, with public land grazing permits often passed down through families (National Parks Service 2006).

Western Expansion

Treaty of Guadalupe Hidalgo 1848. This treaty was signed in 1848 after the Mexican-American War. The treaty required that Mexico cede 55% of its territory (present-day Arizona, California, New Mexico, and parts of Colorado, Nevada and Utah) in exchange for fifteen million dollars as compensation for war-related damage to Mexican property (Library of Congress 2005).

Boom Towns. When gold miners came to an area in the hope of striking it rich in the mid and late 1880s, many small towns and mining communities sprang up near the mines to service and support the miners. Rapidly built towns consisting of retail stores, hotels, and saloons were established and some were later were abandoned as the mines of the Great Basin were either depleted or gold ran scarce. Remnants of some of these ghost towns of the west still exist as either tourist attractions or state parks (Neusius and Gross 2007).

Railroads. In 1862, President Lincoln signed the Pacific Railroad Act, which allowed construction of a railroad line from Sacramento east, built by Central Pacific Railroad and from Omaha West along the Missouri River, built by Union Pacific Railroad. The rail lines met in Promontory, Utah in 1869, completing the first Pacific Railroad (California State Railroad Museum Foundation 2007; Library of Congress 2006). The majority of the Union Pacific track was built by Irish laborers, civil war veterans, and Mormons who wished to see the railroad pass through Ogden and Salt Lake City, Utah. The Central Pacific track was mostly built using Chinese immigrant laborers. The completion of the railroad meant that agricultural produce, lumber, and gold could be shipped to eastern parts of the US, while settlers were able to emigrate from the east to live in the west. The railroad had a large impact on California immigration, which continued through the 20th century.

<u>Trails</u>

Mormon Trail. One of the major forces of settlement in the West was Mormon emigration. Thousands of Mormons (1,600) left Illinois in February 1846, crossing into Iowa, in an attempt to escape religious persecution (Forest Service 2007). Their leader, Brigham Young, opted not to follow the Oregon Trail, but instead forged a new route just north of the Platte River because the route was better suited to wagon travel and because he wished to avoid other travelers from Missouri who frequented the Oregon Trail (Billington 1963). The Mormons crossed Mississippi and established temporary headquarters there, then went on to Missouri, through the Great Plains, where they spent an icy winter and lost 600 people from their party (Billington 1963). They reached the Valley of the Great Salt Lake, where they settled, in June 1847.

Old Spanish Trail. This trail was first established by a Mexican trader, Antonio Armijo, in 1829. He traveled from New Mexico to Los Angeles on a commercial caravan, carrying Mexican woolen goods and planning to bring horses back from California (National Park Service 2007). Prior to the Old Spanish Trail, an established overland southern route to California from New Mexico did not exist although portions of the trail had been used by Native Americans and early traders. The trail runs through present-day Colorado, Utah, Arizona, Nevada, and California (Cultures and Histories of the American Southwest 2007).

California Trail. The trail was used by over 250,000 farmers and gold miners from Missouri during the 1840 and 1850s. The route starts along the Missouri River, and then converges on the Great Platte River Road, overlaps with the Oregon Trail and to the Rocky Mountains. After the crossing the Rockies, many routes were used to get to and cross the Sierra Nevada Mountains. The total system of trails and alternate routes that make-up the California Trail is approximately 5,664 miles (National Park Service 2007).

Nez Perce. This trail extends from Wallowa Lake in Oregon to Bear Paw Mountain in Montana. It is named for the Nez Perce tribe of Native Americans who fled their lands when the US Army pursued them in 1877. Approximately 750 Nez Perce men, women, and children traveled over 1,170 miles through the mountains, on a trip that lasted from June to October of 1877 (US Forest Service 2007). The trails extends from Wallowa Lake, Oregon, through the Snake River at Dug Bar, entering Idaho at Lewiston and then over to north central Idaho, entering Idaho at Bannock Pass and traveling back to east Montana at Targhee Pass to cross the Continental Divide. It bisects Yellowstone National Park in Wyoming, and then follows the Clark Fork River out of Wyoming into Montana. The trail then heads north into Bear's Paw Mountains and ends forty miles from the Canadian Border (US Forest Service 2007). This trail crosses 90 miles of BLM land and 221 miles of USFS land within the project area.

GREAT PLAINS

The area between the Saskatchewan River in the north, the Rio Grande in the south, the foothills of the Rocky Mountains in the west, and the upper Mississippi River valley in the east makes up the Great Plains culture region (Figure 3-18). In general, the area covers parts of southern Alberta, Saskatchewan, and Manitoba in Canada and in the US, parts of Montana, Wyoming, Colorado, Texas, Oklahoma, Missouri, Iowa, and Minnesota, far eastern New Mexico, and all of North Dakota, South Dakota, Nebraska, and Kansas. The majority of this culture region is east of the planning area (DeMallie 2001; Neusius and Gross 2007); planning area states within the Great Plains culture region include eastern areas of Montana, Wyoming, and Colorado (the easternmost planning area in New Mexico is included in the Southwest culture area). These areas are considered to be a part of the Northwestern and Western Periphery/western Central subunits of the Great Plains region (Gunnerson 2001; Frison 2001; Neusius and Gross 2007). The cultures of the Great Plains region are quite varied, primarily due to the diverse environs it covers. Different environments require unique adaptations by the occupants. However, all cultures of the Great Plains regions have at least one trait in common and that is bison hunting

USFS regions included in the Great Plains region include portions of Regions 1 and 2. BLM Field Offices included in the region include all or portions of Miles City, Bilings, Malta, Glasgow, Lewistown, Havre, Butte, Casper, Buffalo, Newcastle, Rawlings, and Royal George offices.

Table I-4 identifies the Great Plains culture region languages and tribes that have been documented within the project area. Culturally, the Great Plains culture region is bordered by the Plateau, Great Basin, and Southwest regions on the west and the Northeast and Southeast on the east.

Table I-4
Languages and Tribes of the Great Plains Culture Region in the Project Area

Language (Linguistic Phylum)	Tribes
Siouan (Macro-Siouan)	Assinibone, Crow
Algonquin (Macro-Algonquian)	Cheyenne, Gros Ventre, Arapaho
Uto-Aztecan (Aztec-Tanoan)	Comanche

Source: DeMallie 2001; Goddard 2001; Waldman 2000

A general chronology of the Great Plains has been developed based on developments in lithic technology with some regional variations and intermediate lithic forms between traditions (Neusius and Gross 2007). The earliest evidence of occupation of the Great Plains may represent the pre-Clovis period, however evidence is scant. The most definitive evidence for early occupation occurs during the Paleoindian Period, comprised of the Clovis and Folsom Periods. The following outlines a general chronology of the Northwest and Western Periphery/western Central subregions of the Great Plains (Neusius and Gross 2007).

- Pre-Clovis: pre-11,500 BP

- Paleoindian: 11,500 – 8500 BP
- Archaic: 8500 – 1500 BP
- Early Archaic: 8500 – 5000 BP
- Middle Archaic: 5000 – 3500 BP
- Late Archaic: 3500 – 1500 BP
- Late Prehistoric: 1500 – 500 BP
- The Protohistoric and Historic periods then follow the Late Prehistoric.

CULTURAL HISTORY

Prehistoric

Pre-Clovis: As stated above, there is very scant evidence for human occupation of the Plaines prior to 11,500 BP. Primarily, this evidence is in the form of bone breakage patterns and a few tools. Even these are sometimes questionable in their linkage to humans. Although there are a number of mammoth bone sites it is difficult to attribute these to human activities. The patterns of breaks in the bones and their distributions suggest an association with humans, but the sites either have few or no stone tools. As such, a pre-Clovis occupation of the Great Plains is not well established at this time (Neusius and Gross 2007).

Paleoindian: There is considerable more evidence of Clovis and later Paleoindian occupations of the Great Plains region. In fact, it is in the Great Plains that archaeologists first encountered evidence of a Paleoindian occupation of the US. There are two definitive subperiods of this time based upon distinct forms of projectile points that are assumed to represent temporally and possibly spatially distinct populations. These are Clovis (11,500 – 10,900 BP) and Folsom (10,900 – 10,200 BP). The style of Clovis points is found in strata below those of Folsom points throughout the region. There are several point styles found in specific sub-areas that are viewed to be area-specific transitional styles that occurred between the periods of Clovis and Folsom points. The style of Plano points, comprised of unfluted lanceolate, stemmed, and unstemmed projectile points, represent lithic technologies of the Late Paleoindian period. Again, there is regional variation of lanceolate point styles. Between 9000 and 8500 BP a larger variety of lanceolate points is found, denoting a transition to the Archaic period and perhaps could be called a Terminal Late Paleoindian Period (Neusius and Gross 2007).

Combined with other tools in the Paleoindian toolkit, these projectile points suggest an emphasis on hunting and the use of high-quality raw materials suggest the importance of quality and reliability in the tools (Neusius and Gross 2007). In the foothill-mountain groups of the northwestern subregion, materials were typically extracted from local sources. Additionally, projectile points were not as important as in other subregions, possibly reflecting the use of different procurement strategies adapted specifically to this area (Frison 2001). Caches of blades and bifaces found in the region, such as the Anzick Cache in Montana, do indicate an overall importance placed on lithics. Some of these are even associated with burials (Neusius and Gross 2007).

However, the majority of Great Plains Paleoindian sites are large game kill sites. Clovis points are most often associated with mammoth kill sites, although other large game is also found. Bison hunting appears to have begun with Folsom points, probably due to the environmental conditions of the time creating stable grasslands for the bison to roam in. Bison hunting strategies were carried out by individuals as well as small and large groups. Ambushes conducted at springs and playa lakes appear to have been the most common during the Folsom period based on archaeological evidence. Later bison drive, trap, and jump sites, such as the Jones-Miller site in east Colorado, became more common (Neusius and Gross 2007). It should be noted however that bison was not the only meat package used by the Great Plains Paleoindians as some sites contain a diverse faunal assemblage (Frison 2001).

Overall, archaeological evidence indicates that the Great Plains Paleoindians existed in small, mobile bands that ranged between the mountains and high plains. There is debate however as to whether these were specialized or general hunter-gatherers. Additionally, the archaeological record is biased toward large kill sites, such as those described above (Neusius and Gross 2007). Very few non-kill sites are represented in the record resulting in a gap in our knowledge of the region during this period. Similarly, the adaptations of the foothill-mountain groups of the northwest subregion are not as well known as other Great Plains groups. Further study of sites in the northwest would provide a better understanding of the niche adaptations that occurred here (Frison 2001).

Archaic Period: Subsistence and settlement patterns are basically the same during the Archaic Period of the Great Plains as they were during the Paleoindian Period. The period is denoted by a change in lithic technology, namely a replacement of lanceolate points by notched points across the Great Plains (Neusius and Gross 2007). The most notable change indicating the Archaic is the development of horticulture, also called "Woodland," around 2500 BP. This occurred primarily in the eastern portions of the Great Plains region while the west and northwest remained mostly reliant on large game hunting. In the Northwestern as well as in the western Central Great Plains, however, there is a continuation of mobile hunting and gathering cultures (Frison 2001), hence the term "Hunting and Gathering Tradition" alternatively used to refer to this period. Groups established a seasonal settlement pattern that adjusted to conditions. They also established a flexible social organization to allow for aggregation of bands during hunts (Neusius and Gross 2007).

The Early Archaic is represented by more cave and rockshelter sites than open sites, presumably due to unusual environmental conditions during this time (Frison 2001). Grinding implements such as manos and metates were developed during this period of Great Plains occupation as well as earthen fire pits. These developments reflect an increased emphasis on vegetal foods (Frison 2001; Neusius and Gross 2007). This is also when horticulture developed in the river valleys and the Eastern Great Plains, although not in the Northwest and western Central Great Plains. In this area, faunal remains are scarce; however there are still a few bison kill sites in limited areas as well as evidence of communal hunting (Frison 2001). Throughout the Archaic, such sites are typically associated with arroyos, sand dunes, steep bluffs, or artificial corrals (Neusius and Gross 2007), remains of which may still be present. The large side-notched projectile point is the typical diagnostic marker for the Early Archaic in Northwest Great Plains (Frison 2001; Neusius and Gross 2007). However, in the western Central Great Plains, corner-notched points are prevalent (Frison 2001). The evolution from Paleoindian lanceolate points to notched points may indicate the new use of the *atlatl* by hunters (Neusius and Gross 2007) or it could represent the local development, transmission of outside ideas and technology, or population movements (Frison 2001). In either case, caching of lithic tools such as these does appear to continue on from the Paleoindian period (Frison 2001).

Although there is definitive evidence of housepits at Early Archaic sites, often associated with storage pits (Neusius and Gross 2007), there are not a significant number of sizable occupations in Northwest and western Central Great Plains, with the exception of caves and rockshelters (Frison 2001). However, there is no doubt that Early Archaic peoples existed here given the common surface finds of diagnostic artifacts. The apparent lack of large cultural occupations should not be attributed to a lack of human population, but may be related to site preservation and population mobility (Frison 2001). Similarly, the higher incidence of sites in caves and rockshelters may simply be due to their excellent preservation conditions.

The Middle Archaic saw many of the Early Archaic characteristics carry on, including grinding tools, fire pits, and numerous occupations of caves and rockshelters, especially along the Bighorn and Absaroka Mountains of Wyoming and Montana, respectively. Many of these sites have little to no stratigraphic separation between deposits of the two subperiods, indicating continuous occupations. Alterations in projectile point styles are the most notable Middle Archaic diagnostics. McKean and Mallory type projectile points are the diagnostic styles that occur throughout the Northwest Great Plains; McKean points also occurring in the western Central Great Plains.

Bison remains become more frequent and bison jumps are still present, but vegetal foods also continued to be consistently represented in people's diets. Overall, the subsistence base during the period of McKean points would indicate a strategy adapted to ecotones that provided the most variety of resources (Frison 2001).

Changes in point form, particularly the appearance of the Pelican Lake corner-notched projectile point, indicate Late Archaic sites in the Northwest Great Plains (Frison 2001). It is thought that some Late Archaic points are small enough to have functioned as arrow points (Neusius and Gross 2007), the bow and arrow becoming prevalent in the subsequent Late Prehistoric Period. Little in subsistence strategies changes between the Middle and Late Archaic periods. Caves and rockshelters of the Big Horn Mountains and northern Wyoming still yield Archaic archaeological sites of this time period, including perishable materials such as basketry (Frison 2001).

Late Archaic peoples expanded further into the intermontane basin interiors as well as the foothills and mountains of the western Great Plains during the Late Archaic. This is indicated by fire pits, which at some sites can cover hectares and at others just a single pit will be found. The pits, often characterized by perimeters of red oxidized clay due to heat exposure or stone linings, are associated with other features and artifacts such as boiling pits, grinding stones, and flake tools. Although some of these were most certainly used for cooking, some were also probably used for a source of heat within structures. Prehistoric lakeshores created by retreating glaciers were often used for Archaic occupations. Many of these have been affected by modern efforts for water storage. These Archaic lifeways in the Northwestern and western Central Great Plains regions, concentrating on vegetal resources, continued into the Late Prehistoric period, while in other more "plainslike" environments economies were oriented more toward bison hunting (Frison 2001).

Stone rings, one of the most characteristic artifacts of the Late Prehistoric period on the Northwest Great Plains, first began to occur in large quantities during the Late Archaic. Raised topographic features in the interior basins and plains as well as in the foothills are the most sensitive for these kinds of sites, including butte tops, barren ridges, minor topographic rises, and stream terraces, particularly cobble-filled terraces. The rings occur singly or in clusters and vary in diameter. Association with cultural refuse is rare, making dating difficult in some cases (Frison 2001). Functions attributed to these rings range from structure bases, such as tepee rings, to ceremonial, such as medicine wheels (Frison 2001; Neusius and Gross 2007). Other features attributed to the Late Archaic, but are also difficult to date include petroglyphs, pictographs, and stone cairns and lines (Frison 2001).

Late Prehistoric Period: Dependence upon bison hunting, pottery making, and use of the bow and arrow combine to characterize the Late Prehistoric Period. In general, however the adaptive strategies of previous times continued into the Late Prehistoric. This period occurred concurrently with the Great Plains Woodland and Great Plains Village Periods of the majority of the Great Plains cultural region to the east of the project area. Some of the historically documented Great Plains tribes can be documented by the archaeology of the region during this time (Neusius and Gross 2007).

Historic

Initial European contact with Great Plains tribes occurred first in the Southern and Central Great Plains. The Great Plains regions of the project area continued to support mobile bison hunters while further east several migrations and relocations occurred creating a tangled history of movement in those areas. Such movements represent the fluidity of the Great Plains Native American cultural geography during the Historic Period (Neusius and Gross 2007).

Three other factors contribute to the historic character of Native Americans in the Great Plains: introduction of the horse, trade in European goods, and disease. The horse allowed extended trade through the increased mobility that it brought, impacting economies and intergroup relations. Social structures were also impacted as individuals sought to gain more of these luxury items. The increased mobility brought by the horse also impacted political tribal relations as groups traveled farther into neighboring territories, often resulting in increased violence and raiding. Trade in European goods, guns in particular, also contributed to the increased violence. Europeans also brought Native Americans into their trades, including the fur trade. European diseases, however, decreased Native American populations, forced migrations and created changes in settlement patterns, as well as political breakdowns and unions (Neusius and Gross 2007).

Euro-American Contact

The first European explorers to explore the Great Plains came from Spain and France by way of three routes: the Spanish came to the Southern Plains and were explored by Alvar Nunez Vaz de Vaca from 1528 to 1536 across Texas. The Central Plains was explored by Francisco Vasquez de Coronado, who came to the Great Plains region (present day Texas and Kansas) in approximately 1540-1542. Coronado explored present-day Arkansas, New Mexico, Colorado, Kansas, and Nebraska. The Northern Plains was explored by Pierre Esprit Radisson and Medard Chouart, from France in 1659. Alvar Nunez de Vaca crossed Texas and parts of northern Mexico from 1528 to 1536 (Swagerty 2001). The French also explored area between 1742-1743, passing through North Dakota, Wyoming and Montana.

Euro-Americans began taking more of an interest in the Great Plains area after the Louisiana Purchase in 1803. The Lewis and Clark Expedition of 1804-1806 included present-day Missouri, South Dakota, North Dakota, Montana and other areas in the west. Fur and hide trading was one of the results of exploration of the area, and was the reason thousands of Europeans came to the Great Plains (Scott 1952). The Great Plains region continued to support mobile Native bison hunters while further east several migrations and relocations occurred creating a tangled history of movement in those areas (Neusius and Gross 2007).

Trade

Fur Trade. The fur trade was an attractive economic pull for settlers to the Great Plains area. Trappers and traders from France, Spain, Russia, Britain and US came to the region to trade furs and hides. Native American tribes acted as middlemen and indirectly traded with other tribes and societies (Neusius and Gross 2007). After Lewis and Clark's exploration of the area, Americans also established trading posts within the Great Plains. Much of the trade industry began in the northern portion of the Great Plains with Hudson's Bay Company and the American Fur Trading Company. The French established trading posts there as well (Swagerty 2001). The Hudson's Bay Company controlled most of the trade in areas that drained into the Hudson Bay, including North Dakota and Minnesota as well as the Canadian portion of the Northern Plains. The French traded on the tributaries of the Mississippi, or west from the Great Lakes, where they established posts along the rivers (Neusius and Gross 2007). This prosperous trade lasted from 1806 to 1850, and included trappers from France, Spain Brittan, Russia and the United States. Construction of trading posts lasted from 1822 until 1850, when supply and demand for beaver fur ended.

Ranching. Ranching on the Great Plains developed initially using the open range lands where cattle were free to roam without fences or barriers. In most areas land was not surveyed, settled or fenced. The lack of forests and trees also made it difficult to build fences to control livestock. The commercial development of barbed wire in 1870 was instrumental in providing fencing material for cattle, which enabled ranchers to separate their cattle and control grazing (International Information Programs 2007 and Webb 1931). The use of open ranges continued in some places into the 20^{th} century.

After the Civil War, railroads were used to transport cattle to eastern and northern markets. Cattle were driven hundreds of miles along established routes overland to railroad towns like Abilene, Kansas. The industry grew steadily as Native populations were displaced, more land became available for settlement, and more rail transportation was developed. The last brief boom in the ranching economy occurred in the early 1880s when there was a large influx of ranchers that settled in the region (Webb 1931). Soon after drought, harsh winters, overgrazing, and competition resulted in disastrous setbacks for the ranching industry, which began to collapse in the mid-1880s (Webb 1931). Ranching continues to be an important economic mainstay in many parts of the Great Plains region.

Mining. Gold, silver, and copper mining were important resources within the Rocky Mountain States of the Great Plains in the nineteenth century. Energy resources such as petroleum, natural gas and coal are currently important resources in the Plains (USDS 2008).

Western Expansion

Hide hunters and trappers were first attracted to the region because of the large numbers of bison in the area. A prosperous fur trade took place in the early decades of the nineteenth century, which led to the eventual depletion of the bison population. Early American emigrants came to the Great Plains region in larger numbers beginning in 1840, many passing through on their way further west. Gold discovered in Colorado, Montana and California greatly increasing overland travel. In 1850 alone, 100,000 emigrants crossed the Great Plains, many bound for the gold fields of California (Swagerty 2001). Permanent settlement in the Great Plains was avoided because of the lack of trees, water sources, and difficultly in producing crops (USDS 2008). Many crops failed in the Great Plains largely due to rainfall fluctuation in the region, and the marginal quality of farming lands. Early settlers often bypassed the Great Plains region in order to settle in areas more hospitable to farming (USDS 2008). Those that did settle in the region had more success with ranching, an alternative to farming.

In 1854, Congress passed the Kansas-Nebraska Act, which created the Kansas and Nebraska Territories. The acquisition of lands originally held by Native Americans expanded the boundaries of the United States west of the Mississippi. The Homestead Act of 1862 attracted setters, many of whom were recent immigrants from Europe. The Homestead Act transferred more than 270 million acres of land from Federal to private ownership. Large numbers of homesteaders settled in the Great Plains, especially the western portion. Many of these new settlers tried to establish farms and homesteads that failed due to the poor suitability of the land for agriculture. Extensive irrigation in the area eventually led to productive crop growing, and livestock raising was consistently part of the area's economy (National Park Service 2006).

<u>Trails</u>

Oregon Trail. The Oregon Trail was used by settlers traveling to the Great Plains region or to pass through the area on their way to more westerly points. The Trail began as an unconnected series of trails used by the Native Americans. Fur traders expanded the route to bring pelts to trading posts in the early 1800s (Bureau of Land Management 2007). The route extends roughly 2,000 miles west from Missouri toward the Rocky Mountains to the Willamette Valley. A trail to California digressed from the route in Idaho (Bureau of Land Management 2007).

Several groups followed the route to settle the west between 1800 and 1880s. Missionaries used the trail during the 1830s, traveling along the Platte and Snake Rivers to settle churches in the Northwest. Mormons, headed toward Salt Lake in Utah, used the trail beginning in 1847, and the discovery of gold in California caused many gold miners to use the trail in 1849. Military posts and spur roads were established along the Oregon Trail. Fort Laramie in Wyoming was established in 1849 as the base for protecting a long stretch of the Oregon Trail (National Park Service no date). The trail was used for driving cattle driving trail eastward for a brief time as well. The construction of the Central Pacific Railroad, connecting California to the rest of the continent in 1869, decreased use of the Oregon Trail. By the early 20th century, the trail was no longer a major transportation corridor, as railroad lines paralleled the original route in many places (Bureau of Land Management 2007, Schwantes 1989).

Mormon Pioneer Trail. One of the major forces of settlement in the West was Mormon emigration. A large colony of Mormons left Illinois in February 1846 and crossing into Iowa, in an attempt to escape religious persecution (Forest Service 2007). Their leader, Brigham Young, opted not to follow the Oregon Trail, but instead forged a new route just north of the Platte River because the route was better suited to wagon travel and because he wished to avoid other travelers from Missouri who frequented the Oregon Trail (Billington 1963). The Mormons crossed Mississippi and established temporary headquarters there, then went on to Missouri, through the Great Plains, where they spent an icy winter and lost 600 people from their party (Billington 1960). They reached the Valley of the Great Salt Lake, where they settled, in June 1847. The trail is approximately 1,300 miles long (American West 2007).

Nez Perce. This trail extends from Wallowa Lake in Oregon to Bear Paw Mountain in Montana. It is named for the Nez Perce tribe of Native Americans who fled their lands when the US Army pursued them in 1877. Approximately 750 Nez Perce men, women, and children traveled over 1,170 miles through the mountains, on a trip that lasted from June to October of 1877 (US Forest Service 2007). The trails extends from Wallowa Lake, Oregon, through the Snake River at Dug Bar, entering Idaho at Lewiston and then over to north central Idaho, entering Idaho at Bannock Pass and traveling back to east Montana at Targhee Pass to cross the Continental Divide. It bisects Yellowstone National Park in Wyoming, and then follows the Clark Fork River out of Wyoming into Montana. The trail then heads north into Bear's Paw Mountains and ends forty miles from the Canadian Border (US Forest Service 2007). This trail crosses 90 miles of BLM land and 221 miles of USFS land within the project area.

<u>*Railroads*</u>

*T*he construction of the Union Pacific and Central Pacific Railroad, linking Missouri to California was completed in 1869. These completed railroad lines increased settlement in the Great Plains area from emigrants from the eastern US. The rail lines not only transported people, but was also used to transport hides and cattle to markets in the east (National Park Service 2007). Many of these lines were constructed in an east-west direction instead of a north-south direction because early travelers were merely passing through the region, not settling there (Webb 1931). An important exception was the Kansas Pacific

Railroad from Abilene to Chicago which established in 1867 a gateway for cattle from the southern plains to reach eastern consumer markets through the stockyards of Chicago.

The construction of the railroads often required temporarily quarters for the construction crews to inhabit while they built stretches of railroad. These towns would consist of large tents that held dance floors, gambling areas, dance floors and bars. Many of the rural "boom towns" eventually became ghost-towns due to a loss of population and because much of the agricultural land was unsustainable (Billington 1963). However, many towns and cities within the Great Plains region have their origins in the small boom towns associated with railroads line. Some of these cities continue to be important to the economy of the Great Plains (USDS 2008).

CALIFORNIA

The California culture region resembles the modern state, however it excludes parts of the northwest and northeast corners of the state (Northwest Coast and Plateau culture regions, respectively), as well as the Mojave Desert and areas east of the Sierra Nevada (Great Basin culture region) (Figure 3-16). The region does extend south into Mexico and Baja California, but since these areas are not included in the project area, it is not discussed here. Although the region is not consistently split into subregions, the terms Southern California, Central Coast, and Northern California are used here (the Central Valley is not discussed because it is mostly excluded from the potential development area). Southern California is considered to include the area south of Santa Barbara; the Central Coast is covers primarily Santa Barbara, San Luis Obispo, and Monterey Counties; and Northern California is considered to be the area from the San Francisco region north.

USFS regions included in the California region include all of Region 5 and a small southern portion of Region 6 in Oregon. BLM Field Offices included in the region include all or portions of the El Centro, Palm Springs/South Coast, Barstow, Needles, Ridgecrest, Bakersfiled, Hollister, Folsom, Ukiah, Eagle Lake, Redding, Arcata, Alturas, Surprise and Lakeview offices.

Table I-5 identifies the California culture region languages and tribes that have been documented within the project area. Culturally, the California culture region is bordered by the Southwest and Great Basin culture regions to the east and the Plateau and Northwest Coast culture regions to the north.

A general chronology of California has been developed based on developments in social organization and bead forms (Neusius and Gross 2007). The early prehistory of California has been dramatically affected by post-glacial sea level

Table I-5
Languages and Tribes of the California Culture Region in the Project Area

Language (Linguistic Phylum)	Tribes
Athapascan (Na-Dene)	Tolowa, Hupa, Chilula, Whilkut, Mattole, Nongatl, Sinyone, Lassik, Wailaki, Cahto
Algonquian (Macro-Algonquian)	Yurok, Wiyot
Uto-Aztecan (Aztec-Tanoan)	Tubatulabal, Tataviam, Gabrielino, Luiseño, Kitanemuk, Serrano, Cahuilla, Cupeño
Karok (Hokan)	Karok
Chimariko (Hokan)	Chimariko
Shastan (Hokan)	Shasta
Palaihnihan (Hokan)	Achumawi, Atsugewi
Pomo (Hokan)	Western Pomo, Northeastern Pomo, Eastern Pomo, Southeastern Pomo
Yanan (Hokan)	Yana
Esselen (Hokan)	Esselen
Salinan (Hokan)	Salinan
Chumashan (Hokan)	Eastern Coastal Chumash, Obispeño Chumash, Purisimeño Chumash, Interior Chumash
Yuman (Hokan)	Tipai and Ipai
Miwok-Costanoan (Penutian)	Lake Miwok, Eastern Miwok, Coast Miwok, Costanoan
Wintun (Penutian)	Wintu, Nomlaki, Patwin
Maidu (Penutian)	Maidu, Nisenan, Konkow
Yokutsan (Penutian)	Monache, Southern Valley Yokuts, Northern Valley Yokuts, Foothill Yokuts
Yukian (Undetermined linguistic phylum)	Yuki, Coast Yuki, Huchnom, Wappo

Source: Heizer 1978a; Shipley 1978; Neusius & Gross 2007; Waldman 2000

rise, resulting in inundation of the coastline and altering coastal environments. Although a few sites have been attributed to Pre-Clovis occupations, many archaeologists do not agree these are true representations of a very early occupation of California. Rather, the earliest agreed upon evidence is for a Clovis-like occupation. The following outlines the general chronology of California (Neusius and Gross 2007). It should be noted that this chronology is not based on the summary regional chronology given in the standard *Handbook of North American Indians* (Heizer 1978b), but is instead based on more recent archaeological data.

- Paleoindian: pre-11,000 BP

- Archaic: 11,000 – 4000 BP
- Early Archaic: 11,000 – 8000 BP
- Middle Archaic: 8000 – 6000 BP
- Late Archaic: 6000 – 4000 BP
- Pacific: 4000 – 500 BP
- Early Pacific: 4000 – 2500 BP
- Middle Pacific: 2500 – 1500 BP
- Late Pacific: 1500 – 500 BP
- The Historic period then follows the Late Pacific Period.

CULTURAL HISTORY

Prehistoric

Paleoindian: The most accepted evidence of first cultures in California is comprised of Clovis-like fluted points found primarily as surface scatters. As in other regions however, such finds are rare (Neusius and Gross 2007). Their scarcity may be due to the rise of sea level at the end of the Pleistocene. Consequently any sites formed during the Paleoindian period along the now submerged coastline, would also be submerged.

Evidence from one archaeological site, Borax Lake, in the North Coast Range of northern California supports a notion that early inhabitants of the northern region were generalized foragers, opposed to the big-game hunters of other regions. Other sites in the southern California region include lithic hunting and cutting tools, and lack millingstones, indicating an emphasis on large game hunting. A series of Paleoindian sites are located along the California coast and are associated with coastal rivers, lagoons, and estuaries. These sites indicate a possible early maritime adaption that is separate from the Clovis-like occupations. Fluted points are not found at these sites. Also indicated is a use of watercraft suitable for ocean crossings, given the location of some sites on the Channel Islands of the Santa Barbara region (Neusius and Gross 2007).

Archaic: The Archaic period witnessed warmer and drier conditions that required adaptations by prehistoric populations in the California culture region. However, Early Archaic sites were most certainly affected by rising sea levels, becoming inundated by rising sea levels or eroded from cliffs by wave action. The period saw a slow, but necessary evolution of subsistence activities, beginning with hunting, followed by an emphasis on seed collection, followed by a variety of specializations adapted to the range of environments in the region (Wallace 1978).

Archaic adaptations included the incorporation of seeds into the diet, requiring development of millingstones. Along the coast in southern California, many Archaic sites incorporate numerous amounts of shell with simple flake and cobble tools as well as manos and metates. However, many inland southern California sites include many more flaked stone tools and often not made from cobbles, like those along the coast, and they lack shell. Along the Central Coast in the Santa Barbara region some pithouses have been attributed to the Archaic and mortars and pestles appear rather than metates. In the San Francisco Bay region the earliest times of the Archaic period are poorly represented, probably due to sea level rise creating for the Bay for the first time (Neusius and Gross 2007). As such, the area may not have been resource-rich prior to sea level rise. In the same thought, any sites that would have been in the Bay would now be underwater. Archaic sites that are present in the San Francisco Bay region exhibit the same millingstone tool kit as other areas, as well as mortars and pestles and simple shell beads. Along the coast north of San Francisco Bay the Borax Lake tradition is prominent. This tradition is based on the presence of a distinctive projectile point with a square stem, millingstones, mortars, pestles, simple lithic tools, knives and bifaces (Neusius and Gross 2007). Additionally, charmstones, presumably of ceremonial significance, are found throughout the culture region during this period.

Patterns of settlement during the Archaic period are best known from the archaeological record of Southern California. During the earliest period of the Archaic prior to sea level rise, sites were situated along the coast on higher ground, such as bluffs and marine terraces. As sea levels rose, the sites became concentrated on such topographic features near the forming lagoons and estuaries. However, it is unknown if these are true cultural patterns or if it is a biased pattern formed as a result of site inundation along the coast (Neusius and Gross 2007). As sea levels continued to rise during the Archaic, sediments carried down streams and rivers to the ocean began to fill the lagoons and estuaries that had formed at their mouths. The result for some was the formation of mudflats while others were entirely cut off from the ocean, depleting their original productivity. Late Archaic populations adapted to these changes by moving to the open coast and permanent bays and wetlands. In Southern California, sites along the coast acted as seasonal base camps while inland sites were occupied only for parts of the year. Such a pattern indicates small, highly mobile groups. Alternatively, along the Central Coast there are large base camp sites along the coast accompanied by a variety of smaller, season al camps more inland. This pattern indicates a semi-sedentary lifestyle (Neusius and Gross 2007).

The earliest Archaic peoples made great use of the varied environments of California in their diets. Along the coast shellfish were favored and supplemented by seeds and land mammals, but surprisingly fish is not as common in archaeological sites as would be expected. Millingstones appeared in earnest along the coast around 8000 – 9000 BP, indicating intense use of seeds. Meanwhile in more inland areas large game and seeds were the staples of diets there. In the Middle Archaic, hunting became increasingly more important throughout the culture region. There is also an increase in incidence of mortars and pestles during the early part of Late Archaic, indicating increased use of acorns (Neusius and Gross 2007).

Pacific: The Pacific Period is similar to other post-Archaic patterns in North America. Stable food supplies were adopted and economies developed that were based on those supplies. Populations grew and developed social hierarchies as a reaction to the imbalance of the population and available resources. An increased importance on trade in specialized and luxury items helped to maintain the developing hierarchy. In coastal and southern California cultural time periods during the Pacific are based primarily on changes in shell bead and ornament typologies (Neusius and Gross 2007).

A variety of sites characterize the Pacific Period, namely permanent villages, seasonal camps, specialized resource procurement sites (such as quarries) that replaced the more generalized camp sites of the Archaic, rock art sites, and trading sites. Populations were sedentary primarily in the Santa Barbara region, while in other parts of the project area they were semi-sedentary with permanent villages and seasonal base camps. For instance, along the northern coast semi-sedentary villages were established in the lowlands and camps in the uplands, the latter occupied by a portion of the village population. Often, bedrock milling features (such as bedrock mortars and grinding slicks) are associated with many of the sites of the Pacific Period (Neusius and Gross 2007), further indicating the importance of seeds and other vegetal foods.

Along the coast shellfish remained an important part of the prehistoric diet and the importance of fishing apparently increased. Along the Central Coast hunting of marine and land mammals supplemented this diet, while in the south acorns and seeds were more common supplements (Neusius and Gross 2007). The increase in fishing may have been supported by new technologies in watercraft, such as the *tomol*, or plank canoe. It should be noted that ocean going watercraft apparently were in use during the Early Archaic given the location of sites on the Channel Islands.

With the intensification of stable resources such as acorns, hard seeds, fish, and marine resources, the development of storage became a requirement. Acorn granaries are in fact a prominent feature of most California sites. In the desert areas of Southern California, acorns were often replaced with honey and screwbean mesquite. In the areas farthest south ceramic vessels were commonly used for storage rather than granaries (Neusius and Gross 2007).

Later in the Pacific Period artifacts begin to be elaborated with engraving and shell ornamentation along the coast. The numbers of groundstone artifacts such as millingstones, mortars, and pestles, increases there is extensive use of marine resources. Additionally small arrowheads are found in sites. Along the south coast and in the southern foothills and mountains sites have a more diverse assemblage, including ceramics, triangular and side-notched arrowheads, mortars, metates, and manos. Evidence of cremation is also present at sites, whereas during the Archaic individuals were commonly buried. The practice of cremation along with similarities in artifact styles seem to indicate interaction between this southern portion of the California culture region and parts of the Southwest region. Likewise, along the northern coast of California, similarities are seen in the settlement patters of the northern California coast and the adjoining Northwest Coast region, likely indicating interactions between the two areas (Neusius and Gross 2007).

The use of the plank canoe not only allowed people of the Pacific Period to venture farther out for fishing, but also allowed interdependent economic systems to develop between the mainland and islands. This, along with the increased population indicated by larger sites (Neusius and Gross 2007), only further developed the social hierarchies of settlements. Those with resource surpluses could afford to have canoes built and could therefore exercise control of trade along the California coast, continuing to attain and control luxury and specialized items, such as the *Olivella* shell beads used for money and made using lithic materials available only on Santa Cruz Island in the Santa Barbara Channel.

Historic

Contact with a variety of European ethnicities brought exotic goods such as glass beads, china, and iron to the California region, as well as the diseases that were brought in the same way to other cultural regions. The decrease in California populations as a result of European diseases most certainly affected the social organization and subsistence activities of the people (Neusius and Gross 2007).

As the Spanish established missions, pueblos, and presidios across the region, missionaries sought to convert the Native Americans to Christianity and settle them at the missions. Missions were established in areas with large Native American populations and where water and other resources were readily available (Neusius and Gross 2007). Some Native Americans did move to the missions, assisting with the construction of the missions and their systems (such as irrigation), others did not. Uprisings of Mission Indians are recorded as some realized that they did not want to stay at the missions. The Mission life was much different than what native groups were used to, however studies have shown that female activities continued relatively unchanged, while male activities resembled more Spanish-derived pursuits (Neusius and Gross 2007).

After Mexico gained independence from Spain, much of the land of California was transferred to private ownership in the form of ranchos and haciendas; however, the Spanish pueblos also grew. The presence of Native Americans at these locations varies across the state. At some, there is no evidence of their presence, while at others there is evidence of their use as laborers (Neusius and Gross 2007).

Euro American Exploration

The first known Europeans to explore the area that became California were the Spanish, British, and Russians.

Spanish exploration of the California region began in the sixteenth century. Francisco Coronado and Hernando de Alarcon, along with Melchor Diaz led expeditions in 1540. Juan Rodriguez Cabrillo, from Spain, led an expedition to the region in 1542 (Castillo 1978). By the end of the century, the Spanish authorities in Mexico hoped to secure the California coast and find ports and expand its thriving Pacific trade. Manila galleons, heavy sailing ships with many decks for cargo, brought silks, jewels, spices, and fine china to western Mexico from the Philippines, returning with cargoes of gold and silver from the mines of New Spain. Cabrillo explored the coast along present day San Diego, Catalina Island, San Pedro, and the Channel Islands area (Castillo 1978).

Sir Francis Drake, a British explorer, landed on the California coast in 1579. He explored the present-day Bodega Bay or Drake's Bay area, and claimed it as Britain's territory (Castillo 1978). Two hundred years later, Captain James Cook explored and mapped the coast of California and Alaska all the way to the Bering Strait.

The Russians are not known to have entered California in the sixteenth century, but beginning in 1742 they began exploring the Aleutian Islands and the west coast of Alaska seeking furs. They established a permanent settlement on Kodiak Island in 1784. Soon thereafter, native Alaskan hunters working for the Russians traveled south to hunt sea otters along the coast of California.

The Spanish were eager to establish a settlement in California because of the fear that British and Russian would continue to expand control and begin to settle along the California coast (Castillo 1978). In 1769, the Spanish organized an expedition led by Captain Gaspar de Portola and Father Junipero Serra. The expedition also resulted in the establishment of the first of twenty-one missions along the California coast, in San Diego, named San Diego de Alcala (Castillo 1978; Library of Congress 2006). The missions functioned both as economic and religious outposts of the Spanish empire.

The expedition to California also resulted in the founding of the first presidios, and by 1800 there were three presidios established along the coast. Presidios were military forts the Spanish used to obtain control of an area and to defend coastal harbors against attack. During the next fifty years, the Spanish continued to explore the coast of California, establishing missions, presidios and pueblos (civilian towns) from San Diego to Sonoma (Neusius and Gross 2007).

Western Expansion

Mexico including California became independent from Spain in 1821. This led to the secularization of missions and the removal of Native Americans from missions (Castillo 1978). Independence meant a shift of power from church to private landowners. Governors of Mexico were able to secure land grants in the form of ranchos, large pieces of lands, to individuals. The ranchos often contained buildings made from adobe, including large residences. During the Mexican period, cattle-raising, and the marketing of beef and hides became an economic staple in California (Library of Congress 2006). Fur traders and trappers settled in California during this period, and many visitors came through California on their way to Oregon.

The Mexican American War was won by the US in January, 1847, ending the Mexican Period. The population of California at that time was 150,000 Native Americans and 14,000 Mexican and European descendants (Library of Congress 2006). This was soon followed by the discovery of gold in the Sierra Nevada Mountains. The discovery of gold meant new settlers to the region, many of whom did not respect the property rights of rancho owners and squatted on their lands.

Chinese were among the largest emigrants to California during the gold rush. They were not welcome by the Anglo-miners, and the Chinese often set up camps and small enclaves which were entirely populated by Chinese (California Historical Society 2000).

California was admitted to the union as a free state in late 1850. The population and economy of the state grew rapidly in the 19th and 20th centuries. Agriculture became an important part of the economy and other industries developed, such as the oil and entertainment industries (California Historical Society 2006).

Major Industries

Mining. The discovery of gold in 1848 in Coloma, California marked a huge transition. Thousands of miners and gold-seekers came from other parts of the United States and other countries and continents. Many who came traveled by routes through seas and came through the port of San Francisco (California Historical Society 2000). Mining became a thriving industry during the 1880s, and technical advances in mining equipment, such as hydraulic mining, became a thriving industry (Library of Congress 2006).

Settlers who came to California for the gold rush found business and farming lucrative and settled in the region. Ports, such as San Francisco (then Yerba Buena) experienced growth in exports and businesses catering to the mining community thrived during the 1880s into the early 1900s. Other mining towns, called "boomtowns" were established during this period, to service the miners who traveled distances to work in the mine fields. The biggest boomtowns in near the gold fields were Sacramento and Stockton.

Agriculture, Ranching

Commercial agriculture and ranching in California had its roots in the missions and pueblos. The Spanish introduced a wide variety of Old World and Asian cereal and fruit crops and domesticated livestock to California. They also brought in irrigation systems, metal tools and crop processing methods. The missions were not only expected to be self sustaining, but they also needed to support the Presidios and provide goods to be traded. Livestock was raised for meat, but also for wool, leather, and tallow, and for cultivating the land.

After secularization there was a decline in agricultural production. With the discovery of gold, the needs of the miners and the growing cities caused a rapid increase in both crops and ranching. . Wheat became a strong agricultural product in California by 1850 (Library of Congress 2006) and cattle ranching peaked in the 1860s. Direct access to the eastern markets through the railroad in 1869 and later through refrigerated train cars allowed expansion of agriculture through the 19th century. A later transformation was the change from dryland agriculture to intensive-irrigated agriculture at the turn of the last century. California has historically produced a variety of crops including vegetables, fruit, nuts, diary, livestock, poultry, and flowers for export to other regions in the U.S. as well as to other countries. While much of the current agricultural activity is located inland, there is crop production along the coastal valleys of northern and southern California (Johnston 1994). Field crops continue to be the mainstay of the agricultural economy of California.

Railroads. Shortly after California became a state in 1850, rail lines were constructed. In 1862, President Lincoln signed the Pacific Railroad Act, which allowed construction of a railroad line from Sacramento east, built by Central Pacific Railroad and from Omaha West along the Missouri River, built by Union Pacific Railroad. The rail lines met in Promontory, Utah in 1869, completing the first Pacific Railroad (California State Railroad Museum Foundation 2001; Library of Congress 2006). The completion of the railroad meant that agricultural produce, lumber, and gold could be shipped to eastern parts of the US, while settlers were able to emigrate from the east to live in the west. . The railroad had a large impact on California immigration, which continued through the 20th century.

Trails

Juan Bautista de Anza. This trail was used by a party of 300 Spanish colonists, led by Colonel San Juan Bautista, from Mexico to California in 1775. The party intended to establish a mission and presidio in present-day San Francisco in order to secure the area from Russians and British. The party contained thirty families, a dozen soldiers, cattle, mules, and horses. It took three months to follow the trail through the southwest desert before reaching the California Coast. The trail is over 1,200 miles long. It took another three months to travel from the southern coast up to the northern coast to present-day San Francisco (USDA Forest Service 2007). This was the first overland route established to connect New Spain with San Francisco (National Park Service 2007).

Old Spanish Trail. This trail was first established by a Mexican trader, Antonio Armijo, in 1829. He traveled from New Mexico to Los Angeles on a commercial caravan, carrying Mexican woolen goods and planning to bring horses back from California (National Park Service 2007). Prior to the Old Spanish Trail, an overland southern route to California from New Mexico did not exist. The route was used often by traders and also traded with Native Americans along the route. This combination of footpaths of Native Americans, early trade explorations, and horse and mule routes make up the Old Spanish Trail. The trail was 1,200 miles long and extends from two trailheads. The trail ran through present-day Colorado, Utah, Arizona, Nevada, and California (Cultures and Histories of the American Southwest 2007).

California Trail. The trail was used by over 250,000 farmers and gold miners from Missouri during the 1840 and 1850s. The route starts along the Missouri River, and then converges on the Great Platte River Road, overlaps with the Oregon Trail and to the Rocky Mountains. After the crossing the Rockies, many routes were used to get to and cross the Sierra Nevada Mountains. The total system of trails that make-up the California Trail is approximately 5,664 miles (National Park Service 2007).

Pony Express National Historic Trail. This trail began in 1860 as a mail route connecting the eastern US with California. It was privately financed and was used only for eighteen months before the telegraph system was constructed and replaced the Pony Express. Riders on horseback transported mail from Missouri to California in ten days, traveling over 1,800 miles. The transcontinental railroad later followed much of this route (National Park Service 2007).

SOUTHWEST

The Southwest culture region covers all of Arizona, the western majority of New Mexico, the southern tip of Nevada, southern Utah, extreme southern and western Texas, and parts of southwest Colorado (Figure 3-21). Important Ancestral Puebloan occupations in Southwestern Colorado are found outside of the tribal ranges depicted at the time of contact for the Southwest region. The region does include parts of northern Mexico, but since this part of the region is not included in the project area, it is not discussed here. This is a highly varied region culturally that is rich in cultural resources and it should be noted that many of the tribes and pueblos within the cultural region may have more in common with neighboring cultural regions because of their shared environmental contexts. As a whole though, the Southwest culture region is demanding of its inhabitants and requires extensive adaptations to its environments for survival. This is recognized in the development of agriculture, domestication, stone and masonry architecture, and irrigation systems as well as the mysterious abandonments in some areas. A wide array of other traditions, some having been adopted from Mesoamerican cultures, also characterizes the cultures of the region. However, because of the diversity of the environments these adaptations vary among the subregions of the area (Neusius and Gross 2007; Ortiz 1979a; Woodbury 1979).

USFS regions included in the Southwest region include portions of Regions 2 and 4 and all of Region 3. BLM Field Offices in the region include all or portions of all field offices in New Mexico and Nevada with the exception if the Arizona Strip Office. In addition the cultural region covers a portion of the Royal Gorge Field office. In addition, the southwestern cultural region includes portions of field offices in southern Colorado.

Table I-6 identifies the Southwest culture region languages and tribes that have been documented within the project area. Culturally, the Southwest culture region is bordered by the California to the west, Great Basin to the west and north, Plains to the north and east, and Southeast to the east.

Table I-6
Languages and Tribes of the Southwest Culture Region in the Project Area

Language (Linguistic Phylum)	Tribes
Yuman (Hokan)	Walapai, Havasupai, Yavapai, Mohave, Halchidhoma, Quechan, Cocopa, Maricopa
Uto-Aztecan (Aztec-Tanoan)	Papago and Upper Pima, Hopi, Jocome and Jano, Tewa, North Tiwa, South Tiwa, Jemez, Pecos, Tano
Athapascan (Na-Dene)	Navajo, Western Apache, Chiricahua Apache, Mescalero Apache, Jicarilla Apache
Zunian (Penutian)	Zuni
Keresan (Undetermined linguistic phylum)	Rio Grande Keresans, Acoma, Laguna
Kiowa-Tanoan (Aztec-Tanoan)	Piro, Tompiro

Source: Ortiz 1979b; Neusius & Gross 2007; Waldman 2000

No single framework of Southwest cultural chronology is entirely appropriate for the whole culture region given the high degree of variability across it. However, there is enough similarity in the development of the major characteristics of the culture region for researchers to have established a very general chronology while limiting the amount of subareas discussed for each period (Neusius and Gross 2007; Ortiz 1979a; Woodbury 1979). Throughout the region the evidence for a Pre-Clovis occupation is rare, but there is definite evidence of a Clovis and post-Clovis Paloeindian occupation. The following outlines the general chronology of the Southwest culture region. Unlike other regions, the more recent cultural and technological patterns of the Southwest do not allow for an overall chronology after the Archaic Period and more localized patterns must be used (Neusius and Gross 2007).

- Paleoindian: pre-8000 BP
- Archaic: 8000 – 1750 BP
- Early Archaic: 8000 – 3500 BP
- Late Archaic: 3500 – 1750 BP
- Fully Developed Regional Traditions: 1750 – 400 BP

The Historic period then follows the localized regional traditions in the Southwest.

CULTURAL HISTORY

Prehistoric

Paleoindian: Southwest populations of the Paleoindian Period were organized into small, mobile groups of hunter-gatherers and resembled the Great Plains in many ways (Irwin-Williams 1979; Neusius and Gross 2007). Evidence for Pre-Clovis (pre-11,500 BP) people in the region is scant and what does exist is not very reliable. Evidence for Clovis hunters is much more accepted and found across the Southwest culture region, if not still in small numbers. In fact, Clovis points are named after the town in New Mexico, where examples were found in 1929. Such evidence comes from mammoth and bison kill and butchering sites where bones of the large game are associated with Clovis points as well as surface finds of Clovis points throughout the Southwest culture region (Neusius and Gross 2007). Paleoindian lifeways in general in the Southwest were intimately tied to the changing environmental and climatic context, technological innovations and adaptions, changing population sizes, and changing social organization (Irwin-Williams 1979; Neusius and Gross 2007).

Following the early Paleoindian Period, distinct patterns developed in the east and west portions of the Southwest, marked by the Arizona and New Mexico state line. In the east, a definite Folsom lithic technology with large game hunting is seen beginning around 11,000 BP. In the western Southwest, post-Clovis evidence is rare and what evidence has been found does not seem to indicate a reliance on big game hunting. This pattern continued throughout the rest of the Paleoindian Period, however late Paleoindian sites of the eastern Southwest, which tend to be situated in the foothill and mountain areas, appear to lack the diagnostic Folsom points (Neusius and Gross 2007).

Archaic: Unlike other culture regions, there is less distinction between the subperiods of the Archaic in the Southwest culture region (Neusius and Gross 2007). Additionally, Paleoindian similarities between the region and the Great

Plains disappear (Irwin-Williams 1979). As a whole however, sites of this age are typically ephemeral because they were used for comparatively short periods of time, although simple houses first occur in the region during the first half of this period. The Archaic Period brings the first indication of regional variation among groups in the Southwest culture region (Neusius and Gross 2007).

The Early Archaic corresponds with a climatic interval called the Altithermal when moisture levels varied locally and temperatures were unusually warm. Pleistocene large game disappeared presumably due to this environmental shift. These factors combined to require new adaptations by Southwest culture region populations. The largest difference is in technology. Groundstone occurs much more frequently in sites, including millingstones which indicate an increased reliance on seeds in the diet. Projectile points become smaller and their form changed from Folsom-type fluted and stemmed points to side- and corner-notched points with new hafting techniques. A variety of other stone tools are also included in the Archaic toolkit. The foragers of this time likely followed blooming and ripe plants. In the southern portion of the Southwest, this likely drew people to the valleys of permanent rivers. Caves and rockshelters of these kinds of areas were frequently used (Neusius and Gross 2007).

Four Archaic regional variants developed during the Early and continued into the Late Archaic Periods, incorporating the above adaptations as necessary: San Dieguito-Pinto in the west, Oshara in the north, Cochise in the southwest, and Chihuahua in the southeast. Pinto sites are often found as surface sites in dry lake basins and along drainages. Oshara sites develop into seasonal fall or winter camps. The Cochise concept is under debate, but later sites attributed to it tend to include simple houses. Chihuahua sites are similar to Oshara and Pinto sites, but are not well understood incorporating their own distinct artifacts and patterns. Although each of these areas and traditions have their own expressions, the Late Archaic Southwest populations practiced a broad-spectrum subsistence method, based on hunting large game and supported by trapping small game and gathering and storing seeds (Irwin-Williams 1979; Neusius and Gross 2007).

The Late Archaic saw the onset of modern, moister conditions. This change once again demanded additional adaptations by populations in the above traditions, most notably with the planting of crops. The skill of plant cultivation spread to the Southwest culture region from Mesoamerica (Woodbury and Zubrow 1979; Neusius and Gross 2007). It should be noted that not all cultigens of Mesoamerica transferred to North America. Crops grown in the Southwest included maize, cotton, squash, and the common bean and bottle gourd. Foragers of the Southwest did not immediately give up their mobile lifeways following the adoption of crop planting. Early crops were likely "casual" with people providing minimal tending so a lost crop would not have represented a total loss of effort (Neusius and Gross 2007). However, sedentism eventually did take place and populations increased (Irwin-Williams 1979; Neusius and Gross 2007). This was likely due to a symbiotic relationship between agriculture and population size. The better people got at agriculture, the larger the population grew. Increased populations become more dependent upon agriculture since the naturally occurring resources cannot support the higher numbers manipulated plants can. The increased dependence of a population on crops would have required people to restrict their mobility in order to consistently tend to the crops and ensure their productivity. The extreme investment made in crop productivity and populations' dependence on crops is evident in the irrigation systems developed at some sites of the Late Archaic (Neusius and Gross 2007).

Regional Traditions: Beginning and continuing on since the Archaic agriculture became widespread throughout the Southwest culture region. Subsistence became dependent upon crops, especially maize, beans, and squash. Other crops were eventually grown in the more southern areas of the Southwest where extensive irrigation systems of canals and wells were dug (Woodbury and Zubrow 1979; Neusius and Gross 2007). This is not to say that agriculture was the only means of subsistence. Hunting and seed collecting continued to play a part in obtaining food. Additionally turkeys and dogs began to be domesticated. As all of these resources became increasingly more reliable for groups, people became more sedentary and healthy. More productive areas attracted more people. So settlements in the Southwest culture region began to grow through increased births and in-migration. Architecture began to become elaborated with development of pueblos and features that were conducive to community integration, such as the multi-family pueblo dwellings (Neusius and Gross 2007).

Although these general patterns were experienced across the culture region the varying environmental conditions across the region demanded some different adaptations for survival. The settled village dwellers of the Southwest culture region are generally divided into five groups based on their unique regional traditions: the Anasazi in the Plateau country of the northern Southwest culture region, the Hohokam in the low deserts of Arizona, the Mogollan in the area from southern New Mexico west to Arizona's Verde River and south in northern Mexico, the Patayan in the Colorado River Valley and adjacent lands, and the Sinagua in the area from Flagstaff to Phoenix in Arizona. The Anasazi culture is recognized by its coil-and-scrape red and white ceramic pottery with black paint, the early construction of pithouses and masonry surface rooms that later developed into large pueblos, kivas, and cliff dwellings, likely due to population aggregation and political and social integration, and the practice of dry farming although some simple irrigation canals were developed later. The Anasazi subregion was abandoned sometime between 950 and 850 BP, likely due to environmental conditions, but was re-populated again later. The Hohokam culture is recognized by its paddle-and-anvil red or buff pottery with red paint, irrigated farming along rivers as well as flood farming in arroyo mouths, and clusters of houses built in pits developing into groups of clusters with associated integrative facilities (i.e. ball courts, plazas, and platform mounds). The culture was centered on the Gila and Salt River basins near Phoenix, Arizona. The Mongollon culture is characterized by coil-and-scrape red- and brownwares early on with red- and black-on-white pots later and Mimbres pottery even later, pithouses that developed into surface pueblos, and dry farming supported with hunting. Early Mongollon sites tend to be walled, suggesting defense, and situated on hilltops and mesas. Site location then shifted to along rivers and on river terraces. The Patayan culture includes paddle-and-anvil pottery with buffware in the lowlands of the subregion and brown pottery in the uplands, dry masonry rock features, including walls and earth ovens, and flood agriculture along the Colorado River and rainfall farming elsewhere in the subregion supported with hunting and gathering. Settlements during the growing season were situated along rivers, where flooding and modern development have had destructive effects, and in the uplands at other times where pit and surface structures were constructed as well as making use of rockshelters. The Sinagua culture is the most poorly known of these groups. What is known is that the culture is characterized by farming, pueblo-style communities, and paddle-and-anvil red- and brownware pottery tempered with cinders or crushed volcanic rock. Many settlements have been buried by volcanic eruptions that began in 866 BP, the ash of which may have made the soils of the region more productive for agriculture attracting more people, but the northern part of the subregion was eventually abandoned around 650 BP (Neusius and Gross 2007).

As noted above, a number of abandonments occurred throughout the Southwest culture region, including Virgin Anasazi area of southeast Arizona, the Kayenta Anasazi of northern Arizona, the Mesa Verde region of southwest Colorado, most of the Sinagua region, and some parts of the Mogollan area highlands. Groups appear to have relocated and aggregated into large settlements in several localities, making them more sensitive for cultural resources of this time period. Such areas include the Rio Grande valley, west central and eastern New Mexico, and eastern Arizona. It is believed that a drought in the northern parts of the Southwest culture region, which was abandoned by 650 BP, caused these population movements. Other theories involve warfare and violence forced the movements and cooperation between some groups. However, a clear line of descendency between prehistoric populations and modern Native American populations in the Southwest culture region is apparent in the continuity of lifeways (Neusius and Gross 2007).

Historic

Spanish explorers in the Southwest were the first to have contact with the Native Americans of the culture region (Neusius and Gross 2007; Ortiz 1979a). As Spanish towns, presidios, and missions were established contact increased, particularly at missions where the intent was to introduce Christianity to native populations and were thus built near existing population centers. Although some populations rejected Christianity and Spanish governmental institutions, they still adopted some useful items including metal plows and hoes and expanded their crops to include items like apples, peaches, and apricots. As in other areas, Native Americans participated in trade relations with the Spanish and other Europeans. Some Spanish pueblos traded with tribes of other regions, such as the Plains. Of course relations were not always so mutually beneficial though and in fact some tribes were often the adversaries of US soldiers later in time as the US continued to expand and explore westward (Neusius and Gross 2007).

Euro American Contact

The Spanish explored the region beginning in 1540s by following the Rio Grande north from Mexico. Vasquez de Coronado and his men traveled through much of the southwestern United States, ventured deep into the plains of Kansas, descended the walls of the Grand Canyon, and visited all the major Indian villages in the region. Although the gold Coronado was seeking was not found, the Spanish started settling the area soon thereafter and established a colony with the capital at Santa Fe (Neusius 2007). Other cities and towns were established primarily in river valleys and associated with existing Native American communities. Missions, military outposts and towns were founded, primarily in New Mexico, but also in Arizona and Texas to convert natives, protect settlers and solidify colonial rule. Santa Fe was founded in 1610, Albuquerque in 1706, Las Trampas in 1751, and Taos between 1780 and 1800 (Neusius 2007; National Park Service 2007). In Northern New Mexico, the Pueblo people revolted and drove out the Spanish in 1680, but the Spanish were able to return by 1692. In Arizona, Father Eusebio Kino, a Jesuit, founded the missions of Guevavi (1692) and Tumacacori (1696), near Nogales, and San Xavier del Bac (1700), near Tucson. The Spanish Empire, however, expelled the Jesuits in 1767, and those in Arizona subsequently lost their control over the indigenous people.

Mexico obtained control over the Southwest region in 1821 following the Mexican war of independence from Spain. With independence came commercial freedom and expansion of trade between Mexico and the United States. The U.S. gained control over the region during the Mexican- American War (1846-1848). Under the Treaty of Guadalupe Hidalgo parts of Colorado, Arizona, New Mexico, and Wyoming, as well as the whole of California, Nevada, and Utah were ceded to the U.S. The remaining parts of what are today the states of Arizona and New Mexico were later ceded under the 1853 Gadsden Purchase. Although military posts, stage routes, ranches, mines and American settlements were established, the region retained many of the well-established Spanish and Mexican traditions (Reeves 1905).

Trade

Missions. The Spanish colonial system was based on rights that the Pope had reserved to the monarchy which granted them newly discovered lands in the New World on the condition that they evangelize the native inhabitants. The missions of New Spain were economic outposts in addition to opportunities to save souls. The Spanish introduced new crops, animals, industries and forms of agriculture from Europe, but also established a trusteeship labor system over the indigenous people they conquered. They had the authority to tax the people under their care and to require them to perform labor. In return, the Spanish were expected to maintain order and to provide teachings in Catholicism. Because in practice there was little respect for native populations and their traditions, they were exploited. Many of the original missions were destroyed in the Pueblo Revolt. When the Spanish returned, the economic importance of the missions waned and trade and commerce in the towns became less dependent on native labor.

Mining. Turquoise had been mined in the Ortiz Mountains south of Santa Fe and traded throughout the Southwest and Mexico long before the Spanish arrived. Other minerals were mined for use in pottery production. The search for mineral wealth was a major reason for the initial interest in the Southwest by the Spanish. Silver was discovered in the 1730s, and was much more abundant than gold (Statistical Research, Inc. 2000). After the Mexican-American War and the Gadsden Purchase, the population of the southwest grew as miners from America rushed in. Mining districts were abundant by the 1860s (Statistical Research, Inc. 2000). Gold was found in the Ortiz Mountains in 1828 (New Mexico Economic Development 2007). Copper was also a prominent mineral in southern New Mexico and Arizona, especially after the decline of the silver market in the late 1880s. Mining was originally done by placer and vein mining, but changed to open pit mining after World War II (Statistical Research, Inc. 2000). The copper industry continues to be a force in the economy. After World War II uranium became an important mineral resource in the Navajo Nation in northern Arizona and New Mexico, as did coal. Towns, made up of commercial centers, saloons, and hotels, were established in close proximity to mines in order support the miners. Many of these towns followed a boom/bust cycle and were abandoned when the mines were depleted.

Ranching. Ranching continues to be important part of the Southwest region's economy. The Spanish brought sheep, goats, cattle and horses, which became the mainstay of livestock raised in the area. Spanish land grants and Indian lands were often broken up or acquired through legal maneuvering. The Homestead Act of 1862 and the Desert Land Act of 1877 further encouraged and promoted the economic development of the arid and semiarid public lands of the Southwest. These laws opened inexpensive land to farmers and attracted settlers. The construction of rail lines was responsible for the growth of cattle ranching, because cattle could be transported via rail to markets in the eastern portions of the US. (New Mexico Economic Development 2007). Homesteading continued into the twentieth century through the end of World War I.

Western Expansion

New Mexico was recognized as a territory of the United States in 1850, Nevada became a territory in 1861, and Arizona Territory was formed in 1864. The Gadsden Purchase of 1854 added roughly 30,000 square miles of to the New Mexico Territory. More ranches and farms were established during this period, and mining was a booming part of the economy. Several towns and cities sprang up around the mines and were later abandoned as the mining industry waned and mineral deposits were depleted (Neusius 2007).

Trails

Juan Bautista de Anza. This trail was used by a party of 300 Spanish colonists, led by Colonel San Juan Bautista, from Mexico to California in 1775. The party intended to establish a mission and presidio in present-day San Francisco in order to secure the area from Russians and British colonization. The party contained thirty families, a dozen soldiers, cattle, mules, and horses. It took three months to follow the trail through the southwest desert before reaching the coast of California. It took another three months to travel from the southern coast up to the northern coast to present-day San Francisco. The trail is over 1,200 miles long (USDA Forest Service 2007). This was the first overland route established to connect New Spain with San Francisco (National Park Service 2007).

El Camino Real de Tierra Adentro. This trail dates dating back to the Spanish Colonial era during the 16th to 19th centuries, when it was the primary route between Mexico City, the Spanish capital, and other Spanish provincial towns (Bureau of Land Management 2008). From Mexico, the trail crosses briefly into West Texas at El Paso and north through New Mexico, primarily in the Rio Grande corridor to Santa Fe. The trail was also used for trade and interaction between Europeans, Spaniards, Mexicans, and Native Americans and affected settlement and development within the southwest (National Park Service 2006).

Old Spanish. This trail was first established by a Mexican trader, Antonio Armijo, in 1829. He traveled from New Mexico to Los Angeles on a commercial caravan, carrying Mexican woolen goods and planning to bring horses back from California (National Park Service 2007). Prior to the Old Spanish Trail, an overland southern route to California from New Mexico did not exist. The route was used often by traders and also traded with Native Americans along the route. The trail has been used as a Native American footpath, an early trade route, and a horse and mule trail. The trail runs through present-day Colorado, Utah, Arizona, Nevada, and California (Cultures and Histories of the American Southwest 2007).

Santa Fe Trail. The Santa Fe Trail was used for trade and commerce between Missouri and Santa Fe, New Mexico from 1821 and 1880 (National Park Service 2008). Near Cimarron, Kansas the Trail branches into two routes: the

Mountain Route through Colorado and the Cimarron Route through the Oklahoma panhandle to New Mexico (Santa Fe 2008). Except for a short hiatus during the Mexican-American War between 1846 and 1848, the trail provided international passage of goods and travelers. The trail was important in changing over time the culture of the Southwest from the Spanish and Mexican to American. Both during and after the war, the Santa Fe Trail was used heavily for freighting of military supplies to forts in the southwest. Once the railroad extended into the southwest territory, the trail was no longer used.

Railroads. Mineral wealth in the area attracted Americans living in the east to the southwest region and an efficient mode of transportation was needed (US Department of State 2007). The Gadsden Purchase allowed the development of a southern route across the continent. The Atchison, Topeka, and Santa Fe rail lines were constructed in New Mexico by the late 1800s. The Southern Pacific Railroad went through Arizona from the west and into New Mexico. There, it met the Atchison, Topeka, and Santa Fe rail lines in Deming in 1881 (New Mexico Economic Development 2007). The development of this railroad network served the primary purpose of exporting mineral resources out of the southwest. However, as the Southern Pacific Railroad developed westward, and the Atchison, Topeka, and Santa Fe lines linking it to the north, Albuquerque quickly became an important hub of commerce and travel. The Southern Pacific line provided a link to the east coast, which fostered the "Americanization" of the southwestern states, bringing settlers, goods, industry, and missionaries. The Atchison, Topeka, and Santa Fe lines provided a north-south movement of the same. Albuquerque was advertised as a premiere destination for emigrants traveling from the east (Dreesen 1980).

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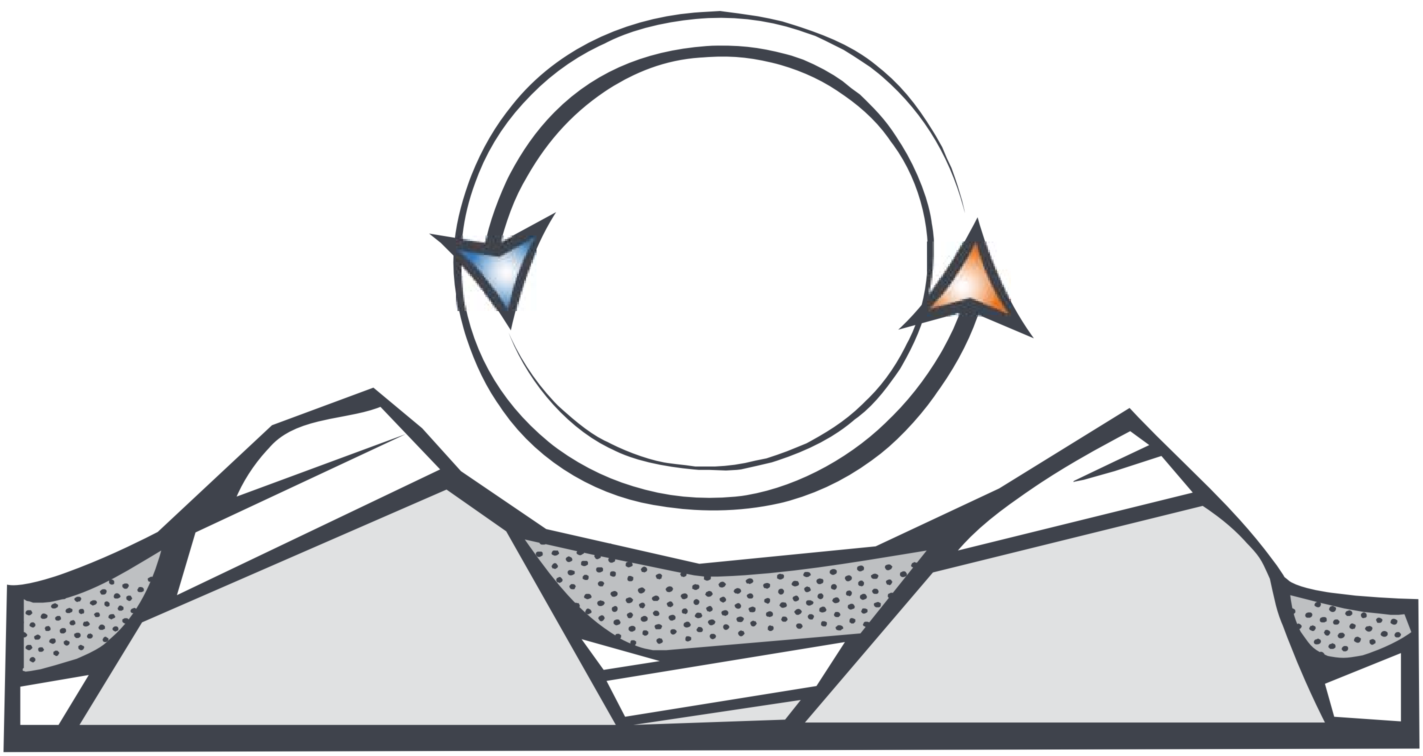

Appendix J

Special Designation Areas on BLM and FS Lands in the 12 Western States

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APPENDIX J
SPECIAL DESIGNATION AREAS ON BLM AND FS LANDS WITHIN THE PROJECT AREA

The following tables list acreage of congressional and administrative designations within the project area by government agency, type of special designation and state or national forest. Because the same area of land can be assigned multiple designations, total acreage of specially designated land within the project area is not calculated here, as combining totals would include acreage overlap.

Table J-1 lists acreage on BLM lands by state and type of designation.

Table J-2 lists acreage on FS lands by national forest and type of designation. Categorization by state was not possible as many national forests cross state lines.

Table J-1
Special Designation Areas on BLM Public Lands within the Project Area

Acreage						
State	**Congressional Designations**				**Administrative Designations**	
	Wilderness Areas	**National Conservation Areas**	**Wild and Scenic Rivers**	**National Monuments**	**Wilderness Study Areas**	**Areas of Critical Environmental Concern (BLM)[1]**
Alaska	0	2,012,082	297,656	0	87,060	2,926,672
Arizona	1,385,882	119,123	0	1,742,579	63,990	676,749
California	3,656,240	10,792,788	39,000	296,951	1,035,027	1,304,474
Colorado	139,529	173,075	178	162,785	619,442	358,146
Idaho	693	484,638	56	272,640	1,333,574	656,171
Montana	6,126	0	33,897	367,507	412,481	2,906,653
Nevada	1,998,197	1,053,119	0	6,548	2,546,992	198,347
New Mexico	151,137	228,591	22,897	4,108	960,463	468,488
Oregon/Washington	193,306	422,907	237,921	52,843	2,737,779	825,622
Utah	132,162	5,081	0	1,864,264	3,273,285	1,212,014
Wyoming	0	0	0	0	571,501	917,212
Total	**7,663,272**	**15,291,405**	**631,605**	**4,770,225**	**13,641,594**	**12,450,547**

[1] Areas of Critical Environmental Concern are a BLM-specific designation

Source: BLM 2008

Table J-2
Special Designation Areas on NFS Lands within the Project Area

Forest	Acreage: Congressional Designations: Wilderness Areas	National Scenic Areas	National Recreation Areas	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Administrative Designations: Wilderness Study Areas	National Roadless Areas (FS)[2]
Angeles National Forest	81,907				14,168			200,290
Apache-Sitgreaves National Forests	22,214							337,219
Arapaho and Roosevelt National Forests	305,779		35,623	20,528	10,659			393,401
Ashley National Forest	271,540		200,115					795,625
Beaverhead-Deerlodge National Forest	219,161						154,988	1,830,896
Bighorn National Forest	191,921							620,561
Bitterroot National Forest	754,257						101,694	405,883
Black Hills National Forest								9,259
Boise National Forest	64,945							1,109,148
Bridger-Teton National Forest	1,297,005						109,352	1,430,637
Caribou-Targhee National Forest	134,606							1,587,205
Carson National Forest	84,391			1,997			43,739	161,071
Chugach National Forest							1,969,892	1,972,397

Table J-2
Special Designation Areas on NFS Lands within the Project Area

Forest	Acreage: Congressional Designations: Wilderness Areas	Acreage: Congressional Designations: National Scenic Areas	Acreage: Congressional Designations: National Recreation Areas	Acreage: Congressional Designations: Wild and Scenic Rivers	Acreage: Congressional Designations: Other Congressionally Designated Areas (FS)[1]	Acreage: Congressional Designations: National Monuments	Acreage: Administrative Designations: Wilderness Study Areas	Acreage: Administrative Designations: National Roadless Areas (FS)[2]
Cibola National Forest	137,628				49,927			246,220
Clearwater National Forest	261,923			23,802	16,481			988,597
Cleveland National Forest	75,580							130,755
Coconino National Forest	179,346			2,918				52,705
Colville National Forest	31,451							181,693
Comanche National Grassland	337,256						61,341	679,997
Coronado National Forest	331,728						143,995	144,947
Custer National Forest	182,716			27,067	42,950			136,467
Deschutes National Forest	82,836					55,500		851,970
Dixie National Forest	101,751							101,056
Eldorado National Forest								716,903
Fishlake National Forest	1,076,152		15,274	23,594				478,673
Flathead National Forest	115,536			11,904				118,718
Fremont-Winema National Forests	717,860				35,050		143,995	703,843

Table J-2
Special Designation Areas on NFS Lands within the Project Area

Forest	Acreage: Congressional Designations: Wilderness Areas	National Scenic Areas	National Recreation Areas	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Administrative Designations: Wilderness Study Areas	National Roadless Areas (FS)[2]
Gallatin National Forest	179,127	33,077						212,623
Gifford Pinchot National Forest	261,923			23,802	16,481			988,597
Gila National Forest	791,784						59,869	749,056
Grand Mesa, Uncompahgre and Gunnison National Forests	551,800		50,969		27,754			1,203,841
Helena National Forest	112,241							444,809
Humboldt-Toiyabe National Forest	913,911		275,634				178,756	3,383,841
Idaho Panhandle National Forest	10,387			23,288			6,014	828,950
Inyo National Forest	639,253	119,238		2,259				966,391
Kaibab National Forest	108,831							53,055
Klamath National Forest	372,503			44,118	18,196			454,277
Kootenai National Forest	93,765	4,808					34,605	638,266
Lassen National Forest	78,109				16,351			186,846
Lewis and Clark National Forest	365,570						169,143	1,003,874
Lincoln National Forest	82,097						20,929	213,182

Table J-2
Special Designation Areas on NFS Lands within the Project Area

Acreage

Forest	Congressional Designations						Administrative Designations	
	Wilderness Areas	National Scenic Areas	National Recreation Areas	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Wilderness Study Areas	National Roadless Areas (FS)[2]
Lolo National Forest	147,965		25,463					758,439
Los Padres National Forest	807,856			1,378				1,037,208
Malheur National Forest	78,353			10,801				181,508
Manti-Lasal National Forest	46,358							645,971
Medicine Bow-Routt National Forest	329,668							821,679
Mendocino National Forest	136,211			4,550				214,202
Modoc National Forest	63,937							202,416
Mt Baker-Snoqualmie National Forest	703,934		8,675	18,780	143,121			415,304
Mt. Hood National Forest	187,268	42,582		51,334	82,328			118,026
Nez Perce National Forest	869,442			10,532				502,240
Ochoco National Forest	35,201			7,575	83,910			61,010
Okanogan National Forest	627,335							427,097
Okanogan-Wenatchee National Forests	844,055				87,862		15,980	579,183

Table J-2
Special Designation Areas on NFS Lands within the Project Area

Forest	Acreage: Congressional Designations: Wilderness Areas	National Scenic Areas	National Recreation Areas	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Administrative Designations: Wilderness Study Areas	National Roadless Areas (FS)[2]
Olympic National Forest	87,577				312,297			85,607
Payette National Forest	780,261			465				904,516
Pike-San Isabel National Forest	425,845							688,086
Plumas National Forest	23,697			18,794	18,423			85,986
Prescott National Forest	101,515			1,511				165,490
Rio Grande National Forest	430,175				1,410			669,024
Rogue River-Siskiyou National Forests	299,684			70,754				368,716
Salmon-Challis National Forest	1,209,082		28					2,264,053
San Bernardino National Forest	130,535							223,329
San Juan National Forest	423,907				62,356			696,594
Santa Fe National Forest	283,541		44,680	51,757				375,008
Sawtooth National Forest	217,737		566,485					1,227,815
Sequoia National Forest	293,786			9,282		286,505		467,232
Shasta-Trinity National Forest	495,678		167,900	20,178	13,112			500,142

Table J-2
Special Designation Areas on NFS Lands within the Project Area

Acreage

Forest	Congressional Designations						Administrative Designations	
	Wilderness Areas	National Scenic Areas	National Recreation Areas	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Wilderness Study Areas	National Roadless Areas (FS)[2]
Shoshone National Forest	1,366,372			6,369	30,050		13,526	686,864
Sierra National Forest	566,927			9,738	33,028	24,279		417,354
Siskiyou National Forest	22,230							51,911
Siuslaw National Forest	121,162		204,668	63,122	7,756			314,659
Six Rivers National Forest	215,413		30,637	9,662	1,662			232,480
Stanislaus National Forest	49,184			7,521	2,895			219,399
Tahoe National Forest	430,175				1,410			669,024
Tongass National Forest	5,745,617		7,009		853,882			6,486,542
Tonto National Forest	577,676			757				271,657
Uinta National Forest	58,458							527,676
Umatilla National Forest	297,685			6,636				282,220
Umpqua National Forest	71,785			6,485	37,008			109,731
Wallowa-Whitman National Forest	372,212		625,090	20,382				514,674
Wasatch-Cache National Forest	309,202							598,385

Table J-2
Special Designation Areas on NFS Lands within the Project Area

Forest	Acreage: Congressional Designations: Wilderness Areas	National Scenic Areas	National Recreation Areas	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Administrative Designations: Wilderness Study Areas	National Roadless Areas (FS)[2]
White River National Forest	748,158							639,602
Willamette National Forest	391,247			14,272	18,897			170,168
Total	**32,352,798**	**199,705**	**2,258,250**	**604,110**	**2,021,534**	**366,284**	**3,227,819**	**52,934,355**

[1] "Other Congressionally Designated Area" is a FS-specific designations
[2] "National Roadless Area" is a FS-specific designation

Source: FS2008 a

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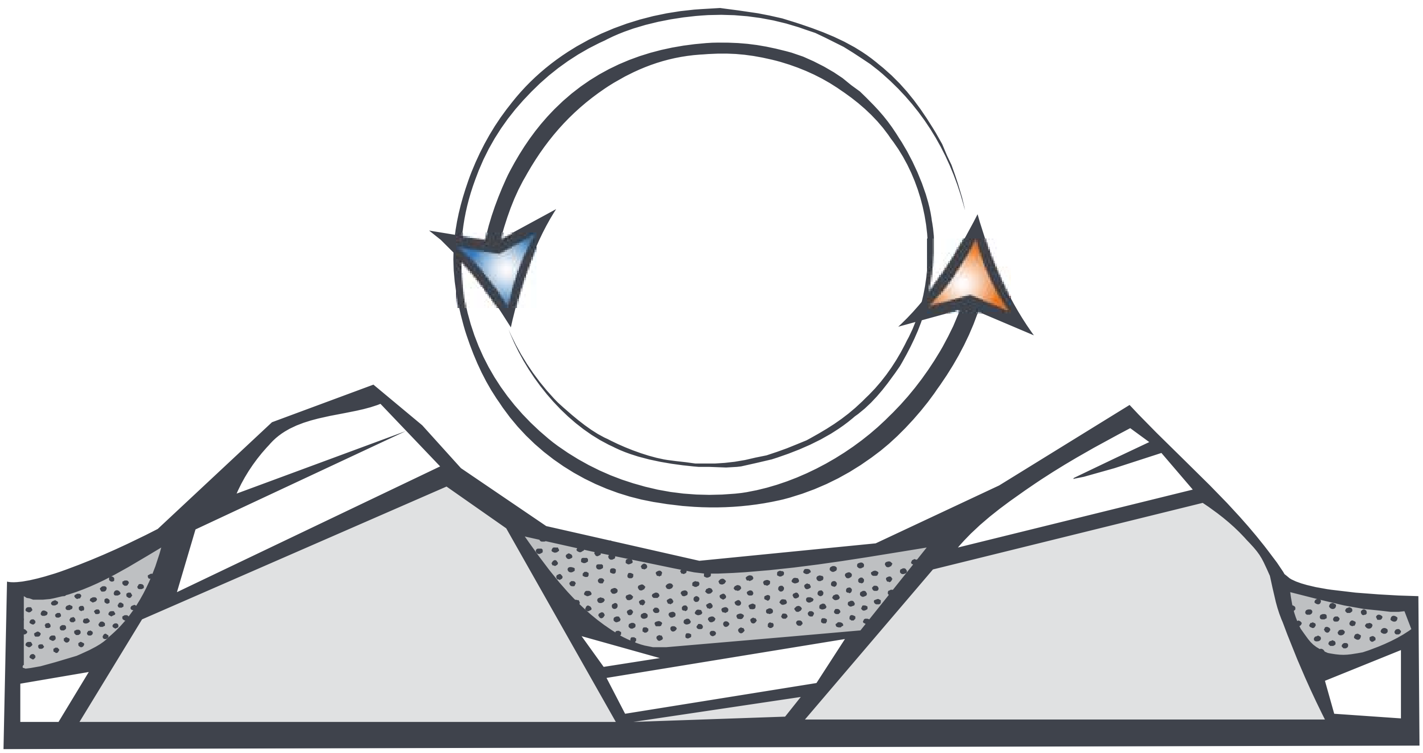

Appendix K

Special Designation Areas on BLM and FS Lands in the Potential Geothermal Area

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APPENDIX K
SPECIAL DESIGNATION AREAS ON BLM AND FS LANDS WITHIN THE PLANNING AREA

The following tables list acreage of congressional and administrative designations within the planning area by government agency, type of special designation and state or national forest. Because the same area of land can be assigned multiple designations, total acreage of specially designated land within the planning area is not calculated here, as combining totals would include acreage overlap. Total acreage of special designations within the planning area can be found in Section 2-2.

Table K-1 lists acreage on BLM lands by state and type of designation.

Table K-2 lists acreage on FS lands by national forest and type of designation. Categorization by state was not possible as many national forests cross state lines.

Table K-1
Special Designation Areas on BLM Public Lands within the Planning Area

Acreage						
	Congressional Designations				Administrative Designations	
State	Wilderness Areas	National Conservation Areas	Wild and Scenic Rivers	National Monuments	Wilderness Study Areas	Areas of Critical Environmental Concern (BLM)
Alaska	0	935,659	85,415	0	0	1,378,832
Arizona	1,114,774	551,557	0	551,557	63,795	597,113
California	2,813,231	296,933	8,682	296,933	1,003,587	1,457,961
Colorado	69,206	104,780	178	104,780	377,655	262,551
Idaho	693	272,640	56	272,640	1,306,415	794,889
Montana	6,126	49	0	49	209,844	45,815
Nevada	1,998,197	6,548	0	6,548	2,546,992	1,282,282
New Mexico	151,137	4,108	22,897	4,108	861,796	452,988
Oregon/Washington	184,705	51,422	216,026	51,422	2,737,779	864,162
Utah	103,861	0	0	0	520,953	186,907
Wyoming	0	0	0	0	422,108	920,063
Total	**6,441,930**	**2,223,694**	**333,254**	**1,288,035**	**10,050,923**	**8,243,565**

[1] Areas of Critical Environmental Concern are a BLM-specific designation

Source: BLM 2008a

Table K-2
Special Designation Areas on FS Lands within the Planning Area

Forest	Acreage							
	Congressional Designations						Administrative Designations	
	Wilderness Areas	National Scenic Areas	National Recreation Area	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Wilderness Study Areas	National Roadless Areas (FS)[2]
Angeles National Forest	76,717							200,460
Apache-Sitgreaves National Forests	81,907	0	0	0	14,168	0	0	200,290
Arapaho and Roosevelt National Forests	4,290	0	0	0	10,659	0	0	230,624
Ashley National Forest	305,769	0	35,622	20,527	0	0	0	385,305
Beaverhead-Deerlodge National Forest	0	0	102,682	0	0	0	0	29,285
Bitterroot National Forest	219,150	0	0	0	0	0	154,980	1,830,896
Boise National Forest	754,229	0	0	0	0	0	101,690	405,883
Bridger-Teton National Forest	64,942	0	0	0	0	0	0	1,109,148
Caribou-Targhee National Forest	712,267	0	0	0	0	0	109,347	758,939
Carson National Forest	134,602	0	0	0	0	0	0	1,587,205
Cibola National Forest	84,391	0	0	1,997	0	0	43,739	161,071
Clearwater National Forest	73,467	0	0	0	30,482	0	0	239,071
Cleveland National Forest	261,915	0	0	23,665	0	0	0	333,364
Coronado National Forest	75,580	0	0	0	0	0	0	130,755
Custer National Forest	29,981	0	0	0	0	0	0	47,148

Table K-2
Special Designation Areas on FS Lands within the Planning Area

Forest	Acreage							
	Congressional Designations						Administrative Designations	
	Wilderness Areas	National Scenic Areas	National Recreation Area	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Wilderness Study Areas	National Roadless Areas (FS)[2]
Deschutes National Forest	182,711	0	0	27,067	42,949	55,500	0	136,467
Dixie National Forest	57,255	0	0	0	0	0	0	504,124
Fishlake National Forest	0	0	0	0	0	0	0	484,666
Fremont-Winema National Forests	115,534	0	0	11,904	0	0	0	118,718
Gallatin National Forest	651,552	0	0	0	35,048	0	143,991	544,958
Gifford Pinchot National Forest	179,126	33,077	0	0	0	0	0	212,623
Gila National Forest	791,776	0	0	0	0	0	59,869	749,056
Grand Mesa, Uncompahgre and Gunnison National Forests	551,793	0	50,967	0	27,753	0	0	1,192,054
Helena National Forest	1,176	0	0	0	0	0	0	269,501
Humboldt-Toiyabe National Forest	795,845	0	275,629	0	0	0	98,446	3,337,293
Inyo National Forest	597,938	104,641	0	2,259	0	0	0	938,360
Klamath National Forest	0	0	0	0	18,195	0	0	4,033
Lassen National Forest	43,970	0	0	0	16,350	0	0	119,188
Lewis and Clark National Forest	0	0	0	0	0	0	0	7,618
Lincoln National Forest	0	0	0	0	0	0	0	30,493

Table K-2
Special Designation Areas on FS Lands within the Planning Area

Forest	Acreage							
	Congressional Designations						Administrative Designations	
	Wilderness Areas	National Scenic Areas	National Recreation Area	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Wilderness Study Areas	National Roadless Areas (FS)[2]
Lolo National Forest	38,108	0	0	0	0	0	0	127,775
Los Padres National Forest	797,759	0	0	1,374	0	0	0	1,037,208
Malheur National Forest	78,351	0	0	10,801	0	0	0	181,508
Manti-Lasal National Forest	0	0	0	0	0	0	0	76,907
Medicine Bow-Routt National Forest	250,639	0	0	0	0	0	0	505,938
Mendocino National Forest	36,294	0	0	0	0	0	0	113,800
Modoc National Forest	63,936	0	0	0	0	0	0	202,416
Mt Baker-Snoqualmie National Forest	703,906	0	8,675	18,779	143,119	0	0	415,304
Mt. Hood National Forest	187,265	42,581	0	51,333	82,326	0	0	118,026
Nez Perce National Forest	869,412	0	0	10,532	83,909	0	0	502,240
Ochoco National Forest	35,199	0	0	7,574	0	0	0	61,010
Okanogan National Forest	621,814	0	0	0	87,859	0	0	338,748
Okanogan-Wenatchee National Forests	737,119	0	0	0	144,112	0	15,194	272,402
Payette National Forest	780,233	0	0	465	0	0	0	904,516
Pike-San Isabel National Forest	425,836	0	0	0	0	0	0	688,086
Plumas National Forest	4,408	0	0	6,623	22	0	0	21,313

Table K-2
Special Designation Areas on FS Lands within the Planning Area

Forest	Acreage							
	Congressional Designations						Administrative Designations	
	Wilderness Areas	National Scenic Areas	National Recreation Area	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Wilderness Study Areas	National Roadless Areas (FS)[2]
Rio Grande National Forest	430,173	0	0	0	1,410	0	0	669,024
Rogue River-Siskiyou National Forests	75,877	0	0	11,748	0	0	0	30,503
Salmon-Challis National Forest	1,209,036	0	28	11,812	0	0	0	2,264,053
San Bernardino National Forest	130,535	0	0	0	0	0	0	223,329
San Juan National Forest	423,902	0	0	0	62,355	0	0	696,594
Santa Fe National Forest	283,542	0	44,680	12,916	0	0	0	374,307
Sawtooth National Forest	217,724	0	566,454	0	0	0	0	1,227,815
Sequoia National Forest	275,549	0	0	9,282	0	192,228	0	422,243
Shasta Trinity National Forest	35,231	0	0	0	13,112	0	0	35,335
Shoshone National Forest	225,036	0	0	0	6,870	0	0	68,171
Sierra National Forest	259,672	0	0	0	0	0	0	99,746
Tahoe National Forest	2,353	0	0	0	0	0	0	32,902
Tongass National Forest	647,656	0	0	0	300,918	0	0	948,574
Tonto National Forest	127,728	0	0	0	0	0	0	25,868
Uinta National Forest	41,396	0	0	0	0	0	0	147,652
Umatilla National Forest	297,671	0	0	6,636	0	0	0	267,459

Table K-2
Special Designation Areas on FS Lands within the Planning Area

Forest	Acreage							
	Congressional Designations						Administrative Designations	
	Wilderness Areas	National Scenic Areas	National Recreation Area	Wild and Scenic Rivers	Other Congressionally Designated Areas (FS)[1]	National Monuments	Wilderness Study Areas	National Roadless Areas (FS)[2]
Umpqua National Forest	71,447	0	0	554	37,007	0	0	61,822
Wallowa-Whitman National Forest	372,188	0	625,070	20,381	0	0	0	514,674
Wasatch-Cache National Forest	104,974	0	0	0	0	0	0	245,945
White River National Forest	748,147	0	0	0	0	0	0	639,602
Willamette National Forest	391,235	0	0	41,911	18,896	0	0	166,415
Total	**19,057,887**	**180,299**	**1,709,808**	**310,140**	**1,177,521**	**247,728**	**788,597**	**31,457,013**

[1] "Other Congressionally Designated Area" is a designation utilized solely by USFS Region 5 (Alaska)
[2] "National Roadless Area" is a FS-specific designation

Source: FS 2008a

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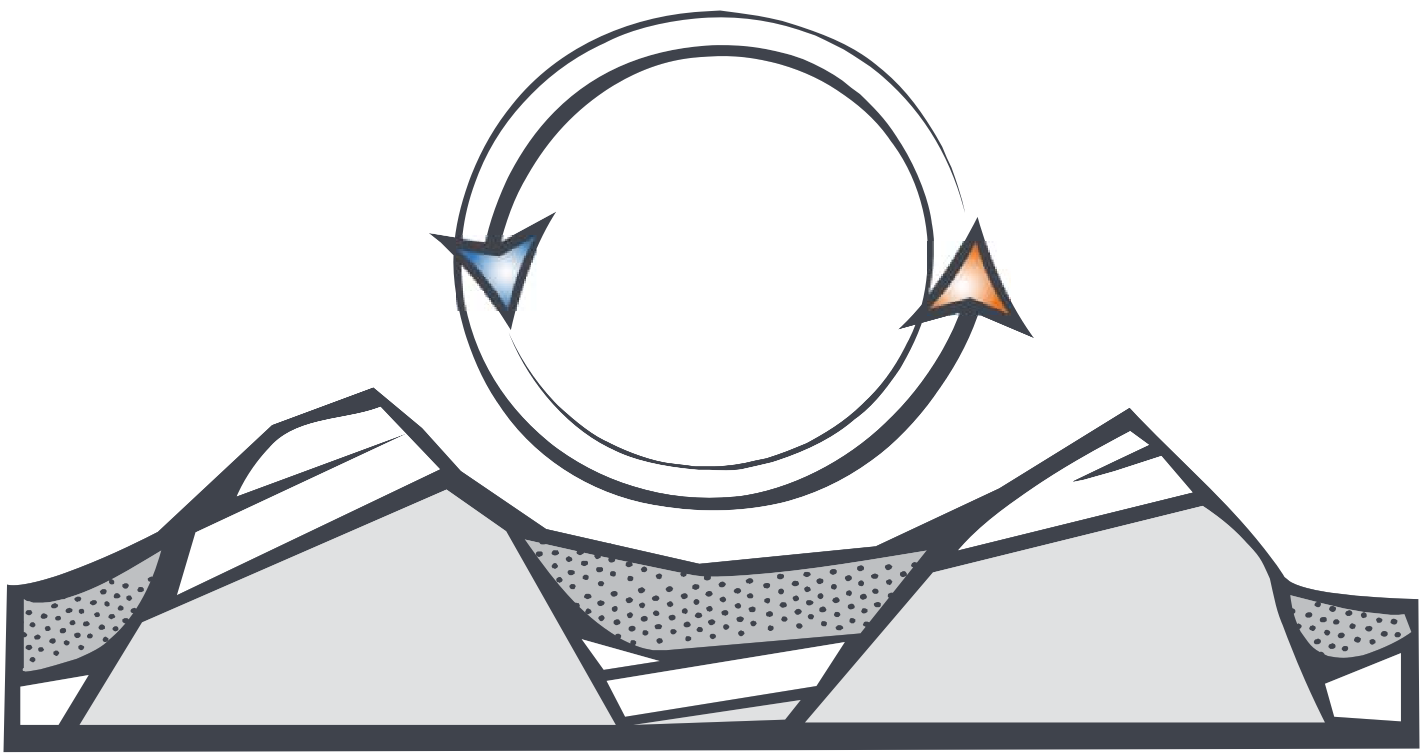

APPENDIX L

PUBLIC COMMENTS AND COMMENT ANALYSIS

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APPENDIX L
PUBLIC COMMENTS AND COMMENT ANALYSIS

1. Method of Comment Collection and Analysis

Methods of submitting comments included letters, facsimiles, and electronic mail messages. All comments, regardless of how they were submitted, received equal consideration.

Letters were tracked as they arrived, registering the author's name and affiliated organization, if applicable. After entering submissions in a tracking list, all were read and evaluated to determine their content. Most submissions contained several individual comments, thus, it was necessary to develop a method to systematically track all individual comments received. This was accomplished through a system in which individual comments within a longer letter or comment form were numbered for tracking purposes. Individual comments were tallied and analyzed, and written submissions were registered in the administrative record.

2. Summary of Written Comments Received

The comment period closed on September 19th, 2008. All written comments sent prior to midnight (12:00 A.M. on September 19th, 2008) were accepted as official comments. Some comments were duplicated within an electronic mail message and a letter submitted via US Mail. Identical, duplicate comments from the same party were not considered more than once.

A total of 74 written submissions were received. Most of the submissions contained multiple comments on different topics. A total of over 500 individual comments were made. All information received through these comments has been evaluated, verified, and incorporated into the Final PEIS as appropriate.

Copies of all accepted written submissions, excluding attachments and appendicies are provided in this Appendix, followed by the agency response.

Each comment is coded using the affiliated organization type, the letter number, and the comment number within the letter. Affiliation types include A (government agency or tribal organizations), I (individual), O (non-profit organization), and C (commercial business or industry organization). The two form letters were received from groups of individuals, and were classified as F (form letter). A vertical line and the comment code note each separate comment within each submission. The agency response to each comment is printed following the comment letter. Everyone who submitted a unique comment letter is included in the commentor index (Table L-1, Comment Letters Received by Author Name), which includes last name, first name, affiliated organization (if applicable) and letter ID. A separate index is provided in which letters are organized alphabetically by affiliated organization (Table L-2, Comment Letters Received by Affiliated Organization).

In addition, form letters with identical or nearly identical comments were received from over 700 individuals on two topics. Individual commentor's names and addresses were recorded, but identical duplicate comments were not responded to more than once. Representative letters for each of the two topics are published in this Appendix. Individuals who submitted a form letter will be directed to the representative letter.

Table L-1
Comment Letters Received by Author Name

Commentor Name	Affiliated Organization	Letter Code
Multiple commentors	n/a FORM LETTER A	F-34
Multiple commentors	n/a FORM LETTER B	F-40
Alvarez, Raymond	Hewisedawi Band of Pit River Indians	A-46
Arnold, Gary	Arnold, Bleuel, Larochelle, Mathews and Zirbel LLP	I-1
Arnold, Gary	Arnold, Bleuel, Larochelle, Mathews and Zirbel LLP	I-2
Banks, Kevin	Alaska Department of Natural Resources	A-56
Barr, Ronald	Earth Power Resources, Inc	C-50
Becker, Dave	Oregon Natural Desert Association	O-42
Berditschevsky, Michelle	Pit River Tribe	A-61
Boggs, Denise	Conservation Congress	O-22
Bromm, Susan	U.S. Environmental Protection Agency	A-45
Canaly, Christine and Smith, Ceal	San Luis Valley Water Protection Coalition and San Luis Valley Ecosystem Council	O-74
Culver, Nada	Wilderness Society	A-58
Davidson, Patty	n/a	I-66
D'Olier, William L.	n/a	I-37
Eastman, Trudy	n/a	I-71
Emmerich, John	Wyoming Department of Game and Fish	A-23
Etchepare, John	Wyoming Department of Agriculture	A-24
Fite, Katie	Western Watersheads Project	A-6
Fite, Katie	Western Watersheads Project	A-9
Fleischmann, Daniel	Ormat Nevada Inc.	C-54
ForestDavis, Olivia	Hewasi Band Pit River Tribal Member	I-68
Fraser, Rob	Idaho Wilderness Federation	O-60

Table L-1
Comment Letters Received by Author Name

Commentor Name	Affiliated Organization	Letter Code
Gawell, Karl	Geothermal Energy Association	C-16
Gillerman, Virginia	Idaho Geological Survey	A-8
Goin, Wayne	Minion Hydrologic	C-26
Guenther, Herbert R.	Arizona Department of Water Resources	A-64
Hayden, Deborah	Swiftcurrent Ventures	C-18
Heiken, Doug	Oregon Wild	O-49
Hoyle, Joe W	n/a	I-52
Jackson, Irene	n/a	I-25
Jackson, Irene	n/a	I-32
Johnson, Stephen	Dunton LLC.	C-48
Kames, Renee	n/a	I-65
Karnes, A	n/a	I-69
Kessell, Mark	n/a	I-67
Kezar, Chuck	n/a	I-51
Kjellander, Paul	Idaho Office of Energy Resources	A-44
Lovekin, James	GeothermalEx, Inc.	C-17
Lovelace, Bonnie	Montana Department of Environmental Quality	A-31
Magnusson, Arni	Glitner Sustainable Energy	C-4
Mansure, Chip	n/a	I-14
Mattson Mc Donnald, Pamela	n/a	I-10
McKee, Michael	Uintah County	A-59
Mitchell, D. Kjell	Glenwood Springs Hot Springs Lodge and Pool	C-20
Murawski, Helene	n/a	I-36
Nash-Chrabascz, Bridget	Quechan Indian Tribe	A-33
Niggemann, Kim	Nevada Geothermal Power Inc	C-13
Pace, Sam	Saguache County Commissioners	A-27
Painter, Janie	Save Medicine Lake Coalition	O-55
Perry, Douglas	Davenport Power LLC	C-19
Prisament, Morty	Tetra Tech	C-11
Purves, Cathy	Trout Unlimited	O-47
Ranger, Richard	API energy	C-43
Ritter, Ginger	Arizona Game and Fish Department	A-29
Ronnerud, Phil	Greenlee County, AZ	A-12
Seeber, Theodore	n/a	I-3
Shockey, Diane	n/a	I-63
Shott, Jim	Medicine Lake Citizens for Quality Environment Inc.	O-70
Sifford, Alex	Sifford Energy Services	C-38
Simmons, Patricia	n/a	I-39
Stansell, Stan	U.S. Fish and Wildlife Agency	A-73
Sullivan, Patrick	n/a	I-15
Sulock, Dot	n/a	I-5
Thrash, Gary	San Juan Public Lands Center	O-41
Tolbert, Krista	n/a	I-28
Von Seggern, David	Great Basin Sierra Club	O-30
Walsh, Stan	Sauk-Suiattle Indian Tribe	A-72
Jones-Weinberger, Carolyn	n/a	I-62
Wenk, Dan	National Park Service	A-57
Wilmoth, Stan	Montana Historical Society	O-7

Table L-1
Comment Letters Received by Author Name

Commentor Name	Affiliated Organization	Letter Code
Witcher, James	n/a	I-53
Wunder, Matthew	New Mexico Department of Game and Fish	A-21
Wyncoop, Eileen	Sierra Pacific Resources (Nevada and Pacific Power)	C-35

Table L-2
Comment Letters Received by Affiliation of Author

Affiliated Organization	Letter Code
Alaska Department of Natural Resources	A-56
API energy	C-43
Arizona Department of Water Resources	A-64
Arizona Game and Fish Department	A-29
Conservation Congress	O-22
Davenport Power LLC	C-19
Dunton LLC.	C-48
Earth Power Resources, Inc	C-50
Geothermal Energy Association	C-16
GeothermalEx, Inc.	C-17
Glenwood Springs Hot Springs Lodge and Pool	C-20
Glitner Sustainable Energy	C-4
Great Basin Sierra Club	O-30
Greenlee County, AZ	A-12
Hewisedawi Band of Pit River Indians	A-46
Idaho Geological Survey	A-8
Idaho Office of Energy Resources	A-44
Idaho Wilderness Federation	O-60
Medicine Lake Citizens for Quality Environment Inc.	O-70
Minion Hydrologic	C-26
Montana Department of Environmental Quality	A-31
Montana Historical Society	O-7
National Park Service	A-57
Nevada Geothermal Power Inc	C-13
New Mexico Department of Game and Fish	A-21
Oregon Natural Desert Association	O-42
Oregon Wild	O-49
Ormat Nevada Inc.	C-54
Pit River Tribe	A-61
Quechan Indian Tribe	A-33
Saguache County Commissioners	A-27
San Juan Public Lands Center	O-41
Sauk-Suiattle Indian Tribe	A-72
Save Medicine Lake Coalition	O-55

Table L-2
Comment Letters Received by Affiliation of Author

Affiliated Organization	Letter Code
Sierra Pacific Resources (Nevada and Pacific Power)	C-35
Sifford Energy Services	C-38
Swiftcurrent Ventures	C-18
Tetra Tech	C-11
Trout Unlimited	O-47
U.S. Environmental Protection Agency	A-45
U.S. Fish and Wildlife Agency	A-73
Uintah County	A-59
Western Watersheads Project	A-6
Western Watersheads Project	A-9
Wilderness Society	A-58
Wyoming Department of Agriculture	A-24
Wyoming Department of Game and Fish	A-23

Comments on the PEIS were concerned with a number of issues including but not limited to: scope of the document, identification of lands available for leasing, and incorporation of site specific stipulations and BMPs. In addition, comments were received for the following resources and resources uses: air quality, cultural resources, fish and wildlife, geologic and seismic resources, livestock grazing, land use and special designations, minerals and energy, noise national scenic and historic trails, recreation, socioeconomics and environmental justice, special status species, tribal interests, vegetation, visual resource, and water resources.

3. Comment Letters and Responses

All unique comment submissions and representative form letters are included below. Reponses can be found immediately following each letter.

ARNOLD BLEUEL
LAROCHELLE MATHEWS &
ZIRBEL LLP
ATTORNEYS AT LAW

ATTORNEYS

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June 20, 2008

Geothermal PEIS
c/o EMPS, Inc.
182 Howard Street, Suite 110
San Francisco, CA 94105

Re: PEIS

Gentlemen:

Please add the undersigned to the mailing list in connection with all matters involving the Draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States ("PEIS"). Please provide to me all notices and other documentation which may be disseminated to the public in connection with the PEIS.

I would like to take this opportunity to provide some initial comments with respect to the PEIS. I am the attorney for Little Lake Ranch, located in the southerly portion of the Owens Valley of the County of Inyo, California. Little Lake's property is located very close to the Coso Geothermal Plant and a separate geothermal exploration project being conducted by Deep Rose, LLC, or its successor, Deep Rose Geothermal 16, LLC. Both projects are located within the jurisdiction of the Ridgecrest Office of the Bureau of Land Management ("BLM"). The property at Little Lake is approximately 1200 acres in size and contains a 90 acre lake, a series of ponds connected by flowing streams and interrelated wetlands that provide habitat for numerous species of migratory fowl, wildlife and flora. Little Lake depends upon the underground water aquifer known as the Rose Valley Water Basin to supply all of its water needs, as there is no surface water in the area.

By virtue of the manner in which Coso designed and has operated its geothermal facility, Coso is depleting the geothermal reservoir of fluids on which it relies to produce the steam and fluids to operate its facility. Because of the large and steady decline of fluids in the geothermal reservoir, Coso is seeking to import water from the Rose Valley Water Basin on which Little Lake relies for its water. According to Coso's own hydrologic studies, Coso's importation of water from the Rose Valley Water Basin could cause substantial environmental impacts upon the Little Lake property, including its lake, surrounding wetlands, habitat and wildlife.

The PEIS is largely lacking in any discussion or analysis concerning the proper utilization of geothermal resources. Notably, there is little to no consideration of alternate technologies by which the geothermal reservoirs are managed to allow for the sustainable production of electricity through the conservation of geothermal fluids by the proper design and operation of the production facilities themselves.

The difficulties of The Geysers operation located in Napa Valley, California, are illustrative. When geothermal production declined at The Geysers due to the loss of water within its geothermal reservoir, The Geysers was forced to import reclaimed water from at least two alternate sewage treatment plants for injection to replenish the underground geothermal reservoir. It would be prudent for any environmental analysis concerning the exploration, development and operation of a geothermal plant to consider the long-term management of the geothermal reservoir to limit or completely avoid the need for imported water. I-1-1

There is no question but that water is a very rare and precious commodity in most of the western United States,. Large portions of the western United States are subject to current drought conditions. Consumers are being asked to conserve the water they use. Geothermal facilities should be designed, constructed and operated in a manner to avoid the need for imported water and to balance the production of geothermal fluids to the natural recharge of the geothermal resource.

One possible explanation of the problems experienced at Coso and other geothermal facilities is their use of water-cooling towers to condense the steam used in the electricity generation process. Unfortunately, by utilizing water-cooling towers, Coso and other geothermal facilities lose a tremendous amount of the geothermal fluids produced, thereby causing a more rapid depletion of the fluids in the geothermal reservoir. There is no consideration in the PEIS of available alternatives, such as the utilization of an air-cooled system by which 100% of the geothermal fluids can be retained within the system and re-injected into the geothermal reservoir. This alternative may prolong the life of the reservoir and allow for a more sustainable production of electricity from the geothermal plants. I-1-2

Similarly, the PEIS does not address the preservation of the geothermal reservoirs through proper long-term management. First, there is no mention of the need to balance the natural recharge of the geothermal reservoirs, compared to the consumption of the fluids from the electrical plants. Second, there is no consideration of the proper size and production capability of an electrical plant to reduce water consumption. In either case, a proper management of the resource could eliminate the need for imported water and allow for a more sustained production over a longer period of time. I-1-3

The reliance upon imported water, even treated wastewater such as occurs at The Geysers, is a short-sighted and environmentally risky answer to geothermal reservoir depletion. Because of the scarcity of water throughout the western United States, perhaps such water resources could be better used, rather than simply injecting water into a geothermal reservoir to produce energy. The PEIS should address the availability of local water sources for injection, whether such water sources are adequate to supply all competing needs and uses of any projected water used for injection, and whether the imported water source is naturally replenished. I-1-4

Without a full consideration of alternative technologies, such as air-cooled mechanisms or other engineering designs to reduce the use of water and increase the amount of the geothermal fluids used for injection, the PEIS does not adequately study and comment upon appropriate and prudent steps to mitigate the depletion of water resources. The possible depletion of geothermal reservoirs, and any plans to import water from the surrounding surface and groundwater sources should be considered in all planning stages. I-1-5

Very truly yours,

ARNOLD, BLEUEL, LAROCHELLE,
MATHEWS & ZIRBEL, LLP

Gary D Arnold

Gary D. Arnold

GDA:jw
cc: BLM-Ridgecrest
Little Lake Ranch
County of Inyo

I-1-1

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1, *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis. Site-specific impacts on water resources, including water importation, would be addressed as part of the environmental analysis for the permitting process.

I-1-2

As noted in the above response, the PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1, *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting).

I-1-3

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. BLM and FS would work with interested and affected parties to identify and resolve resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

I-1-4

See above response for comment I-1-3.

I-1-5

As noted above, issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1, *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process. BLM and FS would work with interested and affected parties to identify and resolve resource conflicts. Appropriate site-specific mitigation would be developed as necessary.

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June 30, 2008

Geothermal PEIS
c/o EMPS, Inc.
182 Howard Street, Suite 110
San Francisco, CA 94105

Re: PEIS

Gentlemen:

I am the attorney representing Little Lake Ranch, Inc. ("LLR"). LLR owns approximately 1,200 acres of land located within the Rose Valley portion of the southern Owens Valley, Inyo County, California. The LLR property contains a navigable body of water known as Little Lake which is approximately 100 acres large. Flowing south from Little Lake is a series of separate ponds, streams, springs and water features. This area further contains associated riparian habitat, wetlands and a vast environmentally sensitive area hosting numerous species of vegetation and wildlife. Migratory fowl depend on Little Lake.

The Little Lake property lies approximately 9 miles southwest of the current geothermal operating plant ("Electrical Plant") managed by Coso Operating Company ("Coso"). Coso has filed an application with the County of Inyo ("County") requesting permission to pump approximately 4,800 acre-feet of water per year from property it purchased within the Rose Valley and transport the water to the Coso Electrical Plant for purposes of injection. According to Coso's own hydrology consultants, such water pumping and transportation project ("Project") could result in the loss of over 60% of the water resources available to LLR. Such an enormous loss of water could cause catastrophic impacts to the Lake, the surrounding wetlands and riparian habitat, and all of the vegetation species and wildlife on which they depend. County is currently processing an Environmental Impact Report ("EIR") under the California Environmental Quality Act. The Project further requires a right-of-way ("ROW") from the Bureau of Land Management ("BLM") to transport the water over federal lands.

During this planning process for the Project, LLR has become much more aware and sensitive to the environmental impacts which may be caused by the siting, location, design, and operation of geothermal facilities operated for the production of electricity. Although the EIR on the pending Project has not yet been released for public review or comment, we are concerned that the EIR will not adequately discuss a number of environmental concerns. Similarly, the Pending

Environmental Impact Statement for Geothermal Leasing ("PEIS") fails to identify, discuss, evaluate or mitigate some crucial impacts as more particularly identified below. While some of the factors noted are measured and influenced by site-specific conditions in relationship to a particular geothermal reservoir, the PEIS should identify all of the environmental issues below and make sure that any site-specific environmental assessment for a specific leasing application should address them in detail.

While the extent of any available geothermal resource is largely unknown during the exploration stage, the existence of the resource will be identified, but its size and composition should be estimated. The amount of electrical production from the geothermal resource should be based upon the size and extent of the reservoir so as to create a sustainable facility. This may reduce the immediate production of electrical energy, but allow for a greater and longer term utilization of the resource, with fewer impacts on the environment as noted below. I-2-1

The PEIS does not evaluate in any fashion the environmental impacts from the alternate designs of available geothermal facilities. The principal designs currently include single-flash systems, double-flash systems, dry steam (depending upon the actual geothermal resource available), binary and any number of hybrid designs incorporating one or more of the foregoing. More exotic designs may further utilize combinations of other energy production methods (fossil fuel, hydroelectric, solar, wind, biomass, etc.), each of which alternate designs pose different environmental impacts. Absent an identification of the projected design of the geothermal facility, it is virtually impossible to accurately assess the ultimate environmental impacts from the utilization of the geothermal resource. I-2-2

Of the 7 identified geothermal leasing applications which are now pending and addressed in the PEIS, 5 of them propose binary systems. There are no designs referenced with respect to the other 2. The PEIS should identify each alternative design and identify the particular environmental impacts associated with each form of a design. Indeed, each and all of the designs should be further analyzed to conserve the geothermal resource itself, as well as minimizing any impacts to the environment each of the alternative designs may pose. Each design should consider how toxic emissions will be minimized and the use of water conserved. I-2-3

The PEIS mentions possible impacts to underground water sources, typically consisting of known underground water basins or aquifers. The PEIS does not separately address or evaluate situations wherein the geothermal reservoir exists as a separate and distinct water basin. In most cases, the geothermal reservoir, containing heated water or steam, or both, (hereafter called herein "GeoReservoir") exists in the form of a water basin, but it is generally separate and distinct from underground water basins/aquifers ("Water Basins"), which are used by the overlying owners for drinking water, irrigation, domestic uses and other typical residential, agricultural, industrial and commercial uses. As such, there can be much confusion between the relationship in the PEIS of these separate resources. While there may be some hydrological connection between the GeoReservoir and the Water Basins, the PEIS does not identify the distinction, nor really evaluate what impacts the use and consumption of the GeoReservoirs may have on the local Water Basins. I-2-4

Are there any connections? If so, what are the environmental impacts? If not, will the Water Basins be used for make-up water in the geothermal plant, and what impacts would this cause on the surrounding environment?

Because of Coso's design of its facility, it has overextended its geothermal reservoir. The reservoir is being consumed and drying out. Thus, Coso seeks water from the Water Basins located within the Rose Valley, to the detriment of LLR and others in the community. This is just one example of an environmental impact, much like The Geysers importation of wastewater.

Depending upon the selected design of any geothermal facility, it may require imported water to reach sustainability. This is exactly the case of the The Geysers, and it is also the case in numerous other geothermal facilities around the world. The PEIS should consider as an environmental impact the exploitation of a GeoReservoir and the possible need for imported water to reach sustainability. What if the water sources are not readily available or may only lead to mounting environmental problems? I-2-5

Many geothermal facilities rely upon water cooling towers ("WCTs") to cool working fluids in a binary plant or steam condensate in dry steam, single flash and double flash facilities. In so doing, a substantial portion of the steam (approximately 85% according to published sources) is lost to evaporation during the cooling process, thereby limiting the geofluids which could otherwise be injected.

The PEIS fails to adequately identify throughout the document the different type of fluids that are contained in a GeoReservoir. Numerous different terms are used interchangeably, but should not be. There are discussions of steam, geofluids, liquids, fluids and the like. It is not correct to say that all fluids produced at a hypothetical geothermal facility are available for re-injection. Geofluids or fluids can be composed of both liquid and steam. While generally the liquids can be re-injected, that portion of the original geofluids which is steam, may not be re-injected, if the design of the facility uses WCT. Because 85% of the steam component is lost to evaporation in the WCT, a similar large amount of the original geofluids may <u>NOT</u> be available for re-injection. This confusion from the use of suspect terminology should be clarified. I-2-6

The PEIS should consider the environmental impacts from allowing WCTs when compared to systems relying upon air-cooled condensers ("ACCs"). The ACC systems would allow for 100% of the geofluids produced at a geothermal plant to be injected, because there are no evaporation losses of the original steam. By eliminating water loss through the WCTs, the geothermal resource can be better preserved, resulting in more sustainable production and minimizing impacts on available water sources. I-2-7

If the WCT design facilities are evaluated, then the PEIS needs to further consider and evaluate where the make-up water will originate and what impacts the use of such imported water will have on the region from which the make-up water is taken. For instance, The Geysers relies upon wastewater imported from 2 sewage recycling plants. While this may be an admirable use of I-2-8 wastewater which perhaps would not otherwise be utilized, many recycling projects are under way throughout California and at other arid climates to make use of recycled water. The commitment of such imported water resources to geothermal plants will then cause impacts from, and prevent other uses of, such recycled water in the areas from which they are taken. What consideration or evaluation should be made of this situation?

Similarly, and particularly in arid areas, the importation of water from either surface water or surrounding Water Basins may have severe impacts upon the area from which the water is taken. Such water will no longer be available to preserve vegetation, natural habitats, riparian areas, and wetlands. Not only may the habitat suffer, but the wildlife which depends on such habitat may also be impacted. I-2-9

In all cases, the design of the geothermal facility is critical in determining what consequences may arise from water utilization at the geothermal plant. A realistic assessment of environmental impact cannot be made until the design of the plant is known and studied among competing alternatives. The PEIS should note these differences and make sure that these impacts are studied on each and every proposed geothermal lease. I-2-10

In 2 of the 7 pending lease applications being reviewed for environmental assessments, no mention is made of the type of geothermal plant. This should be corrected and the impacts mentioned above should be evaluated. I-2-11

Another possible environmental impact has not even been mentioned. All energy-producing plants emit heat to the atmosphere and environment. This is a natural consequence of power production. Indeed, geothermal power plants emit considerably more heat per unit of energy produced than most power plants, including fossil fuel and nuclear. (See DiPippo, *Geothermal Power Plants, Principals, Applications, Case Studies and Environmental Impact*, Second Edition, 2008, at page 406). I-2-12

The foregoing are broad conceptual problems with the PEIS. The following comments will more specifically identify portions of the PEIS which should be corrected, clarified or supplemented by appropriate study and analysis.

At Page 2-35, Table 2-7, the projected MW production at the Coso area in the year 2015 is 75 MW and 150 MW at the year 2025. However, Coso's current rated capacity is around 270 MW, although its actual production may be less. What accounts for this substantial reduction in current capacity, or is this table in error? I-2-13

The PEIS states a typical 50 MW plant would utilize a site area of between 20 to 25 acres to accommodate needed equipment, of which the power plant itself would occupy 25% of the area for a water-cooled plant, or about 50% for an air-cooled plant (Section 2.5.1, Page 2-45). Clarify whether an air-cooled plant would require more land, or just use more to the noted site. I-2-14

The PEIS asserts that most geothermal fluids produced are re-injected back into the geothermal reservoir. In flash-steam facilities, about 15-20% of the fluid would be lost due to flashing to steam and evaporation. Binary power plants utilize a closed-loop system and the geofluids are re-injected with no fluid loss (Page 2-47). This also perpetuates a very loose definition of "fluids." Actually, 85% of the steam used in flash or dry-steam plant is lost to evaporation, when a water-cooled tower is used. Moreover, depending on the type of GeoResource, the percentage of steam produced, and the type of cooling system, the statements are very misleading. The total loss of the "fluids" depends on both the nature of the produced geofuilds, and the type of cooling system, and whether the plant actually re-injects the available fluids. This should be clarified and discussed. I-2-15

Impacts on geologic resources and seismic issues were evaluated. The high pressure injection of fluids directly into fault zones has been related to increases in seismic activities (Section 4.3.2, Page 4-18). The PEIS then notes that the high pressure injection of fluids from outside the geologic system is not the same as where geothermal fluids are withdrawn and then re-injected for a near zero net change, and would represent a much lower risk of increasing seismic activity (Page 4-19). This conclusion ignores the dramatic loss of heated liquids from evaporation when WCTs are employed at the facility for cooling purposes. Indeed, if there is no source of make-up water from nearby surface waters or Water Basins, and a WCT system is used, then the GeoReservoir can be substantially depleted of water over time, actually increasing the possibility of seismic activity. I-2-16

The PEIS notes that subsidence can also occur when groundwater is pumped from underground aquifers at a rate exceeding the rate at which it is replenished. Since geothermal development includes re-injection of the geothermal fluids, it is assumed that the potential for subsidence is low (Section 4.3.2, page 4-19). For the same reasons discussed above, this conclusion ignores the dramatic loss of heated liquids from evaporation when WCTs are used, and there is a high portion of steam in the geofluids. I-2-17

At Section 4.7.3, Page 4-44, the PEIS does mention that geothermal resource utilization could affect groundwater resources because of consumption of water by evaporation and the need to re-inject water to replenish the geothermal reservoir. It is noted that the availability of water resources could be a limiting factor which may affect the expansion of a geothermal resource in a given area. Make-up water is used sometimes to replace the evaporative losses and blowdown in a water-cooled system. While the PEIS notes the impacts, it does not consider appropriate mitigation measures to reduce the need for make-up water, by the design of the plant. I-2-18

The source of cooling water could be either surface water or groundwater (Page 4-44). During operations, most geothermal fluids produced are re-injected. In flash-steam facilities, about 15-20% of the fluid would be lost due to flashing to steam and evaporation, while binary plants are non-consumptive and use a closed-loop system (Page 4-44). These conclusions are not accurate. Even binary plants use cooling plants, and if they rely on water cooling systems, then make-up water for the cooling must be imported and evaporated, thereby consuming valuable water resources. Moreover, the estimate of a 15-20% loss of the original produced geofluids may be I-2-19 accurate, depending on the composition of the geofluids, but is enormously understated as the level of steam produced as part of the geofluids increases, such as at The Geysers.

The PEIS finally discusses the use of air-cooled systems at Page 4-45. Air-cooled systems use less cooling water and are more common in arid regions. Air-cooled systems would have fewer impacts associated with cooling water. The comparisons among various designs, and how they affect the environment, should merit more discussion and analysis. I-2-20

Section 4.10 discusses the various impacts upon fish and wildlife. Primarily, the impacts would be associated with the elimination or degradation of wildlife habitat at project sites in immediately adjacent areas, or within the watershed (Page 4-73). Such degradation could also be due to water usage from areas from which water is imported for injection. This should be mentioned. I-2-21

There is some acknowledgment that geothermal power production could deplete the thermal energy and water from the geothermal reservoirs. (Page 5-27). To minimize this impact, it is simply noted that the super-hot water extracted from the reservoirs could be injected back into the reservoir, but it also notes that over time the resources could be depleted to uneconomic levels. (Page 5-27). Shouldn't the PEIS discuss reduction of power production and the use of other alternatives to minimize or prevent these results? I-2-22

Sections 5.4.8, 5.4.9 and 5.4.10 deal with cumulative impacts to vegetation, fish and wildlife, and endangered species. In each case, the impacts are generally limited to the actual operation of the geothermal plant without consideration of water losses leading to direct impacts on these resources. I-2-23

Chapter 15 discusses the geothermal leasing project within the Mt. Hood National Forest, Prineville Field Office, Oregon. The applicant expects to develop 2 geothermal power plants, 1 consisting of a 30 MW plant and the other a 20 MW plant (Section 15.2.4, Page 15-10). No mention is made of the intended design or type of the geothermal facility. Shouldn't part of the environmental analysis include the actual type of geothermal facility so that its specific impacts upon water resources, habitat and biological resources can be identified and calculated? I-2-24

Chapter 16 discusses the geothermal leasing application within the Willamette National Forest, Salem District, Oregon. The proposal is to ultimately develop 2 power plants, 1 a 30 MW plant and the other a 20 MW plant (Section 16.2.4, Page 16-9). Neither the design or type of the geothermal facility is mentioned, nor its water consumption considered. Shouldn't part of the environmental analysis include the actual type of geothermal facility so that its specific impacts upon water resources, habitat and biological resources can be identified and calculated? I-2-25

Appendix C is a listing of certain areas within the study area which are considered an Area of Critical Environmental Concern ("ACEC"). Interestingly, there are no areas in California listed. While perhaps an oversight or omission, why are no California sites listed within Appendix C? I-2-26

Appendix D is entitled "Best Management Practices" and it provides a summary of the typical requirements that should be adopted and imposed as mitigation measures for environmental impacts. The Best Management Practices ("BMP") are stated to be state-of-the-art mitigation measures applied on a site-specific basis to reduce, prevent or avoid adverse environmental or social impacts (D-1).

Consider the specificity of the BMPs directed to the protection of visual resources (D-46-51). Then, compare the limited and almost non-existent BMPs regarding the protection of water resources, the habitat, wildlife, pollution and other major possible impacts from geothermal facilities. It is suggested that more specific BMPs be adopted regarding the design of geothermal plants, the projected production of geofluids when compared to the capacity and nature of the GeoReservoir, the methods employed to conserve water resources and the GeoReservoir, and each of the other environmental impacts noted in the PEIS. Just as importantly, the PEIS and the BMPs adopted therein, should include specific standards and practices designed to achieve a long-term sustainable production plant, without sacrificing the environmental conditions in which the plant is located. I-2-27

Appendix H is entitled "Federally Listed Species." The Mojave Ground Squirrel is not listed, but it is a California-designated endangered species. Shouldn't the PEIS list all of the state-protected species as well? I-2-28

Thank you for the opportunity to comment upon the PEIS. The geothermal resources themselves are an environmental asset and the impact to the resource should also be studied and protected. They should not be overextended or wasted. I look forward to receiving answers to these questions and observations as well as the revised PEIS.

Very truly yours,

ARNOLD, BLEUEL, LAROCHELLE,
MATHEWS & ZIRBEL, LLP

Gary D. Arnold

Gary D. Arnold

GDA:jw
cc: BLM-Ridgecrest
Little Lake Ranch
County of Inyo

I-2-1

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1, *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

I-2-2

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1, *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

I-2-3

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1, *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

I-2-4

The geothermal lease is for the heat in the federal mineral estate. Unless specifically owned in fee, the fluid part of the resource falls under state laws. Therefore, the amounts of fluid that can be extracted or injected is subject to the individual states' allocation programs, as is the use of other groundwater or surface water sources. The water rights to these fluids, and whether there are better uses for them, is not the subject of this PEIS. The potential for depletion of other sources would be part of the evaluation of each individual lease.

The PEIS does discuss potential water quality impacts to the geothermal resource and other groundwater and surface water sources from the geothermal activities.

Where the geothermal resource includes both heat and fluids (water, steam, or a mix), these resources may or may not be hydrologically connected with local and regional aquifers. Where they are connected, the depletion of fluids from the geothermal resource could impact the availability of water from the other sources of groundwater, or in rare cases, even surface water (e.g., hot springs). More commonly, the reservoir pressure is easier to maintain in situations where the geothermal reservoir is naturally recharged via a connection to the surface. Local conditions would determine the manner and degree to which the systems are hydrologically connected. However, this would not occur (i.e., there is no water loss or drawdown of the geothermal reservoir) in binary situations (most existing plants), because the system is a closed loop that recaptures all water and condensate for reinjection into the same reservoir it is drawn from; the goal is to maintain reservoir pressure. In every case, the operator is required to protect other aquifer zones from mixing or being depleted.

Where the geothermal resource is not connected with other groundwater systems, there is little likelihood that depletion of fluids from the geothermal resource would directly impact the availability of water from the other groundwater systems. The use of other water resources to “replenish” the geothermal resource using other sources is only necessary in the case of “flash” or steam-run plants, which are rare, and would be subject to subsequent allocation permit decisions at the state and federal level. Any new action would also have to comply with environmental laws.

The PEIS discusses the amount of geothermal fluid lost to the system due to emission of steam and cooling losses. New language has been added to state that the generation of electrical power through geothermal energy from flash plants requires the use of varying amounts of water from other sources for cooling purposes depending on the technology used, the temperatures involved, and climatic conditions. The environmental impacts of the use of water from other sources for cooling purposes depend on the source, the amount used, and the ultimate disposition. The different demands for water from the other sources is the subject of water rights and is not covered in this PEIS. This PEIS includes restrictions and mitigations regarding leasing in designated source water protection areas and municipal watersheds or near water bodies, riparian areas, and wetlands. Other restrictions and stipulations apply for special status species and habitats that could include water resources.

These conditions and the potential to impact them vary by location and the proposed development. Prior to making leasing decisions, BLM will assess whether the existing NEPA is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis. Prior to BLM allowing any drilling activities, the lessee will be required to obtain necessary permits from the appropriate state agencies and will be required to isolate and protect groundwater sources from contamination and depletion.

I-2-5

Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. BLM and FS would work with interested and affected parties to identify and resolve resource conflicts. Appropriate site-specific mitigation would be developed as necessary. The use of other water resources to “replenish” the geothermal resource using other sources would be subject to subsequent permit decisions at the state and federal level. Any new action would also have to comply with relevant environmental laws. As discussed in Section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

I-2-6

Since the PEIS must include multiple environments, geothermal reservoir, and power production technologies, the language used is meant to be general and encompasses all fluids (water, steam, and mix) except where specified as one type. Text has been added to clarify that most of the power production anticipated to occur is by binary systems followed by flash steam systems. Geothermal resource with potential for dry steam power production, the type discussed in the comment, is very rare. The Geysers is the only such resource in the United States. Other methods will require considerable development before production leasing becomes more common. See also response to comment 1-2-4.

I-2-7

As noted above, the PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis. All development and utilization and reclamation activities, including impacts of WCTs or ACCs, would be subject to further site-specific permitting and environmental analysis.

I-2-8

Site-specific impacts on water resources, including water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities, including the use of reclaimed water, would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate.

As discussed in Section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

I-2-9

See response to comment 1-2-8, above.

I-2-10

As noted above, the PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis. All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

I-2-11

As noted above, issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site. Site-specific impacts would be analyzed prior to any development activities for the lease sites.

I-2-12

Temperature is not a resource required to be analyzed under NEPA. No environmental resources requiring analysis under NEPA are expected to be affected by heat release by geothermal plants.

I-2-13

This and all RFD numbers come from the Western Governor Association's Geothermal Task Force Report. We are unable to verify data from each location.

I-2-14

An air-cooled plant would require more land and would be closer to the average 25-acre site, whereas a water-cooled plant would require less land and the total site would be closer to 20 acres.

I-2-15

See responses to comments 1-2-4 and 1-2-6.

I-2-16

When fluid is extracted from a geothermal resource, the fluid pressure is decreased, increasing the potential for subsidence and compaction. This can result in an increased number of very small earthquakes with little risk for damage. The greater risk is from injection of fluids into a system, resulting in increased pressure and effective "lubrication" of existing faults. This can result in larger earthquakes occurring along the "lubricated" faults.

Reinjection of extracted fluids helps maintain the existing pressures. As long as reinjection does not occur directly into a fault, maintaining the existing pressures does not increase the potential for large earthquakes.

I-2-17

See responses to comments 1-2-4 and 1-2-6 for discussion of development of high steam areas.

Subsidence also depends on the geological characteristics of the area where the geothermal fluids are extracted, or where any other groundwater source used for cooling may be extracted. These conditions and the potential to impact them vary by location and the proposed development. Prior to making leasing decisions, BLM will assess whether the existing NEPA is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis.

I-2-18

Site-specific impacts on water resources, including water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. Appropriate site-specific mitigation would be developed as necessary.

I-2-19

Site-specific impacts on water resources would be addressed as part of the environmental analysis for the permitting process. The PEIS discusses the amount of geothermal fluid lost to the system due to emission of steam and cooling losses. New language has been added to state that the generation of electrical power through geothermal energy requires the use of varying amounts of water from other sources for cooling purposes depending on the technology used, the temperatures involved, and climatic conditions.

In assessing the RFDS, the PEIS discusses the total fluid expected to be extracted per lease (2 wells with up to 5 million gpd). The PEIS also discusses the amount that could be reinjected for closed loop systems (10 million gpd) and flash steam facilities (8 to 8.5 million gpd). Dry steam power plants like The Geysers do not reinject any fluids. However, resources capable of being developed for dry steam power plants are very rare. The Geysers is the only such resource in the United States. Text has been added to the PEIS to discuss the rarity of potential dry steam resources.

I-2-20

As discussed in responses above, issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis. All plants would require site-specific permitting and environmental analysis prior to development.

I-2-21

As discussed in responses above, prior to leasing, the BLM or FS would collaborate with appropriate state agencies, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site specific impacts on water resources, including groundwater and water importation would be addressed as part of the environmental analysis for the permitting process.

I-2-22

As noted above, site-specific impacts on water resources, including any impacts on groundwater, would be addressed as part of the environmental analysis for the permitting process prior to development or utilization.

I-2-23

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife.

Furthermore, all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including analysis of cumulative impacts as appropriate.

I-2-24

Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1, *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis, including analysis of water resources and biological resources.

I-2-25

See above response for comment I-2-24.

I-2-26

ACEC data were provided by individual state offices and may not represent a comprehensive list. Geothermal leasing will recognize existing ACECs. Leasing will be prohibited or restricted on ACECs where the BLM determines that geothermal leasing and development would be incompatible with the purposes for which the ACEC was designated or for those whose management plans expressly preclude new leasing or development for oil and gas or geothermal resources.

I-2-27

BMPs included in the PEIS for visual resources are more specific because all BLM and FS lands can be assessed and put into a few specific categories. In contrast, water and biological resources are highly location specific. BMPs for water and other resource in this document are intended to provide BLM and FS offices the flexibility to respond to different local needs. Local staff will consult with local stakeholders and develop BMPs and stipulations that are appropriate for the protection of those resources.

I-2-28

As stated in Section 3.11.1, the state-listed species that occur in the planning area that may be affected by a particular project would be identified in site-specific environmental analysis.

geothermal_eis

From: Mary_Christensen@blm.gov [Mary_Christensen@blm.gov] **Sent:** Thu 6/26/2008 4:15 PM
To: geothermal_eis
Cc:
Subject: Mail forwarded from geothermal_eis@blm.gov
Attachments:

This message has been automatically forwarded from geothermal_eis@blm.gov.

"Theodore M. Seeber" <seebert@aracnet.com>
06/26/2008 05:12 PM

To <geothermal_EIS@blm.gov>
cc
bcc
Subject As I'll be on vacation on the coast for the public meeting

I can only hope that somebody has mentioned the danger of such plants- and the technological solution.

I-3-1

The danger: Pumping out too much water, lowering the pressure on fault lines, thus causing earthquakes.

The solution: heat exchangers and reinjection pumps.

Ted Seeber

Beaverton,OR

I-3-1

As stated in Sections 2.5.1 and 4.3.2, geothermal fluids will be used and then reinjected for near zero net change in fluids. This procedure would represent a low risk for increased seismic activity.

Also see response to comment 1-2-16.

GLITNIR

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July 1, 2008

Rf: Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (PGEIS)

To Whom It May Concern:

Herewith, Glitnir would like to comment on the joint Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (PGEIS) of the Department of the Interior's Bureau of Land Management and the U.S. Department of Agriculture's U.S. Forest Service.

In the United States, the majority of the land with geothermal potential can be found within the western states. For electrical generation or direct heat applications, about 530 million acres in the 12 western states have the geothermal potential. Roughly half of this land, 248 million acres, are on federal land administered by the US Department of the Interior, Bureau of Land Management (BLM) and by the US Department of Agriculture, the National Forest System (NFS).

For developing geothermal projects on those lands, clear leasing processes, leasing decision and administrative guidance are essential for the much needed increase of geothermal energy development in the United States. The implications of any efforts aimed at improving and speeding up the current processes are not to be underestimated. C-4-1

Glitnir therefore commends the efforts by the Bureau of Land Management and the U.S. Forest Service, to programmatically improve leasing processes for geothermal development on federal land, while at the same time clearly point out the importance to fulfill its role in protecting the environment in the land administered by these two agencies.

Glitnir would like to comment on the main points that are put forward in the PGEIS.

Regarding the "proposed action", we support that statement there is need for clear identification of land open or closed to leasing for geothermal development and clarity about pending lease applications. The efforts for formulizing concrete points of stipulations, best management practices and procedures will provide the consistent guidance needed by the industry. The same applies the amendment of land use plans according to the aforementioned. C-4-2

Glitnir shares the opinion of BLM and NFS for the needs for federal action, namely the push for issuance decision on lease applications, time limits as set for by the EPAct of 2005, the call for clean and renewable energy and the impact that this will have on the U.S., e.g. for energy imports, reducing greenhouse gas emissions.

Regarding PGEIS intending to take lands "off-limit" to leasing, we see a strong need for a concrete explanation to the reasons, as well as the need for concrete discussions about the possible impact and trade-offs regarding the decision to not consider the possible leasing of those lands today or in the future. C-4-3

The PEIS gives three different alternative scenarios, while only Alternative B and C are scenarios of a real improvement. We clearly favor the "proposed action" as lined out in Alternative B, which would legally open the most of the public land administered by BLM and NSF to the possibility of geothermal leasing. The guiding resource management plan as put forward here, would provide for a clear process, which is essential for streamlined geothermal development and the dealings of developers between and with BLM, as well as the NFS. We would favor clearer rules on the possibility for access to national park land in this plan, but support a determination of non-discretionary and discretionary determination as put forward in the document. C-4-4 C-4-5

The "leasing (of) lands near transmission lines" (Alternative C), would limit the development of geothermal energy along these 20-mile corridor too much from our perspective. It might loose out on favorable geothermal resources that would otherwise be of good potential for geothermal power development. C-4-6

With increasing energy prices and demand for clean energy resources, geothermal has one of the largest potential of the renewable energy sources "meeting the increasing energy demand, while reducing reliance on foreign energy imports, reducing greenhouse gas emissions, and improving national security", as put forward by the PEIS. Therefore, we believe that it is of utmost importance to make sure that Alternative B will be considered the only feasible answer to those immediate demands for clean energy in the United States. Alternative C, can only be an emergency alternative should it not be able to get Alternative B through all necessary decision channels. It has to be clear that Alternative A is no alternative at all and cannot be considered as an option for any further development of geothermal energy in the United States. C-4-7

The comprehensive list of stipulations, best management practices and procedures for the land use amendment process and subsequent permitting, can be considered to be very positive, and it will be essential to include any input from all affected industry players. Only if the voices of the industry are heard and their opinions and concerns are taken into consideration, these processes will have the impact that both, BLM and NFS, as well as anyone involved in geothermal energy development, are wishing for with these efforts put forward in the PEIS. C-4-8

The clear advantages of geothermal energy, as described by PEIS and the minimal environmental impact should provide enough incentives to push for the improvement of current land leasing processes for geothermal development on federal land.

We would like to encourage all parties that are indirectly or directly involved in geothermal energy development in the United States to take the opportunity to participate in the open discussions of the public meetings scheduled across the western States in July of this year. It is of utmost importance for the industry to take part in these discussions as they can and will have a big impact on further development of geothermal energy development. Constructive participation will show that the industry supports all efforts aimed at speeding up the development, while at the same time be heard about concerns regarding those efforts.

With kind regards,

On behalf of Glitnir
Árni Magnússon, Managing Director – Glitnir Sustainable Energy

C-4-1

The commentor's support for a programmatic document is noted.

C-4-2

The commentor's support for the proposed alternative and decisions on pending lease applications is noted.

C-4-3

The comment is noted.

C-4-4

The commentor's support for the Proposed Action is noted.

C-4-5

Leasing is not permitted on NPS by non-discretionary determination. In addition, leasing is prohibited on lands where it is determined, based on scientific evidence, that exploration, development, or utilization of the lands, subject to the lease application or nomination, is reasonably likely to result in a significant adverse effect on a significant thermal feature within the National Park System (see Section 2.2.2).

C-4-6

The comment on Alterative C is noted.

C-4-7

The comment is noted. Input from all commentors, including industry, has been considered in the formation of the Final PEIS.

C-4-8

The commentor's preference for Alternative B is noted.

geothermal_eis

To... Mary_Christensen@blm.gov

Cc...

Bcc...

Subject: RE: Mail forwarded from geothermal_eis@blm.gov

Attachments:

From: Mary_Christensen@blm.gov [mailto:Mary_Christensen@blm.gov]
Sent: Sat 7/5/2008 10:27 AM
To: geothermal_eis
Subject: Mail forwarded from geothermal_eis@blm.gov

This message has been automatically forwarded from geothermal_eis@blm.gov.

Dot Sulock
<dsulock@unca.edu
>

07/05/2008 11:24
AM

To
geothermal_EIS@blm.gov
cc

bcc

Subject
opening public lands for geothermal
is a good idea

Geothermal energy is vastly superior to nuclear or coal and frees us from dependence on foreign oil. We need all the geothermal energy we can get. Support new geothermal exploration on federal lands. I-5-1

Dot Sulock, University of North Carolina at Asheville

I-5-1

Thank you for your comment.

geothermal_eis

From:	Mary_Christensen@blm.gov [Mary_Christensen@blm.gov]	**Sent:**	Tue 7/8/2008 9:16 AM
To:	geothermal_eis		
Cc:			
Subject:	Mail forwarded from geothermal_eis@blm.gov		
Attachments:			

This message has been automatically forwarded from geothermal_eis@blm.gov.

Katie Fite
<katie@westernwat
ersheds.org>

07/08/2008 10:14
AM

To
<geothermal_EIS@blm.gov>
cc

bcc

Subject
Geothermal EiS comments

July 7, 2008

Geothermal Programmatic EIS
c/o EMPSi
12 Howard Street, Suite 110
San Francisco, CA 94105

e-mail: geothermal_EISblm.gov <mailto:geothermal_EIS@blm.gov>

Dear BLM,

Here are comments o Western Watersheds Project on the geothermal development EIS. We are very concerned that BLM is about to allow near-unfettered access an damage to public lands under the Programmatic Wind EIS (already finalized),the Solar EIS, the Geothermal EIS, and innumerable new energy corridor propsals. The devastating ecological Footprint of all of the foreseeable evelopment under this series of EISs (as well as Oil and Gas leasing and other such activty) on sage-grouse, pygmy rabbit and other important and sensitive species ust be fully examined here. 0-6-1

We are very concerned about the filure of the process to provide a framework for rejection/avoidance of solar development on ecologically 0-6-2 important public lands. A set of specifi criteria must be established for examination of ³appropriate² vs. ³inapproprate² siting.

For example, if a geothermal plant and associated roading, owerlines, impacts to water tables, increased human disturbance, habitat fragmentation and other effects is proposedfor an area with a small and/or declining population of sage-grouse, geotermal facilities/ development should not be allowed to occur on those sits. Pleas establish a framework that clearly allows this to happen. We aso ask that you amend the current Wind EIS as part of this geothermal process t add this environmental safeguard to it. Right now, entirely inapproprate and disastrous development is being proposed under that document in Browns Bench/China Mountain and other areas and project proponents/foreign evelopers are saying ³The Wind EIS says development here is ok². This is EXACTLY the stuation that the geothermal EIS must avoid where it is used to justify/cver destruction of critical sage-grouse and other wildlife habitats.

0-6-3

0-6-4

Thisprocess seems aimed at throwing development of many sensitive areas and vunerable native species populations wide-open. A press release states:

The preferred Alternative in the Draft PEIS considers all public lands andNational Forest System lands with potential for geothermal development available for leasing except those that are withdrawn or administrativel closed to geothermal leasing. The Draft PEIS also evaluates another alternatve based on public input gained during scoping that would limit geotherml leasing for electrical generation to areas near transmission lines².

0-6-5

Man BLM Land Use Plans and Forest Plans are old and outdated, and are not crrent inventories of lands and values. New plans finalized in particular oer the past 8 years of the anti-science Bush administration - whre industry desires have trumped all else can not be viewed as using best Avilable or current science in establishing avoidance areas, special naturalareas, or other sites where geothermal exploration/development or oher energy activity may have devastating impacts.

BLM must also establih a process that examines the relative scarcity of the ecological and natral/recreational values affected by geothermal development and exploratin and other ³renewables² on public lands.

BLM must establish a processthat adequately examines the whole Footprint of disturbances and stresss on ecosystems - and deny geothermal development where a series of overlaping and cumulative threats may be jeopardizing species survival.

Several ew alternatives that establish specific criteria for appropriate vs. iappropriate siting, and framework for establishing ³off-limit² areas where denial of leasing readily occurs must be develope as part of this process. Areas that should be evaluated as off-limits t leasing include: Important areas for sage-grouse, pygmy rabbit, and other rae and declining sagebrush-dependent species; Areas with water tables theatened by aquifer drawdown from mining, Las Vegas or other water export such as the Monoregion; areas threatened by irrigation from shallow or geothermal aquifers
sch as habitats for the Bruneau Hot Springs snail, and other vital landsand

waters.

BLM should also act to reconsider and potentially cancel all he flurry of geothermal leasing that is currently occurring especially in Nevada ad other areas where sage-grouse, pygmy rabbit and other species ae greatly threatened by any increased or new habitat fragmentation and loss as would occur with geothermal leasing, development and infrastructure. It eems BLM has conducted this to try to clear as many projects as possible prioto completion of even the minimal controls that could result from this ES. A full accounting of all leases recently issued or foreseeable must be part of this EIS. O-6-6

An honest and accurate ccounting of springsnails and other aquatic biota jeopardized by geothermal dvelopment and the direct, indirect and cumulative effects of livestoc grazing facilities, ag/irrigation, mine aquifer drawdown, SNWA water ming and export, and other activities must be provided as part of this ES. What are these species? What are there populations? What is occurrig with the aquifer levels? How will additional drawdown affect these speces? O-6-7

How might geothermal water removal affect cooler water aquifes and surface expression?

What is the potential for disrupting surface xpressions and flows from various forms of exploration or development inluding invasive dynamiting, drilling etc.? O-6-8

What potentially hazardous substances might be mixed with water re-injected?

How can industry/BLM be certain that anyre-injection does not disrupt aquifers or surface flow expression in ay way?

As mitigation for any geothermal development, purchase of private lnds, purchase and permanent retirement of public lands grazing permits, an removal of harmful spring ³developments² must be required as a range of mtigation actions. Sada et al. 2001 BLM Technical Bulletin details the dsastrous effects of livestock water developments on springs and seeps onpublic lands in the Interior West. It is thus very appropriate that removaland restoration of these very damaging spring developments and pipelines,
couled with removal of the stressor of livestock grazing and trampling disturbnce to spring and seep areas and watersheds, be part of the standardmitigation for geothermal activities on public lands. O-6-9

Please fully examine ow livestock-caused desertification processes may be affecting watershds, and aquifer infiltration (vs. rapid runoff) and slow release of waters. ow does this stress, coupled with geothermal development disturbance, affet ecosystems or natural processes? How do both these stresses affct habitats and populations for important and sensitive species?

How willdevelopment of geothermal energy on private, state or other non-public lans alter or affect the geothermal waters of public lands? Can O-6-10 one mega-geotermal pumping plants lead to rapid and sudden aquifer drawdown? Whereare such activities planned?

How will such geothermal explo and devlopment under this EIS affect the very important public recreational uses associated with public lands hot springs? What sideboards can be placed to liit or prevent losses of these unique and important places?

We are very concrned that geothermal development will be done on remote areas, most of the pwer lost in transmission to urban areas, large corporations will control th development, and the public end up with only desiccated hot springs, furter fragmentation and loss of iortant wildlife habitats with little energy actualy used.

If BLM is indeedto follow sensitive species policies, the ESA, its own claims of Conservation Plans for sage-grouse, then it must place many more limits on developent and places off‹limits to all energy disturbance than it has done so far in a similar EIS process for Wind which is right now alowing disastrous foreseeable development of China Mountain/Brown¹s Bench, Table Mountain on NV UT order, and other areas vital to sage-grouse. Geothermal development, withpowerlines galore and new rding may have similar impacts in some areas and this EIS process must establih a clear and easy path for BLM to evaluate and deny development in sensitive lands. 0-6-11

Pease see the recent Atamian Nevada studies on the effects of the Falcon-Gonder powerline on increasing raven numbers and sage-grouse declines. Mater¹s Thesis, and Five Year and other Progress Reports.

How might stagnant ools or ponds of water resulting from geothermal explo or development promote West Nile virus mosquitoes? Tis represents a migratory bird, sage-grouse and human health risk of much significance. 0-6-12

States have various water laws, allocation proceses, etc. Nearly all are drastically over-allocated. Yet geothermal andother aquifers are not based on state line boundaries. How does this affect the setting, risk and uncertainty wih any geothermal development on public lands? 0-6-13

How will livestock razing potentially be intensified as a result of pools of water and/or electricl lines to pump water associated with geothermal development be used for livestock pipelines nd thus the ecological damage caused or related to geothermal devlopment be intensified? / Under alternatives, no new livestock facilities should be allowed in association wih any rights-of-way/geothermal development. 0-6-14

Please apply the following concrns on the Westwide DOE Corridor, where appropriate, to thi geothermal EIS process as well. This includes all concerns raised fromweed impacts to the inefficiency of remote siting of energy facilities. Te full Footprint of any geothermal development, including in having large tansmission lines built especially for it, must be fully examined and sensitive areas placed off-limits to BOTH geothermaland Energy Corridor activity/authorization. 0-6-15

DOE West-wide Corrido PEIS

Sincerely,

Katie Fite
Biodiversity Director
Western Watersheds Project
PO Box 2863
Boise, ID 83701
208-429-1679

ATTACHMENTS

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O-6-1

Cumulative impacts, including impacts from other renewable energy development, are discussed in Chapter 5. Cumulative impacts on specific lease locations would be addressed in additional NEPA documents, when appropriate.

O-6-2

Addressing solar development is outside of the scope of this document.

O-6-3

Before issuing any leases, the BLM would conduct the necessary reviews to ensure that leasing would be compatible with the local land use plan and with all applicable state and local laws and regulations such as Endangered Species Act and National Historic Preservation Act. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

O-6-3

Amending the Wind EIS is outside of the scope of this PEIS.

O-6-5

Lands designated as open to leasing are subject to existing laws, regulations, and formal orders. In complying with these laws, regulations, and orders, some of the open lands may not be available for leasing. Chapter 2 explains, under *Procedures Prior to Leasing*, that the BLM and FS would comply with the requirements of the Endangered Species Act, including determining if any listed or proposed threatened or endangered species or critical habitat is present on nominated lease parcels and may be affected by any decision to lease. Chapter 6 of the Final PEIS, in turn, explains that the agencies have determined that the decision to lease has no effect on listed species or critical habitat.

To provide further protection for threatened, endangered, and sensitive species, the BLM will impose an Endangered Species Act stipulation (see Section 2.2.2) on all geothermal leases.

This document supports the amendment of plans to adopt the resource allocations, stipulations, procedures, and relevant BMPs for geothermal leasing, as outlined in the PEIS.

The best available science was used in the development of this document.

O-6-6

This document addresses lease applications pending as of January 1, 2005, as well as future geothermal leasing decisions. Current lease sales follow existing procedures outlined in the no action alternative, which include evaluation on a case-by-case basis, including NEPA documentation when appropriate.

O-6-7

Programmatic analysis of the impacts to fish and wildlife is included in Section 4.10. All development, utilization, and reclamation activities would require further site-specific permits and associated environmental analysis.

O-6-8

Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. BLM and FS would work with interested and affected parties to identify and resolve resource conflicts. Appropriate site-specific mitigation would be developed as necessary.

As discussed in Section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

There is no way to ensure that there will be no impacts whatsoever. This PEIS presents the information on the potential impacts to water quality and surface disturbance, as well as recommended restrictions and stipulations (discussed in Sections 4.7 and 4.6) to the decision maker for consideration as part of decision process.

O-6-9

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

O-6-10

The resource uses compatible with geothermal use are likely to vary depending on site-specific conditions. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process.

As discussed in Section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

O-6-11

The sensitive species stipulation in Section 2.19 states:

For agency-designated sensitive species (e.g., sage grouse), a lease stipulation (NSO, CSU, or TL) would be imposed for those portions of high value/key/crucial species habitat where other existing measures are inadequate to meet agency management objectives.

The BLM and FS have added a procedure prior to leasing in Chapter 2:

> The authorized officer of the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states manage and typically have regulatory authority for water quality, water rights, and wildlife.

The commentor did not provide enough information to locate suggested references.

O-6-12

This document covers only the land use planning and lease issuance stage. All development, utilization, and reclamation activities, including the use of holding pools, would be subject to further site-specific permitting and environmental analysis, including analysis of the impacts to fish and wildlife and human health and safety.

O-6-13

As discussed in Section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

O-6-14

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

O-6-15

Attachments, including comments for the west-wide corridor EIS, were reviewed and incorporated into revision when appropriate.

MONTANA HISTORICAL SOCIETY

225 North Roberts ✣ P.O. Box 201201 ✣ Helena, MT 59620-1201
✣ (406) 444-2694 ✣ FAX (406) 444-2696 ✣ www.montanahistoricalsociety.org ✣

Tuesday, July 08, 2008

DRAFT GEOTHERMAL LEASING PEIS
C/O EMPSI
182 HOWARD STREET SUITE 110
SAN FRANCISCO CA 94105-1611

RE: Comments *draft* Programmatic EIS for Geothermal Leasing in the Western US

Dear EIS Team:

Thank you for providing us an opportunity to comment on the *draft* Geothermal Leasing PEIS. As is the case with all such programmatic analysis the document is very broad and many resource sections so general so as to hamper effective assessment of effects to those very resources. That is the case here with the cultural resources sections. That lack of specificity has traditionally been accepted for review, at least for cultural resources, since no specific sites could be identified for specific actions/effects at this date. 0-7-1

Rather, general possibilities are dealt with in leasing situations with standard No Surface Occupancy/No Ground Disturbance Stipulations (NSO/NGD) casually referred to in the EIS and attached in leases as standard procedural requirements to be reviewed on a case by case basis during the much later Application for Permission to Drill. This generic programmatic approach is taken in this draft PEIS (see 4-109). The implication being that section 106 of the National Historic Preservation Act may be deferred until specific places and actions are known and that potential effects would then be avoided by NSO/NGD stipulations.

For many readers this may seem to be reasonable given the decision to be made is so broad, in fact vast in scope and breath.

However there are serious pitfalls recognized in the courts for taking this position. In particular, leases have been found to be undertakings requiring reasonable consideration of cultural resources (Historic Properties) under the National Historic Preservation Act (NHPA) prior to a decision which might adversely affect such places if they are later found to exist in a project area leased under an EIS Record of Decision. Most recently the Ninth Circuit Court in Pit River et. al. v. USFS et. al. (No. 04-15746, D.C. No. CV - 02-01314-DFL Opinion) affirmed yet again the necessity of a more effective procedure including cultural resource considerations prior to issuing decisions resulting in irreversible and irretrievable commitments of federal lands to proponents with, in this case, rights to drill which can not or will not be denied. Real and effective federal agency discretion in allowing or permitting or denying an action must remain after the decision (even a general "programmatic" decision) is issued in the Record of Decision (ROD) if specific avoidance of effects to significant places are proposed to be delayed until after the decision to approve the lease is made, and before potential specific cultural resources are identified and considered under section 106 (NHPA).

We recommend that the Ninth Circuit Court findings and published opinion be included in the analysis here. NSO/NGD stipulations have all too often been found to be ineffective tools in avoiding adverse effects for certain kinds of cultural places (such as Traditional Cultural Places -National Register Bulletin 38) or where the boundaries of the lease are constrained by ownership, other resource concerns or even simple topography. In such cases agencies should have, in order to effectively use the NSO/NGD stipulations, the right or authority to preclude disturbance (drilling) altogether (see above Opinion page 18209). As argued elsewhere (e.g. USDI Office of Hearings and Appeals Board of Land Appeals, Mandan, Hidatsa and Arikara Nation v. Marty Ott, BLM 08/18/2004, page 15) BLM statements that it can address and mitigate effects after a lease issuance are contrary to BLM interpretations of its own regulations at 43 CFR §3101.1-2.

Further, "The agencies have consistently interpreted this lease language as a grant [to Calpine] of an absolute right to develop (Pit River v. USFS Ibid page 18210)." The vested rights of lease holders in other words trump the standard stipulations otherwise protecting cultural resources as agencies claim and proceed as though they have no discretion to deny an Application for Permission to drill. 0-7-2

That being the case, the *draft* PEIS could easily be seen as misrepresenting the "protective" stipulations or at the very least not including reasonable disclosures of the potential problems with the basic procedural assumptions and claims built into the EIS and any leases sold under the ROD.

Sincerely,

Stan Wilmoth

Stan Wilmoth, Ph.D.
State Archaeologist/Deputy, SHPO

O-7-1

The PEIS provides multiple levels of protection for cultural resources.

The cultural resource stipulation states that 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 affects that cannot be successfully avoided minimized or mitigated" (see Section 2.2.2 *Cultural Resource Stipulations)*.

In addition, as stated in the PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and potential for geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

O-7-2

In the PEIS, additional protections exist for cultural resources beyond the standard lease stipulations.

As stated in the PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and potential for geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

Bureau of Land Management and Forest Service
Geothermal Leasing in the Western United States Draft PEIS

We encourage you to provide your comments by filling out and submitting this comment form **by *September 19th, 2008.*** Please fax your completed form to 1-866-625-0707 or mail it to the address on the opposite side. You are also welcome to e-mail your comments to: geothermal_eis@blm.gov

Your Name Virginia Gillerman Date 7-21-2008

Mailing Address 2974 E. Hard Rock Dr. City/State/Zip Boise, ID 83712

Telephone (optional) 208-861-8184 E-Mail Address (optional) vgillerm@uidaho.edu

Would you like to be added to this project's mailing list to receive future project-related information?

Yes ☒ No ☐

Please indicate your affiliation by checking **one** of the following boxes:

☒ Individual (no affiliation) ☐ Private Organization ☐ Citizen's Group

☒ Federal, State, or Local Government ☐ Elected Representative ☐ Regulatory Agency

Name of organization, government, group, or agency (if applicable) (Idaho Geological Survey)

The BLM and FS want to hear from you! Please provide your comments on the Draft PEIS in the space below.

It is a great idea to facilitate geothermal energy development - clean power + heat. You should keep open to leasing the maximum acreage. Also P-DEIS is good way to assist regulators move lease applications through the process quickly. I-8-1

One complaint I have heard is that some private developers wish way to protect their ideas from competitors with more $. Either BLM/FS should nominate parcels or companies should have right to submit counteroffer (first refusal etc.) after higher bid. I-8-2

Also — over

(Continue your comments on the other side)

If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently in your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives of organizations or businesses, will be made available for public inspection in their entirety

To speed things along –
reduce duplication of second
EIS to only look at site-specific issues
and use PEIS and other general regs any
BMPs to help local district BLM/FS
staff swiftly and with minimal cost
write EIS for drill/proposed geothermal
project. I-8-3

(Please fold this sheet in half & tape shut before mailing – Do not staple)

Place
First Class
Stamp
Here

Geothermal Programmatic EIS
c/o EMPSi*
3775 Iris Ave. Suite 1A
Boulder, Co 80301

**Acting as a contracted agent for the Bureau of Land Management and Forest Service*

I-8-1

The commentor's support for geothermal development is noted.

I-8-2

Leasing for indirect use will continue to operate on the current competitive lease sale basis, as described in Section 1.5.3.

I-8-3

It is the intention of the BLM that the PEIS amend affected land use plans by allocating BLM lands as open or closed to geothermal leasing and by identifying appropriate stipulations and BMPs. Subsequent environmental analysis would be focused on site-specific impacts for geothermal exploration, drilling, utilization, and reclamation. Any additional NEPA documents could tier to this document in accordance with NEPA implementation regulations (Section 1.9.1).

Bureau of Land Management and Forest Service
Geothermal Leasing in the Western United States Draft PEIS

We encourage you to provide your comments by filling out and submitting this comment form **by *September 19th, 2008.*** Please fax your completed form to 1-866-625-0707 or mail it to the address on the opposite side. You are also welcome to e-mail your comments to: geothermal_eis@blm.gov

Your Name Katie Fite Date 9/21/08
Mailing Address Western Watersheds Project City/State/Zip PO Box 2863 Boise ID 83701
Telephone (optional) 429-1679 E-Mail Address (optional)

Would you like to be added to this project's mailing list to receive future project-related information?
Yes ☑ ~~No~~ ☐

Please indicate your affiliation by checking **one** of the following boxes:
☐ Individual (no affiliation) ☐ Private Organization ☑ ~~Citizen's~~ Group
☐ Federal, State, or Local Government ☐ Elected Representative ☐ Regulatory Agency

Name of organization, government, group, or agency (if applicable)

The BLM and FS want to hear from you! Please provide your comments on the Draft PEIS in the space below.

Dear BLM - Please
- Require burying all lines to sites to reduce sage-grouse, pygmy rabbit, other impacts ~~[illegible]~~ and including migratory + resident bird collisions. 0-9-1

- No net increase in roads with any public lands project 0-9-2

- Expand no geothermal development zones to key sage-grouse, pygmy rabbit + other sensitive species lands, + BLM wilderness-suitable lands + forest roadless, 0-9-3

(Continue your comments on the other side)

If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently in your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives of organizations or businesses, will be made available for public inspection in their entirety

O-9-1

The scope of this PEIS is to allocate geothermal resources and apply stipulations for leasing on BLM and FS lands with geothermal potential (Section 1.9). Transmission line siting is not determined in this document.

O-9-2

Site-specific impacts for subsequent geothermal exploration, drilling, utilization, and reclamation, including roads, would be addressed during the permitting process in separate NEPA documents.

O-9-3

Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plans and site-specific resources. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

BLM Wilderness Areas are included under Section 2.2.2 as Congressionally designated lands that are likely to be closed to leasing.

The existing case law regarding the roadless rule is inconsistent. On August 12, 2008, the Wyoming District Court found the 2001 Roadless Rule violated NEPA and the Wilderness Act. *State of Wyoming v. U.S. Dept. of Agriculture,* 07-CV-17-B, Wyoming District Court, Cheyenne, Wyoming [2008]). The District Court ordered the 2001 Roadless rule "set aside" and "permanently enjoined." This Order is subsequent to a 2006 California District Court ruling that set aside the 2005 State Petitions Rule and reinstated the 2001 Roadless Rule. See *California ex re. Lockyer v. U.S. Dept to Agriculture*, 459 F.Supp.2d 874 (N.D. Cal 2006).The United States Justice Department, on behalf of the Department of Agriculture, has filed motions with both the Wyoming and California courts seeking adjustments of those courts' conflicting judicial orders. Neither the Wyoming nor California District Court rulings bar the Department of Agriculture from promulgating other roadless area regulations. To address this inconsistency, the PEIS includes the following Department of Agriculture Roadless Area Stipulation, "If future legislation or regulations change the roadless area designation, the restriction would be revised along with any appropriate environmental review." An appropriate NEPA review would be required prior to any changes to the Roadless Area Stipulation.

Follow up

geothermal_eis

From:	Mary_Christensen@blm.gov [Mary_Christensen@blm.gov]	**Sent:**	Mon 7/21/2008 1:54 PM
To:	geothermal_eis		
Cc:			
Subject:	Mail forwarded from geothermal_eis@blm.gov		
Attachments:			

This message has been automatically forwarded from geothermal_eis@blm.gov.

Mattson McDonald <matmcd2002@yahoo.com>

07/21/2008 02:51 PM

Please respond to matmcd2002@yahoo.com

To geothermal_EIS@blm.gov

cc

bcc

Subject Support for Geothermal energy production

Dear BLM project Managers,
I have read the draft on Geothermal leasing of BLM lands for energy production and support it very strongly. Energy independance is a national priority now. Please keep me posted an developments. I-10-1
Pamela Mattson Mc Donald

I-10-1

Thank you for you comment.

Bureau of Land Management and Forest Service
Geothermal Leasing in the Western United States Draft PEIS

We encourage you to provide your comments by filling out and submitting this comment form **by *September 19th, 2008.*** Please fax your completed form to 1-866-625-0707 or mail it to the address on the opposite side. You are also welcome to e-mail your comments to: geothermal_eis@blm.gov

Your Name Morty Prisament Date

Mailing Address Tetra Tech 3380 Americana Terrace Ste. 201 City/State/Zip Boise 83706

Telephone (optional) 208 4892840 E-Mail Address (optional) monty.prisament@ttemi.com

Would you like to be added to this project's mailing list to receive future project-related information?

Yes ☒ No ☐

Please indicate your affiliation by checking **one** of the following boxes:

☐ Individual (no affiliation) ☒ Private Organization ☐ Citizen's Group

☐ Federal, State, or Local Government ☐ Elected Representative ☐ Regulatory Agency

Name of organization, government, group, or agency (if applicable) Tetra Tech

The BLM and FS want to hear from you! Please provide your comments on the Draft PEIS in the space below.

Have not yet reviewed the P-DEIR but appreciate opportunity to attend tonights meeting in Boise. C-11-1

(Continue your comments on the other side)

If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently in your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives of organizations or businesses, will be made available for public inspection in their entirety

C-11-1

Thank you for your comment.

geothermal_eis

From: Mary_Christensen@blm.gov [Mary_Christensen@blm.gov] **Sent:** Tue 7/22/2008 5:18 PM
To: geothermal_eis
Cc:
Subject: Mail forwarded from geothermal_eis@blm.gov
Attachments:

This message has been automatically forwarded from geothermal_eis@blm.gov.

"Phil Ronnerud" <pronnerud@co.greenlee.az.us>
To <geothermal_EIS@blm.gov>
cc

07/22/2008 06:15 PM
bcc

Subject
Comments

Although leasing will be subject to existing laws, regulations, formal orders, stipulations, etc., these documents are insufficient if the people doing the development do not care.

A-12-1

Development of geothermal and other energy resources, e.g. solar and wind, requires onsite, and offsite, infrastructure. That infrastructure maintenance is stopped or the local entities are expected to do the work after project ends. Local entities cannot afford the costs. Development and maintenance of the infrastructure and restoration of the land must be paid by the developer. They should not be able to walk away from any work done without complete restoration. Because of the fragile nature land restoration is not a one time line item. Restoration is a continuous and long term process that has many facets. New techniques need to be developed to help better accomplish the goals.

Scarring of the land from construction disturbance must be considered. Old mines, power lines, and roads leave marks that last for years and over the years can lead to significant local degradation of the land. Witness the

A-12-2

visible marks and erosion from power lines and natural gas lines on aerial photographs. These disturbances then become the sources of sediment and pathways for continued use by other parties.

Costs go beyond direct facilities. Long term land use change as new roads are developed and land becomes easier to access. Traditional land uses change, or is displaced, as new faces arrive at, then leave, the area. Any traditional land uses must be respected. These folks, ranchers and other land resource users, have an interest in the land. Their voices often are not heard or discounted.

A-12-3

These changes then lead to indirect cost for governmental agencies. School districts lose their traditional tax base while new develop. Often the revenue is not replaced. New workers come into communities and expect different services. Law enforcement has new territory to consider.

If a facility will be long term installation then multiple use for the infrastructure, roads and access ways, should be considered. Trails and off road access ways are badly needed for recreation. Design and construction of the facilities should consider and be available all the land users.

Before transporting the energy long distances, local agencies should have the option for use. This local use could help eliminate some of the land use infrastructure issues.

Regards

Philip Ronnerud

Planning and Zoning Director

GreenleeCounty

P.O. Box908

Clifton, Arizona 85533

928 865 4762 voice

A-12-1

Comment noted. This PEIS covers the leasing phase of geothermal development. See Section 2.5 for a discussion of phases of leasing and development. BLM's new geothermal regulations include strict bonding and reclamation requirements. See 43 CFR Part 3200.

A-12-2

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements. This document covers only the land use planning and lease issuance stages.

A-12-3

The comment is noted. As discussed in the above response, there are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public input, as applicable. This document covers only the land use planning and lease issuance stages.

Bureau of Land Management and Forest Service
Geothermal Leasing in the Western United States Draft PEIS

We encourage you to provide your comments by filling out and submitting this comment form **by September 19th, 2008.** Please fax your completed form to 1-866-625-0707 or mail it to the address on the opposite side. You are also welcome to e-mail your comments to: geothermal_eis@blm.gov

Your Name KIM NIGGEMANN Date JULY 22, 2008

Mailing Address 900 - 409 GRANVILLE ST., City/State/Zip VANCOUVER, BC V6N 2V8

Telephone (optional) 1-866-688-0808 E-Mail Address (optional) kniggemann@nevadageothermal.com

Would you like to be added to this project's mailing list to receive future project-related information?

Yes ☒ No ☐

Please indicate your affiliation by checking **one** of the following boxes:

☐ Individual (no affiliation) ☒ Private Organization ☐ Citizen's Group

☐ Federal, State, or Local Government ☐ Elected Representative ☐ Regulatory Agency

Name of organization, government, group, or agency (if applicable)____________

The BLM and FS want to hear from you! Please provide your comments on the Draft PEIS in the space below.

Our concern is what happens when the PEIS does not cover the areas that we wish to conduct exploration (drilling) work on? What kind of a timetable will the BLM field offices be held to? Do we have any guarantee that any additional work required by the BLM will be completed in a reasonable amount of time and expense? 0-13-1

(Continue your comments on the other side)

If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently in your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives of organizations or businesses, will be made available for public inspection in their entirety

O-13-1

Areas not contained within the geothermal potential area are not closed to leasing. These areas will follow the existing procedures for leasing outlined in Alternative A.

Bureau of Land Management and Forest Service
Geothermal Leasing in the Western United States Draft PEIS

We encourage you to provide your comments by filling out and submitting this comment form ***by September 19th, 2008.*** Please fax your completed form to 1-866-625-0707 or mail it to the address on the opposite side. You are also welcome to e-mail your comments to: geothermal_eis@blm.gov

Your Name CHIP MANSURE Date 7/22/8

Mailing Address 11000 RICHFIELD AVE NE City/State/Zip ALBUQUERQUE, NM 87122

Telephone (optional) 505-844-9315 E-Mail Address (optional) AJMANSU@SANDIA.GOV

Would you like to be added to this project's mailing list to receive future project-related information?
Yes ☐ No ☒

Please indicate your affiliation by checking **one** of the following boxes:
☒ Individual (no affiliation) ☐ Private Organization ☐ Citizen's Group
☐ Federal, State, or Local Government ☐ Elected Representative ☐ Regulatory Agency

Name of organization, government, group, or agency (if applicable)

The BLM and FS want to hear from you! Please provide your comments on the Draft PEIS in the space below.

THE APPROACH OF SEPARATE PROGRAMITIC AND INDIVUAL LEASE ACTIONS, AND ALSO, TOP LEVEL GUIDANCE/ AMENDMENTS IMPLEMENTED/SUPERCEDED BY LOCAL DECISION MAKING IS THE RIGHT/BEST APPROACH.

NO ACTION WOULD BE IRRISPONSIBLE GIVEN THE IMPORTANCE/NEED FOR ENERGY AND CLIMATE ISSUES.

RESTRICTING ACTION TO CORRIDORS OVERLOOKS THE NEEDS OF LOCAL AREAS AND WOULD NOT LEAD TO THE BEST DECISONS AND USE OF BLM & FS PERSONEL/ RESOURCES WHEN ACTION OUTSIDE OF CORRIDORS IS NEED.

PROPOSED ACTION IS CORRECT ONE. **(Continue your comments on the other side)** I-14-1

If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently in your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives of organizations or businesses, will be made available for public inspection in their entirety

I-14-1

Thank you for your comment. The commentor's preference for the Proposed Action is noted.

geothermal_eis

From:	Mary_Christensen@blm.gov [Mary_Christensen@blm.gov]	**Sent:**	Mon 7/28/2008 6:57 PM
To:	geothermal_eis		
Cc:			
Subject:	Mail forwarded from geothermal_eis@blm.gov		
Attachments:			

This message has been automatically forwarded from geothermal_eis@blm.gov.

"Patrick Sullivan" <psullivan32@cox.net>

07/28/2008 08:11 PM

To
<geothermal_eis@blm.gov>

cc

bcc

Subject
Comments on the Western Geothermal Draft PEIS

Hello!

I have reviewed much of the Western Geothermal Draft PEIS, and I would like to submit the following comments:

The proposed action laid out in the Programmatic Analysis of volume 1 best meets the demonstrated needs and follows necessary guidelines. I-15-1

I encourage clarification of the discretionary closure of "Military reservations where geothermal development would conflict with the military mission" (p. 2-7) to specifically confirm that such military reservations are open for development except in instances when a specific conflict with the mission is identified by the military. I-15-2

The proposed actions identified in Chapter 12 (El Centro Field Office leases) does a thorough job of documenting the proposal's success in meeting demonstrated needs without excessive negative environmental impacts. I-15-3

Please include data on the Angeles National Forest, California, in Table K-2, Appendix K, page K-3. I-15-4

Thanks for your time and hard work! Enjoy the rest of the summer!

Sincerely,

Patrick Sullivan
psullivan32@cox.net

I-15-1

Thank you for your comment. The commentor's preference for the Proposed Action is noted.

I-15-2

Thank you for your comment. Language in the Final PEIS has been clarified as suggested.

I-15-3

Thank you for your comment.

I-15-4

Thank you for your comment. The table has been modified as suggested.

GEOTHERMAL ENERGY ASSOCIATION

209 Pennsylvania Avenue SE, Washington, D.C. 20003 U.S.A.
Phone: (202) 454-5261 Fax: (202) 454-5265 Web Site: www.geo-energy.org

July 30, 2008

Dear Bureau of Land Management and US Forest Service,

These comments are submitted on behalf of the Geothermal Energy Association to support the initiative of the Bureau of Land Management and the US Forest Service to develop a Programmatic Environmental Impact Statement for Geothermal Leasing. We applaud the agencies for completing the draft PGEIS, and encourage expeditious completion of this document and necessary subsequent actions to allow geothermal leasing and development.

The development of geothermal energy resources has never been more important. Without access to multiple-use public lands, geothermal energy development for both electric power and direct uses will be curtailed. Today about one-half of the geothermal power production in the US involves use of federal lands and it would be reasonable to assume that at least one-half of future geothermal energy production in the West will depend upon federal leases. The problem in many areas is simply that without adequate environmental analysis and land-use planning, federal agencies cannot make timely and appropriate decisions on geothermal leasing and permitting. This is a critical problem which this PGEIS seeks to address. C-16-1

NEPA and the PGEIS in Context of Global Warming

The Draft PGEIS that has been released is important for both geothermal development and public land management. In the light of recent scientific reports, it is now clear that global warming is one of the greatest threats to the natural resources, wildlife, and other environmental qualities of both BLM and FS lands. (*See*: Preliminary review of adaptation options for climate-sensitive ecosystems and resources, Final Report, Synthesis and Assessment Product 4.4 June 2008, A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius, S.H., J.M. West (eds.), J.S. Baron, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA). According to this as well as other reports a wide range of impacts is being seen already and even more are expected in the future that seriously impact public lands and resources – from increased fires, insect outbreaks, tree mortality, and species extinction. C-16-2

As a result, BLM and the Forest Service should consider, as directed by the National Environmental Policy Act, that development of geothermal energy as an environmental positive use of the public lands supports their future management and sustainability.

Title I of the National Environmental Policy Act (NEPA) contains a Declaration of National Environmental Policy which requires the federal government to use all practicable means to create and maintain conditions under which man and nature can exist in productive harmony. Section 102 requires federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic interdisciplinary approach. Specifically, all federal agencies are to prepare detailed statements assessing the environmental impact of and alternatives to major federal actions significantly affecting the environment. These statements are commonly referred to as environmental impact statements (EISs). Section 102 also requires federal agencies to lend appropriate support to initiatives and programs designed to anticipate and prevent a decline in the quality of mankind's world environment.

Alternatives Considered

Given the context discussed above, it should be clear that the proposed action (Alternative B) is the best alternative, and that both the "no action" alternative (Alternative A) and the "limited leasing" alternative (Alternative C: Leasing Lands Near Transmission Lines) are not acceptable courses of action.

Alternative C is seriously flawed, and could create even more problems that it solves. First, existing transmission lines may lack adequate capacity, and the proposal ignores RETI, WGA and other transmission planning processes. Moreover, transmission lines are primarily an issue of economics for any particular project or area. As a result adopting this alternative would be inappropriately imposing BLM's judgment about project economics in a wholly unsupportable manner.

C-16-3

Power Generation Assumptions

The PGEIS considers geothermal resources in Montana and Wyoming to be viable only for direct uses (heating), which is not correct. It is important that the PGEIS consider that there may be geothermal resources on federal lands in these states that would be viable for power production. The temperature threshold for competitive electric power production is much lower than it was just a few years ago. The PGIES should recognize the potential for electrical power production in all of the states being examined.

C-16-4

PGEIS Decision Implementation

We are concerned that the PGEIS may not achieve its goal of expediting geothermal projects if the federal agencies do not make a clear commitment to follow through with appropriate land-use plan amendments for both FS and BLM lands.

While the BLM has identified the land use plans it proposes to amend if the proposed alternative is adopted, the PGEIS indicates that the Forest Service follows a different process. While the BLM-FS Memorandum of Understanding (MOU) provides some insight into what this process may be, it is not clearly defined in the PGEIS, and there appears to be no clear plan of action laid out for ensuring that this is accomplished. The final document should include a specific plan of action for both FS and BLM lands, which includes specific timelines for implementing the decisions of the PGEIS on the public lands administered by both agencies. C-16-5

Proposed Restrictions

We are also concerned that Alternative B in the PGEIS would restrict geothermal development of public lands in ways that are neither necessary nor desirable. For example, the draft PGEIS seems to assume *a priori* that lands closed to fluid mineral development should also be closed to geothermal projects (at least for ACECs). Applying the same standards to fossil fuel development and renewable geothermal development is inconsistent and fails to consider the environmental benefits of geothermal energy. C-16-6

Given the fact that climate change is such a severe threat to public lands, and that geothermal development helps address this threat, BLM should provide information to adequately explain the impact of the different statutory or administrative rationales for closing lands to leasing. Moreover, the BLM should examine whether subsequent land-use plan amendments should specifically be required to maintain access to public lands for geothermal energy development in light of the positive role geothermal energy plays in supporting the protection of public lands and resources.

Since NEPA seeks to inform decision makers about the potential impact upon the environment of their actions, we would urge the BLM and the FS to consider whether any of the current restrictions or uses of the public lands which may create obstacles to geothermal development will also result directly or indirectly in increased global warming. For example, off-road vehicle use, grazing, and motorized recreation all create direct impacts upon the environment and add to global warming. Other alternative land uses, such as the creation of new recreation areas, can add indirectly to global warming by promoting more use of motor vehicles. C-16-7

If restricting geothermal use of an area results in not just less geothermal energy production but also permits and even promotes other uses that contribute to climate change, this should be made clear in this analysis. Also, the agencies should consider whether, in such cases, there are criteria that should be developed that trigger reconsideration of such decisions in the PGEIS process, subsequent land-use planning amendments, or elsewhere. It is simply unfair and acting in contravention of NEPA to systematically treat the status quo or the "no action" alternative as environmentally preferable, given the overarching impact of global warming and the importance of geothermal energy to addressing this threat.

Conclusion

Thank you for the opportunity to present these comments. We urge the BLM and Forest Service to move forward expeditiously with the PEIS in the full spirit of NEPA. As Section 2 of the National Environmental Policy Act of 1969, Public Law 91-190, states:

"The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will present or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality."

These words takes on new meaning as we face unparalleled challenges to our nation and its environment, challenges that are rooted in our use of unsustainable energy resources and which can and should be addressed by expanding our use of our nation's vast and largely untapped renewable energy resources, particularly geothermal energy.

Sincerely,

Karl Gawell
Executive Director

C-16-1

Thank you for your comment.

C-16-2

The Final PEIS has been modified to include additional climate change discussion for affected resources. Please see the water, soil, vegetation, fish and wildlife, and other resource sections in the Final PEIS.

The commentor's preference for the Proposed Action (Alternative B) is noted.

C-16-3

The comment is noted.

C-16-4

Reasonably Foreseeable Development Scenarios have been added for Montana and Wyoming at levels of 20 MW by 2015 and 50 MW by 2025 for each state. No data were available for these states, but the parallel to Colorado was drawn due to the similarity in resource base across the Rocky Mountain Region.

C-16-5

For the FS, this PEIS expedites geothermal projects by identifying those lands that are legally open or closed to consideration for geothermal leasing on affected NFS lands, along with any terms and conditions. The PEIS also describes Reasonably Foreseeable Development Scenarios for various stages and types of geothermal exploration and development. The FS would be able to tier from the PEIS, and the information in the PEIS would facilitate future leasing analysis and any allocation or stipulation decisions. For any leasing on NFS lands beyond the specific pending lease applications discussed in Volume II, the FS would still need to provide consent. Prior to providing consent to the BLM, the FS generally must identify specific lands that are administratively available for leasing of geothermal resources and under what conditions. In order to make the administrative availability decision, the FS generally must prepare an additional NEPA document (leasing analysis). The FS is not proposing to amend any land use plans as part of the proposed action. Decisions resulting from this PEIS for both agencies are outlined in Section 1.11.

C-16-6

As discussed in Section 2.2.1, areas that require protection from the development of fluid resources are likely to require protection from similar effects from the development of geothermal resources. The BLM has therefore determined that for ACECs, the management approach to development of oil and gas resources may appropriately serve as a surrogate for development of geothermal resources, absent more explicit geothermal-specific treatment.

Rationale for closure of lands is detailed in Section 2.2.1.

The BLM recognizes the benefits of geothermal energy, particularly in respect to climate change. The purpose of the PEIS is to allow geothermal leasing, while providing protection for other resource uses.

C-16-7

The BLM and the FS agree that it is important to facilitate the development of geothermal resources. As explained in Section 4.8, the development of geothermal resources for energy production is likely to offset greenhouse gas emissions that result from traditional fossil fuel methods of energy production. In this respect, the action alternatives appear to be environmentally preferable.

The resource uses compatible with geothermal use are likely to vary depending on site-specific conditions. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. BLM and FS would work with interested and affected parties to identify and resolve resource conflicts. Appropriate site-specific mitigation would be developed as necessary.

An in-depth analysis of the greenhouse gas emission impacts of each and every land use that the BLM and FS currently oversee is beyond the scope of this analysis.

Bureau of Land Management and Forest Service
Geothermal Leasing in the Western United States Draft PEIS

We encourage you to provide your comments by filling out and submitting this comment form ***by September 19th, 2008.*** Please fax your completed form to 1-866-625-0707 or mail it to the address on the opposite side. You are also welcome to e-mail your comments to: geothermal_eis@blm.gov

Your Name JAMES LOVEKIN Date 30 JULY 2008

Mailing Address GeothermEx, 5221 CENTRAL AVE SUITE 201 City/State/Zip RICHMOND CA 94804

Telephone (optional) (510) 527-9876 E-Mail Address (optional) jimlovekin@geothermex.com

Would you like to be added to this project's mailing list to receive future project-related information?
Yes ☑ No ☐

Please indicate your affiliation by checking **one** of the following boxes:
☐ Individual (no affiliation) ☑ Private Organization ☐ Citizen's Group
☐ Federal, State, or Local Government ☐ Elected Representative ☐ Regulatory Agency

Name of organization, government, group, or agency (if applicable) GeothermEx, Inc.

The BLM and FS want to hear from you! Please provide your comments on the Draft PEIS in the space below.

THE AREA OF GEOTHERMAL POTENTIAL SHOULD INCLUDE THE SAN FRANCISCO VOLCANIC COMPLEX IN NORTH CENTRAL ARIZONA. C-17-1

(Continue your comments on the other side)

If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently in your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives of organizations or businesses, will be made available for public inspection in their entirety

C-17-1

As discussed in Section 1.6, *Areas with Geothermal Potential*, the geothermal potential area used to delineate the planning area for the PEIS was developed in a collaborative manner with Federal and state agencies, universities, industries, research organizations, and experts in the field based on areas with a reasonable likelihood for geothermal development activity in the near future.

Geothermal PEIS Public Hearing
Helena, Montana
Louis and Clark Library
July 23, 2008

Oral Comment:
Deborah Hayden- Swiftcurrent Ventures

What happens when other geothermal resources are discovered but are not on this map but are on BLM or FS land. Particularly in the Sweetgrass Hills in Tule County up by the Canadian border, there are volcanic extrusions where the federal government owns the top of mountains (7,000 feet high), but it has not been identified on any of the geothermal potential maps. I-18-1

I-18-1

Areas not contained within the geothermal potential area are not closed to leasing. These areas will follow the existing procedures for leasing outlined in Alternative A.

Davenport Power, LLC

Northwest Geothermal Company

225 NW Franklin Ave. Suite 1 Bend Oregon 97701
&
300 Atlantic Street Suite 301 Stamford, CT 06901

August 6, 2008

Geothermal Programmatic EIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105
emailed to: geothermal_eis@blm.gov

To Whom It May Concern:

Davenport Power, LLC is the operator for the Newberry Geothermal Project in central Oregon, and encourages efforts that will result in efficient development of geothermal energy resources on federal lands. We would like to commend you on the draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States; it is informative, well organized, and timely. Our interest lies in commercial electrical generation and our review therefore focuses on Volume I: Programmatic Analysis.

Davenport Power prefers the selection of Alternative B, with some modifications that are described in this letter. There is a dire need for the United States to move forward and proactively support, C-19-1
manage, and expedite leasing, exploration, and utilization of geothermal resources as a vital part of our country's energy future. Alternative A should not be selected, as this would not be a positive step and may only result in further delays to lease, explore, and develop the federal geothermal resources. Similarly, Alternative C should not be selected because it is based on commercial issues which are bested determined by the market and would therefore arbitrarily restrict future energy opportunities.

VALIDATION

There are important items that should be affirmed, acknowledged, or otherwise clarified in the PEIS to eliminate the risk of being misinterpreted. Two important points to validate are as follows: C-19-2

1. It is our interpretation that leases already issued within National Forests or on Public Lands would not be affected. Once a lease has been approved and issued, it will always be available for leasing, even after expiring or being relinquished.

2. It is our understanding that the PEIS would not supersede any existing legislation which C-19-3
includes provisions and conditions for geothermal leasing or development, such as the

November 5, 1990 legislation which created the Newberry National Volcanic Monument (Public Law 101-522).

PARTICIPATION OF BLM AND FOREST SERVICE

Davenport Power is pleased to see that the BLM and Forest Service are trying to work together to improve management and development of the federal geothermal resources. In our review of the draft PEIS, however, it appears that there are some critical problems. The PEIS states that each agency will take a different approach regarding how they implement and apply the analysis and the resulting decisions. Specifically, "BLM would amend 122 land use plans to adopt the allocations and the appropriate stipulations and the FS would use the PEIS to facilitate subsequent consent decisions for any leasing on NFS lands", as stated concisely in the Abstract. It is not clear how or why it was decided that the PEIS would not be used to amend or update existing Forest Plans and why additional leasing analyses are needed for the Forest Service but not for BLM. C-19-4

Both agencies are presumably equally obligated by the Memorandum of Understanding: Implementation of Section 225 of the Energy Policy Act of 2005 Regarding Geothermal Leasing and Permitting, which is included in Appendix B. The stated principles and goals of the MOU include making this a priority for both agencies and require supporting the nation's increased need for energy resources. We are concerned that there is a huge "disconnect" between the two agencies, as the PEIS is apparently sufficient for the BLM but not for the Forest Service. Both are federal agencies managing federal resources on federal lands; what laws require each agency to take a different approach and attitude to the same task?

Please clarify why the Forest Service will need yet another process to determine which parcels are available for lease, while the BLM does not. The PEIS is quite thorough and should have enough information for the Forest Service to make a reasoned decision regarding leasing, as BLM will do. Furthermore, the stipulations, best management practices, and universal mitigation measures can minimize or even eliminate any risks that the Forest Service may be fearing. We do not believe that additional time and analyses will result in leasing decisions that cannot reasonably be made at this time.

OTHER OPTIONS FOR FOREST SERVICE

Alternative B should be modified so that the Forest Service can use the PEIS to amend forest planning documents on each Forest that has the potential for geothermal resource leasing and development. The programmatic analysis, in order to be more useful, should identify lands for which the Forest Service would or would not consent to the issuance of geothermal leases. Forest Service should have the same decisions resulting from the PEIS as BLM, as described in section 1.11 Decisions to be Made. C-19-5

We suggest modifying the PEIS to give Forest Service the intrinsic capability to use the programmatic analysis to make leasing decisions and amend individual Forest Plans. We suggest the following be considered:

1. National Forest lands allocated as "general forest" should be declared open and available for geothermal leasing. This allocation is generally the most prevalent forest management allocation within a National Forest and is generally the least restrictive. Timber harvest, road construction, and many other common and perceptible uses are outright allowed in these areas. Geothermal exploration and development would in fact be much less obtrusive than many other allowable uses, and geothermal activities would generally be more than appropriate in this management allocation.

2. We believe the PEIS is seriously flawed in that it does not provide a means for Forest Service to utilize the PEIS to make leasing decisions without having to undertake further analyses and additional processes. The PEIS makes no mention of a schedule for the Forest Service to complete these additional analyses and we are skeptical that future

analyses would be carried out in a timely manner. We suggest that the PEIS be revised to allow and require individual Forest Supervisors on affected Forests to use the PEIS to amend their Forest Plans and incorporate PEIS leasing decisions.

We are very doubtful that further analyses would be accomplished by the Forest Service in a timely or effective manner and believe that under Alternative B, leasing on Forest Service lands will in reality be no further advanced than it is under the No Action alternative. This may affect and significantly reduce the figures used in the PEIS to estimate the number of power plants constructed under the Reasonable Foreseeable Development scenarios. Without the ability to directly utilize the PEIS to make decisions, we believe that the Forest Service will not be improving the effectiveness of geothermal leasing.

There may be other opportunities to help expedite leasing efforts. Any means to help the Forest Service make timely and useful decisions based on the PEIS would be welcomed and should be considered.

POSITIVE ATTRIBUTES AND BENEFITS

There are a great number of positive attributes associated with geothermal energy, many of which would be especially evident when geothermal energy is compared to other energy projects and to other uses of public lands. The PEIS seems to focus on negative effects and overlooks positive effects. We would like to suggest a few benefits or positive aspects that should be addressed in Chapter 4 or Chapter 5:

1. It would be important for the PEIS to describe how well each Alternative accomplishes national objectives. This would be appropriate in response to national direction and policies requiring federal agencies to take appropriate actions to expedite projects that will increase the production, transmission, or conservation of energy, to provide initiatives to reduce greenhouse gas emissions, and to encourage renewable energy resources development. In most, if not all scenarios, a power plant generating electricity from geothermal energy will provide electrical power far beyond the local area in which a project is sited. Effects of leasing and geothermal energy production are important factors in terms of the national energy situation and should be described beyond a local level. When considering presumed negative effects, such as localized site disturbance, they must be considered in a larger and more global perspective. C-19-6

2. Geothermal is one of the many federal resources and just one of the multiple uses of federal lands and should be considered fairly with other approved uses on federal lands. The PEIS should address the amount of land disturbance associated with geothermal activities in comparison to other approved land uses on public and national forest lands. A quantified comparison between geothermal scenarios and other uses, such as timber sales, developed recreation sites, roads, oil and gas operations, and motorcycle or OHV trails and staging areas, for instance, would provide meaningful comparisons about the amount of land needed and the commitment of resources required to accommodate the types of uses that are apparently acceptable, already existing, and likely to continue. C-19-7

3. The PEIS should address the fact that geothermal facilities have relatively small footprints and can blend in and be compatible with the landscape, with other resources, and with other uses. Mitigation measures and careful siting can make projects nearly imperceptible to the typical Forest or public lands visitor. A comparison with developments that generate electricity from other forms of energy (coal, oil and gas, wind, or solar) would readily show how environmentally friendly and compatible geothermal development can be. Geothermal requires a limited number of acres to provide clean, renewable energy and serve a large number of people and homes. C-19-8

4. Active geothermal projects can support fire protection and suppression efforts. The PEIS should recognize that geothermal operations can be helpful and support early detection and suppression instead of mistakenly being discussed only as a potential cause of wildfire ignitions. In addition to working in areas cleared of vegetation (i.e.: well pads) that could effectively act as a fire break, geothermal operators are extremely concerned about safety and take many precautions to be safe, including being fire safe. Please address the fact that having geothermal personnel in remote areas mean that people are available to potentially see and report fires early. Additionally, geothermal operations usually involve heavy equipment and water, both of which could be quickly made available to help suppress fires that may occur in the general vicinity. C-19-9

OTHER COMMENTS

We have the following miscellaneous comments and suggestions for your consideration:

1. In most, if not all cases, it may indeed be appropriate to not allow geothermal activities in special designation areas; however, there should be no buffer areas created beyond the established boundary of any specially designated area. Buffer areas or restrictions to geothermal activities should not be imposed arbitrarily or just because of a general proximity to a particular area. Furthermore, most areas that have a special designation already incorporate a buffer area by design, and if one of these areas needed more protection it would have been considered and made larger when it was first established. C-19-10

2. Appendices J and K (page J-4 Table J-2 and page K-4 Table K-2), regarding Special Designation Areas, neglect to show that there is a National Monument on the Deschutes National Forest. The legislation that created the Newberry National Volcanic Monument (NNVM) is very important to geothermal leasing and operations and specifically addresses geothermal resources in this area. It is very important that this be properly included and addressed in the PEIS. C-19-11

3. We found two references in the PEIS where it implies that geothermal leases and operations are occurring or could occur within the "Newberry caldera" (page 2-37) or "Newberry crater" Appendix A, page A-33). The crater (or caldera) is within the Newberry National Volcanic Monument, and the legislation creating the NNVM specifically does not allow leasing or commercial geothermal operations in the crater. "Newberry Volcano" is the correct tem and should be used instead. C-19-12

We appreciate the federal agencies' efforts to expedite and streamline geothermal leasing and development processes. Thank you for the opportunity to comment.

Sincerely,

DOUGLAS S. PERRY
President
Davenport Power, LLC

cc: Bob Fujimoto, Forest Service Regional Office, R-6
Eric Hoffman, BLM Oregon State Office
John Allen, Forest Supervisor, Deschutes National Forest
Karl Gawell, GEA
Alice Tye, Environmental Consultant

C-19-1

Thank you for your comment. The commentor's preference for Alternative B is noted.

C-19-2

The decisions in the PEIS would not change the conditions of any leases already issued on National Forest or public lands. Lands with leases that expire or are relinquished would be evaluated to determine if the lands are still available for leasing (e.g., if an existing lease within a designated closed area expires, it would not be reissued). If the land is available for leasing, it would then have appropriate stipulations, in accordance with the PEIS decisions, placed on the lease parcel prior to offering it for competitive sale or issued as a direct-use lease.

C-19-3

The PEIS does not supersede existing legislation for geothermal leasing or development.

C-19-4

The Geothermal Steam Act requires that "geothermal leases for lands withdrawn or acquired in aid of functions of the Department of Agriculture may be issued only with the consent of, and subject to such terms and conditions as may be prescribed by, the head of that Department to insure adequate utilization of the lands for the purposes for which they were withdrawn or acquired" (30 USC 1014(b)).

In order for the Forest Service to determine whether to consent to issuance of a geothermal lease, and to determine what, if any, terms and conditions may be needed, site-specific analyses must be undertaken. NEPA provides the framework for the Forest Service to look at actions that may affect lands and resources, and to assess impacts, alternatives, and mitigation measures (lease stipulations).

Volume 2 of this PEIS provides the site-specific analysis of 19 pending lease applications. However, site-specific leasing decisions for any other NFS lands will be necessary in order for the Forest Service to make determinations of potential site-specific impacts, and identify site-specific mitigation measures.

C-19-5

The Forest Service follows the National Forest Management Act of 1976, and the Forest Service planning regulations promulgated under that act for land management planning (Forest Plans). The Forest Service is determining how to proceed with Forest Plan revisions and amendments due to recent revisions and conflicting court decisions. However, in order for the Forest Service to make geothermal leasing consent determinations, Forest Plans do not need to be first amended or revised. Forest Plans may be amended following a NEPA-based, site-specific leasing analysis and determination.

C-19-6

The Final PEIS identifies the BLM and Forest Service preferred alternative, which is based on meeting the stated Purpose and Need (Chapter 1), and includes meeting national objectives and evaluating environmental impacts.

C-19-7

The disturbance associated with geothermal activities is discussed at a programmatic level in Section 4.2 *Land Use*. General discussion of other land use activities is included in Chapter 4 land use, recreation, livestock grazing, and other resource sections.

C-19-8

The benefits of geothermal energy are discussed in various locations in the cumulative impacts discussion.

Small footprint size is discussed in Section 5.4.1 *Land Use*. The benefits of geothermal plants compared to fossil fuel plants are demonstrated in Table 4-2 *Hourly Carbon Dioxide Emissions at 2015 and 2025*. A comprehensive comparative analysis of impacts of geothermal development versus other energy sources is beyond the scope of this analysis.

C-19-9

The document has been revised to reflect your comment.

C-19-10

Given that impacts on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for any lands. However, if it is determined in advance of leasing that exploration, development, or utilization of the lease parcel would "reasonably likely result in a significant adverse effect on a significant thermal feature of a National Park System unit," then BLM would be prohibited from issuing the lease (30 USC Section 1026(c)). Please see updated language in Chapters 1 and 2 related to protection of thermal features in NPS lands.

C-19-11

Based on the GIS data, there was no way to distinguish between National Monuments and other Congressionally designated lands; however, it is appropriately included in terms of acreages that are closed.

C-19-12

Thank you for the clarification. The management plan for the monument was reviewed, and changes were made in the Final PEIS.

HOT SPRINGS
LODGE & POOL

Glenwood Springs, Colorado

August 8, 2008

Geothermal Programmatic EIS
c/o EMPS
182 Howard Street, Ste 110
San Francisco, CA 94105

Public Comments
by
Glenwood Hot Springs Lodge and Pool, Inc.
Glenwood Springs, Colorado

Ladies and Gentlemen:

Glenwood Hot Springs Lodge and Pool, Inc. ("HSL&P") is pleased to submit these public comments concerning the published *Draft Programmatic Environmental Impact Statement for Leasing of Geothermal Resources in 11 Western States and Alaska* and comment in response to the solicitation in 73 FED. REG. 33802 (June 13, 2008).

HSL&P is a Colorado corporation. Its principal place of business is Glenwood Springs, Colorado. Its principal business is ownership and operation of the world famous Glenwood Hot Springs and Pool and its Lodge. This business and a significant part of the City of Glenwood Springs' economy rely on Glenwood's geothermal springs. HSL&P believes that without proper development safeguards, geothermal resource development could adversely affect HSL&P and the City of Glenwood Springs.

Application of geothermal waters on the North bank of the Colorado River for spa and pool purposes followed the founding of the Town of Glenwood Springs in 1884. The pool and its geothermally heated buildings represent substantial development of geothermal water resources. Feasibility and utility have been demonstrated for more than 100 years. Near contemporaneously South bank geothermal waters were also used.

Geothermal Adjudications

In its ownership, management and operation of the Glenwood Hot Springs and Pool HSL&P enjoys adjudicated water rights granted according to Colorado law. These are:

1. ***Mammoth Yampa Hot Spring*** Decree, entered Sep. 13, 1967, in Civil No. 1416 for 5.0 cfs absolute. C-20-1

2. ***Small Yampa Springs*** Decree, entered Apr. 29, 1982, in Civil No. 81CW415, for 0.3 cfs absolute.

PO Box 308, Glenwood Springs, CO 81602 P 970.945.6571 F 970.945.6683 www.hotspringspool.com

3. ***Mammoth Hot Spring First Enlargement***, entered Mar. 11, 1996, in Civil No. 94CW167, for 1.86 cfs absolute, and 1.14 cfs conditional.

4. ***Hot Springs Area No. 1*** and ***Hot Springs Area No. 2*** (South-side Springs) Conditional Decree entered May 31, 1972, for 3.59 cfs (conditional).

5. ***Mineral Hot Springs Area No. 3***, Conditional Decree entered Feb. 28, 2005, for 0.445 cfs (conditional).

Concerns

HSL&P's concerns are three-fold:

First: These decreed water rights are artesian, naturally occurring surface springs.

Second: These surface geothermal springs result from local geologic faulting protected by a fragile, naturally occurring protective mantle identified in professional studies and reports as the Leadville Limestone formation. Once damaged this protective mantle probably cannot be remediated. If damaged it is probable area geothermal springs–the pool and a significant measure of the economy of the City of Glenwood Springs–will be adversely affected

Third: No one is certain of the extent of the artesian reach of Glenwood's geothermal springs. Interference with artesian flows may damage or destroy Glenwood's artesian geothermal springs, the pool and a significant measure of the economy of the City of Glenwood Springs. Studies commissioned by HSL&P suggest that the radius of this reach is approximately three miles surrounding Glenwood Springs.

HSL&P's concerns are supported by professional studies. Pertinent are those submitted with these comments. With one exception, these studies and papers have been scanned and reproduced on a Compact Disc ("CD") submitted as a part of these comments.

Federal Recognition of State Water Rights System and State Water Rights Adjudications

Water rights established under Colorado's Water Rights Determination and Administration Act and its prior adjudicatory procedures coexist with reserved federal water rights. Since enactment of the McCarran Amendment, 43 U.S.C. § 666(a), Congress established state courts as the forum for adjudication of federal and state water rights. *United States v. District Court, Eagle County, Colorado*, 401 U.S. 520 (1971); *United States v. District Court, Water Division No. 5, Colorado*, 401 U.S. 527 (1971). And see, *Winters v. United States*, 207 U.S. 564 (1908). C-20-2

In *Colorado River Water Conservation Dist. v. United States*, 424 U.S. 800, 819-20 (1976), the United States Supreme Court spoke unequivocally that,

> The consent to jurisdiction given by the McCarran Amendment bespeaks a policy that recognizes the availability of comprehensive state systems for adjudication of water rights as the means for achieving these goals.
>
> As has already been observed, the Colorado Water Rights Determination and Administration Act established such a system for the adjudication and management of rights to the use of the State's waters. As the Government concedes [footnote omitted] and as this Court recognized in Eagle County and Water Div. 5 [401 U.S. 520 and 401 U.S. 527], the Act established a single continuous proceeding for water rights adjudication which antedated the suit in [Eagle County and Water Div. 5, citations omitted]. That proceeding "reaches all claims, perhaps month by month but inclusively in the totality." Ibid. Additionally, the responsibility of managing the State's waters, to the end that they be allocated in accordance with adjudicated water rights, is given to the State [Water] Engineer. [*Id.* at 819.]

The United States Supreme Court reviewed with approval the statutory water rights adjudication and administration system of Colorado. It, like other western states, is a comprehensive system that has no federal counterpart, administrative or judicial. The Colorado system, as the Court observed, is an established system more comprehensive and orderly than piecemeal litigation in federal court.

This Congressional mandate and judicial approval has important application to geothermal resources on federal lands.[1] By requiring each prospective lessee-developer apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources puts that potential use in a comprehensive water rights system. The process permits an orderly, comprehensive determination that a proposed use is proper and will not interfere with or harm other water rights. As the Court also noted:

> Moreover, as Eagle County said, "questions (arising from the collision of private rights and reserved rights of the United States), including the volume and scope of particularly reserved rights, are federal questions which, if preserved, can be reviewed (by the [United States] Supreme Court after final judgment by the Colorado court." [*Id.* At 813.]

From these decisions, it is clear the United States recognizes adjudicated state water rights. A corollary to this adjudication process is the duty of the United States to protect previously adjudicated water rights, particularly those affecting or that may be affected by reserved waters.

---

[1] The Colorado water rights system includes both surface and subsurface waters. Both are subject to adjudication and the scope of its comprehensive water rights system.

Accordingly, Glenwood artesian and other adjudicated geothermal rights are relevant to this rule-making process. Because of uncertainties inherent in extractive recoveries, provision must be made by federal rule to preserve antecedent artesian rights so federal geothermal leasing will not interfere with them.

Proposed Rule-Making Safeguards

1. Geothermal operating permits not be issued or withheld until such time as the lessee has applied for and obtained an adjudicated water right for the proposed use according the state law as required by the McCarran Amendment.

2. Geothermal leases not issue for such resources within five (5) miles of an existing municipality.

3. Geothermal leases not issue for such resources within five (5) miles of existing, adjudicated artesian geothermal occurrences. C-20-3

4. Prior to issuance of drilling permit, a geothermal lessee proposing to drill within fifteen (15) miles of existing, adjudicated artesian geothermal occurrences,

   a. conduct and submit a study that concludes to a professional certainty that proposed drilling shall not interfere with existing artesian geothermal occurrences, and

   b. give notice to all existing geothermal users within this area radius.

5. Any such professional study include consideration of all available literature, papers, and publications, if any, relative to or within a 15 mile radius of the proposed drilling site and/or geothermal resource.

Engineering-Geologic Studies & Reports
HSL&P CD

Like the terrain around Glenwood Springs, its geology and geothermal occurrences are complex. HSL&P has assembled and submitted with these comments a CD reproducing several of the more pertinent engineering-geologic studies. These explain HSL&P's positions and proposals. The reproductions are in ADOBE ACROBAT™ *.pdf* format. The CD contains a table of contents ("bibliography") with "links" to the reports described.

Very truly yours,

GLENWOOD HOT SPRINGS LODGE & POOL, INC.

By ______________________
D. Kjell Mitchell, COO & Gen. Mgr.

DJM:em
Encl.: CD

C-20-1

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater and artesian springs, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

C-20-2

As discussed in Section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

C-20-3

As discussed in Section 1.5.1, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 3200, and 3280). The PEIS is not proposing to amend or change any of the laws or regulations; therefore, the PEIS cannot adopt the proposed rulemaking items discussed in the comment. Addressing site-specific issues is evaluated during the subsequent permitting process. The BLM and FS can apply conditions of approval on such permits to avoid and minimize any impacts to specific resources. While the BLM manages the geothermal resource (namely the heat), the state has primacy over the associated water resource. In accordance with state regulations, a lessee/operator must secure permits from the state before the BLM can issue a permit to drill either a temperature gradient well or a full diameter exploration well.

Furthermore, before issuing any leases the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and site-specific resources in order to comply with all applicable state and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

GOVERNOR
Bill Richardson

DIRECTOR AND SECRETARY
TO THE COMMISSION
Bruce C. Thompson, Ph.D.

Robert S. Jenks, Deputy Director

STATE OF NEW MEXICO
DEPARTMENT OF GAME & FISH

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August 15, 2008

Geothermal Programmatic EIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105

Re: Draft EIS for Geothermal Leasing in the Western United States; NMDGF Project No. 12159

To Whom It May Concern:

In response to the Federal Register Notice of Availability dated 13 June 2008, the New Mexico Department of Game and Fish (NMDGF) has reviewed the above referenced document. In addition to review of the document, NMDGF staff also attended the public meeting on July 22 in Albuquerque, New Mexico. The Bureau of Land Management and U.S. Forest Service have identified lands as either open or closed to geothermal leasing and propose lease stipulations and best management practices (Best Management Practices, BMPs) to be attached as conditions for specific project permits. The DEIS amends 122 land use plans (9 in New Mexico) to adopt the proposed allocations and stipulations and provides site specific analysis for 19 pending lease applications. None of the pending applications are in New Mexico; therefore NMDGF comments (below) only on Volume I of the DEIS.

The only known high-temperature geothermal system in New Mexico occurs in the Valles Caldera National Resource Area. NMDGF concurs with designation of the Valles Caldera as closed to geothermal leasing, due to significant wildlife habitat and other resource values. Via this letter, we request a map of lands open for leasing (versus specially designated and administratively closed areas in New Mexico) and at a scale which will allow us to evaluate other particular geographic areas for potential wildlife related concerns. A-21-1

Many native wildlife species potentially face adverse impacts as a result of recent climate change. NMDGF supports the development of geothermal resources for direct heating and for generating electricity, which creates dramatically less greenhouse gas than burning fossil fuels. NMDGF is in general agreement with the proposed stipulations and Best Management Practices. A-21-2

NMDGF appreciates the federal commitment to coordinate with state wildlife agencies in establishing wildlife-related seasonal or timing stipulations, as well as exception considerations, waivers or A-21-3 modification of such stipulations (2.2.2, p. 2-14 and 2-17). We appreciate the federal commitment to consider state listed and sensitive status species that occur on public land when analyzing project impacts (3.11, p. 3-153). NMDGF strongly supports the stipulation that requires monitoring of thermal features (2.2.2, p. 2-18). All potentially affected thermal features should be monitored, regardless of whether they are within lease boundaries or on public land.

NMDGF recommends the addition of BMPs that address the following wildlife protection issues to those listed in Appendix D:

- Pipelines conveying geothermal fluids are constructed above ground due to thermal gradient induced expansion and contraction. Pipelines are typically 24 to 36 inches diameter and rest on cradles above ground level, allowing small animals to pass underneath. Projects should be analyzed to ensure adequate passage for all wildlife species. The pipeline can be raised higher to allow wildlife passage where needed. 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.

- 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 (detergents, oils), 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. A-21-4

Install underground utilities as described below.

- <u>To minimize the amount of open trenches</u> at any given time, keep trenching and back-filling crews close together.
- <u>Trench during the cooler months</u> (October – March). However, there may be exceptions (e.g., critical wintering areas) which need to be assessed on a site-specific basis.
- <u>Avoid leaving trenches open overnight</u>. Where trenches cannot be back-filled immediately, escape ramps should be constructed at least every 90 meters. Escape ramps can be short lateral trenches sloping to the surface or wooden planks extending to the surface. The slope should be less than 45 degrees (100%). Trenches that have been left open overnight, especially where endangered species occur, should be inspected and animals removed prior to back-filling.

Appendix D refers to construction of geothermal facility associated transmission lines as described in APLIC publications. However, the citations are not shown. The relevant references are: A-21-5

Avian Power Line Interaction Committee (APLIC). (1994). Mitigating Bird Collisions with Powerlines: The State of the Art in 1994. Edison Electric Institute, Washington, D.C. http://www.aplic.org

Avian Power Line Interaction Committee (APLIC) (2006). Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, DC and Sacramento, CA. http://www.aplic.org

Thank you for the opportunity to comment on this Draft Programmatic EIS. If there are any questions, please contact Rachel Jankowitz at 505-476-8159, or rjankowitz@state.nm.us.

Sincerely,

for Terra Wunder

Matthew Wunder, Chief
Conservation Services Division

cc: Wally Murphy, Ecological Services Field Supervisor, USFWS
Mark Olson, NW Area Habitat Specialist, NMDGF
Scott Draney, NE Area Habitat Specialist, NMDGF
Pat Mathis, SW Area Habitat Specialist, NMDGF
George Farmer, SE Area Habitat Specialist, NMDGF

A-21-1

Concurrence on the Valles Caldera National Resource Area designation is noted. Communication occurred with the agency regarding information request.

A-21-2

Thank you for your comment. The commentor's agreement with stipulations and BMPs is noted.

A-21-3

Thank you for your comment. The commentor's support for stipulation for monitoring thermal features is noted.

A-21-4

The suggested BMPs have been reviewed and added to the document, as requested.

A-21-5

These are common BMPs; therefore, references have been removed from BMPs to correspond with all other BMPs.

Conservation Congress

August 20, 2008

Geothermal Programmatic EIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105

Re: Draft Programmatic EIS for Leasing of Geothermal Resources in 11 Western States and Alaska

The Conservation Congress appreciates the opportunity to provide comments on said document. Please incorporate them into the record and analyze them prior to release of the FEIS.

"The goal of the PEIS is to examine the potential impacts of geothermal leasing on certain lands administered by the BLM and the USFS. Completion of the PEIS will improve the efficiency and effectiveness of the geothermal leasing and application process on Federal lands. The analysis in the PEIS will serve the following two purposes.

> "(1) Analyze the impacts of leasing in areas that are determined through scoping to have reasonable near-term exploration/development potential for geothermal resources, including areas for which leasing applications have not yet been filed. The PEIS will thereby assist the BLM in determining how best to amend, as appropriate, its land use plans for these areas, by identifying the potential for geothermal development in the areas and determining the areas where geothermal development will be considered as an allowable use. The PEIS will similarly address USFS managed lands that have potential for geothermal resources and provide the basis for future geothermal leasing availability analysis and decisions.
>
> "(2) Enable the BLM to reduce the backlog of lease applications that were pending on BLM and USFS administered lands as of January 1, 2005 by at least 90 percent as required by section 225(b)(3) of the Energy Policy Act of 2005. This Act gives the BLM until August 8, 2010, to achieve this goal. As of January 1, 2005, there were nearly 100 applications for geothermal leases pending on BLM and USFS lands. The PEIS will include the necessary site specific analysis to facilitate processing of these pending lease applications by deciding whether geothermal leasing is appropriate and under what stipulations they may be leased.

PO Box 5
Lewistown, MT 59457
406-538-4220

Comments are being solicited so as to determine:

(1) The scope of this analysis,
(2) significant issues or concerns related to the proposed actions, and
(3) alternatives to the proposed actions.

Conservation Congress Comments

Scope of the Analysis

It would appear the primary factor driving the PEIS is the backlog of pending lease applications. We suggest a more prudent and legally defensible course of action would be for the BLM to analyze only those existing applications rather than attempt to write a NEPA deficient EIS encompassing 530 million acres of land in 11 western states. O-22-1

The PEIS should have been divided up by state at a minimum, and in order to facilitate useful public comment, prudently analyze the potential for geothermal leasing by each National Forest or BLM Unit. The seriousness and potential environmental impacts associated with allocating approximately 117 million acres of BLM lands and 75 million acres of National Forest lands to geothermal leasing can't be overstated. The DEIS fails entirely to adequately analyze the potential direct, indirect and cumulative effects of such action on a myriad of resources at risk. O-22-2

According to the Federal Register Notice a reasonably foreseeable development scenario estimates a potential for 5,500 MW of new electrical generation capacity by 2015 through 110 new geothermal power plants and an additional 132 power plants by 2025 as a direct result of the approval of the proposed action.

In addition, the cumulative effects analysis failed to include basic NEPA-required information. For example, it doesn't appear that the cumulative effects analysis included how many other extraction programs are being allowed in the same areas? Or that the other extraction-leased areas were overlayed with the geothermal areas to show how much ground is *not* being developed and 'roaded'? O-22-3

We do not believe the EIS would withstand legal scrutiny under NEPA for analysis of past, present and reasonably foreseeable future impacts on an estimated 530 million acres.

Significant Issues of Concern

We are significantly concerned about impacts to TES and rare and imperiled species; geothermal resources; and historic and heritage sites. Other than a list of generic stipulations and BMPs, there is no pertinent site-specific data regarding impacts to these resources. The EIS is incomplete and fatally flawed. O-22-4

According to the PEIS:
"The BLM will provide further information at the scoping meetings regarding the locations of, and the planning areas and forests that may be affected by, the actively pending applications. The

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406-538-4220

purpose of the public scoping process is to identify issues that should be addressed in the environmental analysis and the scope of the alternatives."

Due to the short time frame involved in the scoping process we were unaware of the scoping meetings; none of them were within 100 miles of our office; and we would argue that information "regarding the locations of and planning areas and forests that may be affected by the actively pending applications" should have been substantively analyzed through the EIS process on a case-by-case basis. 0-22-5

Alternatives to the proposed action

In light of the aforementioned concerns, the only legally acceptable alternative is the No Action Alternative where lease applications would be evaluated on a case-by-case basis and would require additional environmental review and possibly land use plan amendments. We would suggest this is the lawfully proper course of action to take regardless. 0-22-6

Furthermore, the other action alternative – Leasing Near Transmission Lines Alternative – considered a larger buffer around Yellowstone National Park. We recommend that any alternative chosen for implementation should require the largest buffer possible around YNP. Despite decades of research little remains known about the plumbing system of YNP's remarkable geothermal resources. A reckless policy should not be implemented in an attempt to hurry through a few lease applications. 0-22-7

It is extraordinarily disappointing, although perhaps not surprising, that under the Bush Administration this illegitimate and reckless EIS is being rammed through. But the courts exist for a reason and this EIS is surely headed that way if it continues on its current path.

Please keep the Conservation Congress on the mailing list for this proposal and forward all relevant documents to our office address.

Sincerely,

Denise Boggs

Denise Boggs,
Executive Director

PO Box 5
Lewistown, MT 59457
406-538-4220

O-22-1

The purpose of the PEIS, as discussed in Section 1.2, is as follows:

- to complete processing active pending lease applications (discussed in Volume II); and
- to amend BLM land use plans to allocate BLM lands as open or closed to geothermal leasing and indentify appropriate stipulations, BMPs and procedures for geothermal leasing (as discussed in Volume I).

Site-specific impacts for subsequent geothermal exploration, drilling, utilization, and reclamation would be addressed during the permitting process or in separate NEPA documents.

The decisions for the PEIS and the pending lease analysis will be signed in separate RODs; therefore, decisions on the pending leases could occur separately from a decision on the programmatic analysis.

O-22-2

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

O-22-3

Additional discussion has been added to the cumulative impact analysis. As noted in Chapter 5, past, present, and reasonably foreseeable actions, including commercial uses of public and federal lands, are documented and analyzed.

O-22-4

As noted in response to comment O-22-2 above, all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis.

O-22-5

Scoping meetings were held throughout the 12-state planning area. As explained in Section 1.11.3, this document covers only the land use planning and lease issuance stages and is not intended to provide full analysis of all stages of development. Site-specific impacts for subsequent geothermal exploration, drilling, utilization, and reclamation would be addressed during the permitting process in separate NEPA documents, if determined to be necessary.

O-22-6

The commentor's preference for no action alternative is noted. This document covers only the land use planning and lease issuance stages of geothermal development. All development, utilization, and reclamation activities would require further site-specific permits and associated environmental analysis.

O-22-7

Given that impacts on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for any lands. However, if it is determined in advance of leasing that exploration, development, or utilization of the lease parcel would "reasonably likely result in a significant adverse effect on a significant thermal feature of a National Park System unit," then BLM would be prohibited from issuing the lease (30 USC Section 1026(c).

WYOMING GAME AND FISH DEPARTMENT

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August 28, 2008

WER 692.00
Bureau of Land Management
Federal Register
Notice of Availability
Draft Programmatic EIS
Leasing of Geothermal Resources in 11 Western States and Alaska

Jack G. Peterson
Geothermal Programmatic EIS
C/O EMPSi,
182 Howard Street Suite 110
San Francisco, CA 94105

Dear Mr. Peterson:

The staff of the Wyoming Game and Fish Department has reviewed the Notice of Availability to prepare a Draft Programmatic Environmental Impact Statement for Leasing of Geothermal Resources in 11 Western States and Alaska. We offer the following comments for your consideration.

We suggest BLM review and consider our comments from our previous letter dated August 7, 2007. Several of our comments below are re-iterations of previous comments we believe remain pertinent to the project. In addition, we are providing new comments pursuant to recent directives from Governor Freudenthal and the Sage-Grouse Implementation Team under his direction.

On August 1, 2008, Governor Freudenthal issued Executive Order #2008-2 directing Wyoming State Agencies to emphasize the importance of managing Wyoming's Greater Sage-Grouse habitats and populations, to maintain the integrity of its status in Wyoming, and to avoid the species from being listed under the Endangered Species Act. Included in the Executive Order are directives to focus on maintenance and enhancement of Greater Sage-Grouse habitats and populations within Core Population Areas as identified by the Sage-Grouse Implementation Team, and to work collaboratively with federal agencies to maintain and enhance Greater Sage-Grouse habitats and populations. A-23-1

In light of the Governor's executive order, we encourage BLM to proceed with measures in Core Population Areas (see attached map) that maintain sage grouse breeding, nesting, and early brood-rearing habitats. Toward that end, we recommend protective stipulations surrounding leks to include 1) No Surface Occupancy within 0.6 miles of occupied leks, and 2) seasonal stipulations within 3 miles of occupied leks that prohibit surface disturbing activities from March 15 to July 15 each year to protect nesting and early brood-rearing habitats.

Geothermal power production may be one of the more environmentally friendly alternatives to generating electricity. Although relatively minor in comparison to other energy infrastructure, there are impacts associated with it that should be disclosed and addressed in the EIS. These include surface and habitat disturbance from plant construction, additional road construction and use, and power line impacts. Surface disturbance of key habitats can cause significant impacts to habitat use and wildlife populations. Roads fragment habitat, the associated traffic will increase wildlife mortality, and fences associated with roads may severely affect populations by blocking big game migration corridors. Power lines, if improperly sited and designed, can cause significant bird mortality, including sensitive species in some areas. A-23-2

We recommend that big game crucial winter ranges and parturition areas, and sage-grouse core areas and leks with associated nesting and brood-rearing habitat be removed from consideration for development. If this is not feasible, the EIS should include a process for planning mitigation measures for any energy plants that may be sited in key habitats, and to include our agency in that planning process. This mitigation may include a combination of methods, including proper siting of facilities, minimizing the habitat footprint, and reducing road and power line impacts. A-23-3

Thank you for the opportunity to comment.

Sincerely,

JOHN EMMERICH
DEPUTY DIRECTOR

JE:VS:gfb
Attachment

cc: USFWS

A-23-1

The sensitive species stipulation in Section 2-19 states the following:

> For agency-designated sensitive species (e.g., sage grouse), a lease stipulation (NSO, CSU, or TL) would be imposed for those portions of high value/key/crucial species habitat where other existing measures are inadequate to meet agency management objectives.

The BLM and FS have added the following procedure prior to leasing in Chapter 2:

> The authorized officer of the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states manage and typically have regulatory authority for water quality, water rights, and wildlife.

A-23-2

Impacts of surface disturbance are discussed at the programmatic level in the RFD scenario for each resource in Chapter 4.

In addition, all development, utilization, and reclamation activities would require further site-specific permits and associated environmental analysis.

A-23-3

The sensitive species stipulation in Section 2-19 states the following:

> For agency-designated sensitive species (e.g., sage grouse), a lease stipulation (NSO, CSU, or TL) would be imposed for those portions of high value/key/crucial species habitat where other existing measures are inadequate to meet agency management objectives.

The BLM and FS have added the following procedure prior to leasing in Chapter 2:

> The authorized officer of the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states manage and typically have regulatory authority for water quality, water rights, and wildlife.

In addition Appendix D provides a number of BMPs that would be applied as appropriate to protect sensitive species and habitats.

Wyoming Department of Agriculture

2219 Carey Avenue, Cheyenne, WY 82002 ■ Phone: 307-777-7321 ■ Fax: 307-777-6593 ■ Cust. Serv. Hotline 888-413-0114 ■ Website: wyagric.state.wy.us ■ Email: wda1@state.wy.us

The Wyoming Department of Agriculture is dedicated to the promotion and enhancement of Wyoming's agriculture, natural resources and quality of life.

Dave Freudenthal, *Governor*
John Etchepare, *Director*

August 18, 2008

Draft Geothermal Leasing PEIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

To Whom It May Concern:

Following are the comments from the Wyoming Department of Agriculture (WDA) pertaining to the Draft Programmatic Environmental Impact Statement (PEIS) developed by the Bureau of Land Management (BLM) and the United States Forest Service (FS) for geothermal leasing in the western United States.

Our comments are specific to our mission: to be dedicated to the promotion and enhancement of Wyoming's agriculture, natural resources, and quality of life. As this proposed project affects our agriculture industry, our natural resources, and the welfare of our citizens, it's important that we be kept informed of proposed actions and decisions and that we continue to be provided the opportunity to express pertinent issues and concerns.

This project will impact grazing permittees, agriculture producers, landowners, and other citizens, as well as our natural resources, both in and around each geothermal leasing project area. For these reasons, we are making the following comments to the Draft PEIS.

The WDA appreciates the Draft PEIS recognizing the importance of multiple uses on public lands, as evidenced in sections 3.2 and 3.13. Livestock grazing is an important aspect of multiple use and the impacts of energy development on livestock grazing are addressed competently in this Draft PEIS. A-24-1

However, we recommend you insert the following specific recommendations into the Final PEIS.

Section 4.13.3 - Exploration
The text currently lists several impacts to livestock grazing. We recommend adding the following effects to the current list: A-24-2

- gates left open due to travel to and from geothermal developments
- damaged range improvements (i.e. vegetation improvement projects)
- interference of livestock movement and herding due to increased roads and traffic
- introduction and spread of noxious weeds and invasive plants

Section 4.13.4 - Impacts under Alternative B
WDA supports the discussion of mitigation for dust control, litter, noxious weeds, and water. We recommend adding language addressing the loss of Animal Unit Months (AUMs) and reduced grazing land acreage. Such mitigation strategies and costs could include, but are not limited to the following: A-24-3

- movement of livestock to a vacant allotment or pasture
- monitoring of energy development impacts on vegetation
- purchase or lease of additional grazing land to replace lands temporarily lost for grazing
- reimbursement to producers for temporary loss of AUMs and pastures

Decisions in the proposed plan should allow BLM officials, FS officials, grazing permittees and private landowners the opportunity to work cooperatively. The WDA encourages flexibility to make the best site-specific, case-by-case decisions that are in the best interests of the affected resources and citizens throughout the geothermal energy production process. A-24-4

In conclusion, we appreciate the opportunity to comment on the scope of Draft PEIS for geothermal leasing in the western United States. We encourage continued attention to our concerns and we look forward to being informed and involved in proposed actions and decisions.

Sincerely,

John Etchepare
Director

JE/jc

CC: Governor's Planning Office
Wyoming Game and Fish Department

A-24-1

Thank you for your comment.

A-24-2

The suggested additional impact of "interference of livestock movement and herding due to increased roads and traffic" is included in the discussion of development impacts in the Draft PEIS. Additional suggested impacts have been reviewed and added to Section 4.13, as appropriate.

A-24-3

The following BMP has been added in Appendix B to provide the most flexibility in response to individual situations:

- work with livestock operators to minimize impacts to livestock operations.

A-24-4

Thank you for your comment. The PEIS allows the flexibility of individual BLM land use plans to adopt the appropriate BMPs and stipulations.

From:	Mommy Jackson
To:	Zoe Ghali
Cc:	Mommy Jackson; tea_tunes@yahoo.com
Subject:	Geothermal Leaseing Project Comment
Date:	Monday, September 08, 2008 4:01:35 AM

Zoe,

I am submitting my comments for the Geothermal Leasing Project.

I request that the DEQ mandates a full review from the Environmental Quality Commission on the basis of the Three Basin Rule for the proposed geothermal leasing within the Willamette NF, the 1,115.280acres of land that are in a river valley centered on the North Santiam River. This is a drinking water source for a major population in Oregon. (Salem, and Stayton etc.) The potential for public health hazards, as well as the impacts to wildlife, fish and plant habitat is unacceptable. The Forestry Department is required to protect the operations on State and private lands and follow water quality standards that are intended to be attained and are implemented through best management practices and other control mechanisms established under the Forest Practices Act (ORS 527.610 to 527.992) and rules thereunder, administered by the Oregon Department of Forestry. Therefore operations within the Forest Practices Act are required to be in compliance with this rule. The DEQ works with the Oregon Department of Forestry to review the Forest Practices program so that it attains water quality standards. The waters and tributaries are identified as "Fish Use Designations" for Salmon and Stealhead Spawning. A 401 water quality certification may contribute to warming of State waters beyond 0.3 degrees Celsius (0.5 degrees Fahrenheit), and are therefore designated as water-quality limited, to develop and implement a temperature management plan that would not be achieved by the geothermal plant with unapplicable temperatures. I-25-1

The Mt. Hood propsed site is within an unstable earthquake area. There are many faults in the area which would impact Portland and surrounding areas should it trigger an earthquake during the drilling process. This is an unacceptable impact. I-25-2

Sincerely,
Irene Jackson
momjackson3@gmail.com

487 N. Myrtle Avenue
Stayton, Oregon 97383
503-769-6992

I-25-1

The comment is noted. This is a request of the Oregon DEQ and does not require any direct changes to the PEIS. The DEQ received the PEIS for their review.

I-25-2

As stated in Section 4.3.2, geothermal use generally involves reinjection of fluids after use for a net zero change in fluids. This represents a low risk for increased seismic activity.

MINION HYDROLOGIC
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3 September 2008

Zoe Ghali
EMPS Inc.
3775 Iris Avenue, Suite 1A
Boulder, CO 80301

Draft Geothermal Leasing PEIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

Re: Comments on the Draft PEIS for Geothermal Leasing in the Western United States

To Whom It May Concern:

Commentary regarding the Draft PEIS for Geothermal Leasing in the Western United States, primarily directed at Alternative B (the proposed action), are provided in this report.

SCOPE OF PEIS

It is stated in the Draft PEIS for Geothermal Leasing in the Western United States (hereafter PEIS) that **"leasing land does not involve ground-disturbing activities or any type of construction, so there would be no direct impact on water resources. Indirect impacts would result from activities pursued after leasing"** (pg. 4-40). Impacts which occur to water resources from leasing provided via the PEIS would not have occurred without the lease process, thus specific broader range water resource protection concepts should be considered as a primary part of the PEIS. The Draft PEIS approach of relying on regional BLM or FS BMP's, individual State, and/or other local governments to protect existing geothermal resource users, or to provide the expertise for supplying the broader range water protection parameters, creates a high potential for damage (injury) to existing geothermal springs, wells and decreed geothermal water rights throughout the Western US. C-26-1

Under the PEIS Purpose and Need for Action (PNA) Section, Item 1.2 - The purpose is stated as, **"To amend BLM land use plans to allocate BLM-administered lands with geothermal resource potential as closed, open, or open with major to moderate constraints to geothermal leasing. This includes establishing a projected new**

level of potential geothermal development with existing planning level decisions (termed reasonably foreseeable development scenario), and identifying appropriate stipulations, BMP's, and procedures to protect other resource values and uses while providing sufficient pre-leasing analysis to enable the BLM to make future competitive geothermal leasing availability decisions" (includes FS lands).

"The planning area includes BLM- and FS-administered surface lands with minerals under federal ownership that have geothermal potential and the subsurface federal mineral estate on other lands" (PEIS Executive Summary (ES) Section ES.4.). "The BLM cannot lease lands over the objection of the FS. The FS makes their consent decision after conducting a leasing analysis, including NEPA... This leasing determination will be used to amend FS land use plans as appropriate" (PEIS PNA Section 1.5.4).

There are several sections within the PEIS regarding issues related to water resources. In order to minimize the potential for damage to existing geothermal resource users it is recommended that drilling for, and utilization of, geothermal resources for energy extraction be limited within the PEIS as follows:

1) Lease applications received by the BLM or FS should not be reviewed in-depth until notice of the lease applications have been forwarded to all existing geothermal water right owners and existing geothermal resource users located within 2 miles of the proposed lease area. The existing geothermal users should have at least 60 days to comment regarding concerns, etc. to the BLM and/or FS as part of the lease review process. This is important, as the lease periods run for long duration time periods. **As stated in PEIS PNA Section 1.5.3 - A lease is issued for a primary term of 10 years and may be extended for two five-year periods... At any time a lease may receive a 5-year drilling extension...** C-26-2

   It is also stated, **"Geothermal exploration and production on federal land conducted through leases is subject to terms and stipulations to comply with all applicable federal and state laws pertaining to various considerations for tribal interests, sanitation, water quality, wildlife, safety, cultural resources, and reclamation" (PEIS PNA 1.5.3).** The concept of protecting existing decreed geothermal water rights or existing geothermal resource users from injury due to geothermal drilling, exploration or utilization is not mentioned in any section of the PEIS dealing with water resources.

2) Any subsequent applications for drilling permits within a geothermal lease area should be forwarded from the lease applicant to all existing geothermal users within the 2 mile

area as identified under item 1) above. The notice should be sent by certified mail, return receipt requested, and should include a copy of the permit application to the BLM and/or FS. Once the notice is received, the local geothermal resource users should have at least 60 days to provide comments or written objections if they are opposed or seek modifications to the proposed drilling program.

The process of giving notice will allow for adjacent existing geothermal water right owners and resource users to work on installation of pre-drilling monitoring structures 'up-front'. In this fashion, baseline data can be collected which actually confirms if there is non-injury to the existing proximate geothermal resource users.

3) As part of the PEIS, no geothermal exploration drilling should be permitted within one (1) mile of decreed geothermal water rights, or existing geothermal springs and wells which are currently utilized by local resource users. This includes any vertically or directionally drilled well for either geothermal production (resource producing well) or for closed loop systems. Any geothermal well drilled within a 2-mile proximity to an existing geothermal resource user should only be permitted in a downgradient direction (in terms of the aquifer ground water gradient).

These restrictions could be lifted if all of the geothermal water right owners and resource users within the 1-mile and 2-mile area(s) described above agreed to waivers. In this fashion, if all of the existing geothermal water right owners and resource users within the 1-mile and 2-mile restriction areas were not concerned about immediately adjacent geothermal resource development the lease applicant could proceed without these restrictions.

The above comments regarding the necessity for inclusion of broader range water resource (primarily geothermal resource) protection parameters within the PEIS are valid based on the stated purpose under PEIS PNA Item 1.2 (shown above). **PEIS PNA Item 1.9.1 - "This PEIS... analyzes the broad impacts associated with allocation of geothermal resources for leasing along with the adoption of stipulations and BMP's. As such, it meets the intent of the implementing regulations for the NEPA, which state, <u>"Agencies shall prepare statements on broad actions so that they are relevant to policy and are timed to coincide with meaningful points in the agency planning and decision making"</u> (40CFR 1502.4). The PEIS does not evaluate site-specific issues associated with geothermal exploration, drilling, utilization, or reclamation and abandonment. Site specific impacts for subsequent geothermal exploration,** C-26-3

drilling, utilization, or reclamation and abandonment would be assessed during the permitting process and in separate NEPA documents prepared by local BLM and FS offices. <u>Such analysis could tier to this document in accordance with NEPA implementation regulations</u> (40CFR 1502.20)" <u>(emphasis added)</u>.

Background knowledge leading to the request for inclusion of items 1) - 3) listed above into the PEIS are based on over 20 years of personal experience working on geothermal projects within Western Colorado.

Inclusion of items 1) - 3) listed above into the PEIS would greatly reduce the potential for injury to existing geothermal resource users and the frequency of resource damage related lawsuits. This approach would also reduce much of the uncertainty for potential geothermal resource developers applying for leases. Many of the potential geothermal lease applicants may have no concept of geothermal water rights or geothermal use injury issues. The notice requirements for both the initial lease and subsequent drilling permit would help the lease applicants gain knowledge of local geothermal water right owners and resource users. The one-mile no drilling protection zone discussed above would assist with minimizing damage to existing geothermal resource users.

As stated under the PEIS BMP's for water resources under the Exploration, Drilling and Construction and Utilization phases of a lease (listed on pages D-7, D-22, D-38 - Mitigation Measures - Volume III - Appendices) - **"Operators shall gain a clear understanding of the local hydrogeology. Areas of ground water discharge and recharge and their potential relationships with surface water bodies shall be identified... Operators shall avoid creating hydrologic conduits between two aquifers during foundation excavation and other activities".**

A lease applicant may be willing to state 'up-front' through basically 'surficial hydrogeologic studies' that their proposed well or appropriation will not materially injure a valid geothermal right (or user), but this assertion cannot be proven until the well(s) is drilled and potential effects have been proven through aquifer testing/monitoring. It will probably not be possible to accurately understand local hydrogeology without data from several well tests, especially in fractured geologic formation type geologic settings which is certainly the case in Western Colorado. C-26-4

Once any injury occurs, the only option in terms of geothermal water supply is to offer 'replacement geothermal water'. The concept of the lease applicant obtaining and offering to provide to any affected party an equivalent amount of replacement water of comparable quality is very difficult to perform. There can be significant water quality differences in geothermal waters within a very limited geographical area. In addition, piping of replacement geothermal water from a well to another area is often a logistical problem for the affected pre-existing geothermal use operation, due to pipe scaling, equipment failure, power failure, potential new pump and pipe installation(s), etc. These issues can be very problematic, especially for business operations which depend on continuous flow of the geothermal waters. People, or groups, who own geothermal water rights or utilize geothermal resources generally have much invested in their operation. The operation is based not only on a typical flow regime and source type (spring or well), but also on the given geothermal temperature and water quality, including the pH of the geothermal water.

Another major problem with the 'replacement water' concept is the public perception of 'naturally flowing' geothermal spring water versus geothermal water from a well, or from artificially heated water. There is no special allure to a heated swimming pool or hot tub; the real value of the geothermal spring water at many places of use is the perceived, and actual, health benefits from the 'naturally occurring' minerals in the water (see Colorado Geological Survey Bulletin 11 - "Mineral Waters of Colorado" for a scientific analysis). People do not travel great distances to soak in a spring which is filled and maintained with 'replacement geothermal water'.

The potential for injury to existing geothermal users cannot be adequately determined 'up-front' through assumption and theory processes. The only way to accurately know is to set-up monitoring networks and obtain adequate baseline data prior to drilling a geothermal well. The best approach for facilitating this type of process is a requirement to give notice to the geothermal water right owners and resource users located within 2 miles of a potential lease area during both the lease process and as part of obtaining a well permit.

Basically, the hydrogeologic conditions are what the testing shows. If a lease applicant can drill and test the well(s) and show no injury to adjacent proximate geothermal water right users they can claim their appropriative amount. If the drilling and testing does show injury, and the lease applicant cannot supply the injured party with geothermal water which is 'equivalent' (in terms of flow, temperature, water quality and source type - from a spring source or a well source), the lease applicant should not be able to appropriate the geothermal resource. Experience has shown there is potential for injury simply due to drilling or other types of excavation, and as such this PEIS should include the 1-mile no drilling protection zone.

The 1-mile no drilling protection zone for existing geothermal resource users and water right owners is recommended to greatly reduce the potential for lawsuits regarding injury from geothermal drilling. Experience has shown that suing government agencies is frustrating and expensive as governments generally have limited liability. Assuming some of the larger oil companies become involved in the geothermal prospecting business, it would be very expensive to sue due to their nature of 'dragging things out' in Court with the intention of bankrupting the other side. It is the BLM and FS responsibility to proceed with geothermal leasing within this PEIS in a manner which carefully considers and includes protections for existing geothermal water right owners and resource users.

Perhaps the best way of bringing into perspective the potential concern for proximate construction of geoexchange well systems or geothermal production wells is to assume you own and operate a geothermal spring and your neighbor intends to drill a vertical geoexchange or production well. This type of scenario could actually occur in several small towns and lodge/spa facilities located very proximate to Federal lands in Western Colorado, and likely in other locations throughout the Western US.

Under PEIS ES Item ES-4 - **"This PEIS analyzes the potential environmental, social, and economic effects of these actions in accordance with the NEPA, the CEQ regulations for implementing NEPA, and applicable BLM and FS authorities". On PEIS page 3-198, under the Socioeconomics and Environmental Justice Section - "Areas of high geothermal potential are often located in rural areas, which typically have chronic, high unemployment rates. The development of geothermal resources in such rural areas can improve local socioeconomic conditions... the idea that a single expenditure in an economy can have repercussions throughout the entire economy. The long lifetime of geothermal plants means that they can become a stable, reliable part of a community's economic base (National Geothermal Collaborative 2007)".**

PEIS ES-4 statement indicates the social and economic effects of the proposed geothermal leasing must be considered. The subsequent statement on PEIS page 3-198 is erroneous in regard to Western Colorado, and likely many other geothermal spring or well use areas in the Western US. Many of the existing geothermal use areas have thriving lodging and spa businesses which are basically the lifeblood of the communities. Depletion in geothermal flows at any of these areas would create economic and social hardship, not improve socioeconomic conditions. The existing lodging and geothermal spa facilities are the stable, reliable part of these communities' economic base, which could be seriously disrupted by proximate geothermal drilling and associated depletive effects to the geothermal resource. In regard to tourism, the average tourist's interest in geothermal power plants is not nearly as high as their interest to soak in naturally occurring geothermal hot springs.

Other specific comments regarding water resource related issues, as stated within the PEIS, are given in the Water Resource (Geothermal) Issues section of this report.

STATE OF COLORADO

In PEIS ES-1 it is stated, **"The BLM has the delegated authority to issue geothermal leases on federal mineral estate, such as that underlying lands administered by the FS. A geothermal lease is for the earth's heat resource where there is federal mineral estate... Leasing geothermal resources by the BLM vests with the lessee an exclusive right to future exploration and to produce and use the geothermal resources within the lease area subject to existing laws, regulations, formal orders, and the terms, conditions and stipulations in or attached to the lease form or included as conditions of approval in permits".**

PEIS PNA Item 1.5.1 - Geothermal Leasing Laws and Regulations - **"A geothermal lease is for the heat resource of the earth where there is a federal mineral estate. Unless specifically owned in fee, the federal government does not own the hot water commonly associated with the heat; this falls under state water laws. Geothermal developers must obtain the appropriate water rights and state permits, in addition to the federal lease for the resource."** PEIS PNA Item 1.9.1 defines the Planning Area as including **"BLM and FS-administered surface lands with minerals under federal ownership that have geothermal potential and the subsurface federal government mineral estate on other lands".** C-26-5

In the State of Colorado, there are existing Rules regarding the permitting and development of geothermal resources. The title of these Rules are as follows: State of Colorado, Division of Water Resources, Office of the State Engineer - "Rules and Regulations for Permitting the Development and Appropriation of Geothermal Resources Through the Use of Wells" (Geothermal Rules) - 2CCR 402-10, with an effective date of 30 September 2004. These Rules are a revised version of the initial 1994 Geothermal Rules. Any drilling of geothermal wells on Federal lands (BLM/NFS) within the State of Colorado are subject to these Rules. In Colorado, the heat contained within geothermal water is not a mineral right, it is an integral part of any decreed geothermal water right. A copy of the Geothermal Rules are shown in attached Appendix A.

The initial 1994 Geothermal Rules were promulgated pursuant to a lawsuit filed against the Colorado State Engineer's Office (SEO) by owners of geothermal springs in Ouray, Colorado for the SEO's lack of regulation/oversight of geothermal permitting and drilling during the late 1980's. Several geothermal wells were drilled within Ouray, and several geothermal springs were affected. The flow in the geothermal springs at one Lodge was significantly reduced, and the discharge of a different geothermal spring at another Lodge facility ceased altogether.

PEIS PNA Section 1.6.2, Table 1-1 - Lists BLM lands of 6,289,076 acres and NFS lands of 15,347,069 acres included in the Geothermal Potential Area (Planning Area). Review of Figure 1.5 shows this includes almost all of western Colorado.

Under PEIS Proposed Action and Alternatives (PAA) Section Item 2.5.1, Table 2.7 - Commercially Viable Geothermal Capacity for Electrical Generation by High Potential Area - lists under Colorado the following Hot Spring Areas of potential - Wuanita, Routt, Cottonwood, Mt. Princeton, Poncha and Pagosa Hot Springs, Wagon Wheel Gap, Orvis and Ouray Hot Springs. A copy of PEIS Appendix F, pg. F-10 which lists geothermal areas of interest in Colorado is shown in attached Appendix B. There are numerous existing geothermal users and geothermal water right owners located within the areas listed on PEIS Table 2.7 and Appendix F, pg. 10.

Under PEIS PAA Section Item 2.2.2 - Lease Stipulations - **"Lease stipulations are major or moderate constraints applied to a new geothermal lease. A lease stipulation is a condition of lease issuance that provides a level of protection for other resource values or land uses by restricting lease operations during certain times or locations or by mitigating unacceptable impacts, to an extent greater that standard lease terms or conditions".**

A standard item which should be included in any lease stipulations for Western Colorado (as well as much of the potential lease area in the Western US) should be that geothermal drilling and aquifer testing be limited to the time periods of geothermal spring baseflow. This time period generally extends from November through early March of any given year.

Longer-term monitoring of geothermal springs at several sites in Western Colorado has shown annual fluctuations in spring discharge. Generally, the best time period for measuring geothermal spring baseflow is during the winter months. The late fall/winter seasons are the best time period for drilling and performing aquifer testing on new geothermal wells, as there are no significant outside influences (increased recharge, etc.) affecting the geothermal springs, and the baseflows generally remain fairly constant. During this time period any potential impacts or injury from new geothermal well drilling, testing or production can be more readily ascertained.

No new geothermal well drilling or testing should be permitted to occur during the run-off through mid-summer time periods, as the flow rates, and sometimes temperatures, from geothermal hot springs can vary significantly. Any potential impacts to existing geothermal users from drilling and testing activities during this time period would be much more difficult to determine.

Review of the Colorado Geothermal Rules shows, among other items, that it is required for applicants applying for geothermal exploration well permits to "give notice of the proposed well construction to the owners or operators of any valid, prior water or geothermal rights that are located within one half (½) mile of the proposed well.... The application shall specify whether the well will be used to explore or appropriate a geothermal resource, and if so, specify the proposed production rate and disposal of a geothermal fluid. Any secondary uses of a geothermal fluid or recovery of by-products shall be identified in the application. The application shall be supplemented with evidence showing that notice was given..."

Increasing the area for lease and drilling notices in the PEIS to 2 miles and not allowing drilling within 1 mile of existing geothermal water right owners and resource users is based on the difficulties for a geothermal water right owner or resource user to coordinate regulations, issues, concepts, etc. with both Federal and State government agencies. However, the notice and drilling protection concepts are primarily due to the potential for high magnitudes of resource extraction and associated aquifer impacts associated with a geothermal energy plant. PEIS Section PAA Item 2.5.1 states, **"... it appears that production of geothermal fluids could be expected to vary widely from one to six million gallons per well, per day"**. One well producing one million gpd is equivalent to an average pumping rate of 694 gpm for a consistent 24-hour period every day. PEIS Section PAA Item 2.5.2, states **"Direct use resources are more likely to be developed when they are in proximity to existing communities"**. This statement basically clarifies the intent is to drill production wells in proximity to communities which are already utilizing the geothermal resources for their socioeconomic base.

The requested inclusion within the PEIS of items 1) - 3) on pages 2-3 of this report will help avoid injury to existing proximate geothermal resource users. However, higher yield direct use geothermal power plants could still impact existing geothermal resource users especially if the geothermal resources are being produced from confined aquifer conditions. The inclusion of request items 1) - 3) would not eliminate the requirements for long-term aquifer testing to ascertain depletive impacts from new geothermal wells.

WATER RESOURCE (GEOTHERMAL) ISSUES

Relevant issues which infer the potential for injury to existing geothermal springs and/or wells are mentioned under several sections of the PEIS. Several of these PEIS statements are shown below along with subsequent commentary.

PEIS Section PAA Item 2.5.1 - "**Looking to the future, it is likely that most direct use applications will not be able to draw from existing surface manifestations as they have in the past. Surface manifestations such as naturally occurring hot springs have become increasingly sought after with increases in population in the western US, increased recreational use, and more stringent regulations preserving such resources for their recreational, cultural or scenic value. In such cases where surface manifestations are not nearby or are not being utilized directly, exploration activities similar to those described above for indirect use would also apply for direct use**". C-26-6

The surface manifestations described (geothermal springs) are basically surface manifestations of the local ground water table(s). Drilling and/or production within proximate distances to the geothermal springs can cause injury to spring flow rates and/or water quality.

Section 3.7 Affected Environment - Water Resources and Quality (WRQ) pg. 3-72 - "**Ground water is the primary water resource that is potentially affected by geothermal exploration and development. Potential effects to surface water are more limited in area and scope to the immediate vicinity of geothermal exploration and development activities...** C-26-7

These statements justify the need for the 1-mile no drilling protection zone and the 2-mile notice area.

PEIS WRQ Section pg. 3-218 - "**Drilling activities can result in the pollution of shallower water aquifers with drilling fluids as wells are bored through them, although this effect is limited to the duration of drilling. Well casing is used upon well completion, which separates geothermal fluids from any shallower aquifers that a drilled well may pass through. Ground water contamination can occur in rare situations involving a well casing break or the percolation of surface-discharged geothermal fluids... Surface water bodies can be contaminated from either surface discharges or spills of geothermal fluids, or underground contamination of springs that feed a surface water body. Surface discharges are regulated through state and local permits, and abatement technologies are installed as necessary to reduce contaminants to acceptable levels**". C-26-8

This statement is a broad oversimplification of the potential concerns associated with well drilling. Simply installing a well casing does not guarantee a seal between aquifers, or even along the borehole and the casing. It is difficult to adequately seal the borehole/casing zone; it is even more difficult to seal-off water producing zones within a well. These seals can be viable for shorter time periods; it is very difficult to maintain these well seals over longer time periods.

PEIS Section on Environmental Consequences - Impacts on Water Resources and Quality (IWRQ) Section 4.7.3, pg. 4-43, **Drilling Operations - "BLM and FS guidelines and state regulations for maintaining and plugging and capping wells to prevent blowouts and mandating proper well casing and drilling techniques would minimize the risk of impacting surface water and ground water in the immediate area". Blow-out prevention equipment would be required in areas of known artesian pressures** (PEIS PAA Section 2.5.1). C-26-9

In Western Colorado there have been wells drilled which encountered unexpected artesian flows of geothermal water. Any drilling within a proximate boundary of the proposed 2 mile notification radius should be equipped with blow-out prevention equipment.

PEIS IWRQ Section 4.7, pg. 43 - **"Ground water extraction and injection wells are installed and pumped to cycle geothermal fluids within the geothermal reservoir to remove heat energy. To be effective, it is desirable to create an efficient circulation system where the injected (cool) fluid is resident in the formation long enough to heat up to the maximum temperature without significantly altering subsurface pressures". Most geothermal fluids produced are re-injected back into the geothermal reservoir, via reinjection wells** (PEIS PAA Section 2.5.1 pg. 47).

C-26-10

A main concern with cycling fluids within the well is the potential for decreasing the temperature within the geothermal aquifer. There is no accurate 'up-front' way to determine the effects to temperatures of adjacent geothermal springs due to fluid reinjection within the geothermal aquifer. In addition, re-injection of fluids which are not contained in a closed loop system could be a problem in areas with geologic faulting (as is the case in most fractured geologic settings). Introducing fluids into fractured and faulted geologic formations could result in increasing the earthquake potential in the area (e.g. Rocky Flats near Denver, CO, etc.).

PEIS IWRQ Section 4.7, pg. 4-43, **"Extracting geothermal fluids could result in drawdowns in connected shallower ground water aquifers, with the resulting potential to affect streams or springs that are in turn connected to the water table aquifer. The potential for these types of adverse impacts is reduced through** C-26-11

extensive aquifer testing, which is the basis for designing the geothermal plant and for locating, designing, and operating the extraction and injection wells. Combined with the requirement to comply with state and federal regulations that protect water quality and with limitations imposed by water rights issued by the state engineer, the impacts on water quality and the potential for depleting the water resources is expected to be minimized. <u>There is a medium risk for moderate to high impacts on ground water supplies from the use of ground water for geothermal activities"</u> <u>(emphasis added).</u>

As discussed in the State of Colorado report section (pages 7-9 of this report), the Colorado SEO had to be enjoined in a lawsuit before Geothermal Rules were promulgated in Colorado. The drilling and aquifer testing described above as reducing the potential for injury to existing geothermal users has in fact been the cause of permanent damage to geothermal water rights and resources at existing lodge and geothermal spa facilities in Western Colorado. Expectations that the measures stated on pgs. 4-46 and 4-47 (Impacts under Alternative B) would protect water resources do not say anything about protection of existing geothermal (hot) springs or wells.

PEIS IWRQ Section pg. 4-45, **Utilization - "Hot springs are surface features that indicate the presence of geothermal features deep within the earth. These springs can be part of sensitive ecosystems, recreation areas, or traditional cultural properties. The geothermal resources that would be developed are usually at greater depths that the shallow ground water associated with the hot springs. However, withdrawing shallow ground water or surface water for cooling purposes could affect nearby springs".**

This statement is contradictory. The stated concept appears to be that the existing hot springs indicate the presence of geothermal features deep within the earth, yet are somehow not connected to this deep source. This assumption seems to be fairly widespread, that there is much more geothermal resource within a given area than is indicated by the naturally occurring flow of the geothermal hot springs. Yet, drilling in areas of Western Colorado has not shown this is the case. Drilling, pumping and/or flowing of artesian geothermal wells has shown impact (injury) to adjacent hot springs.

C-26-12

If there is such confidence that there is greater geothermal potential at depth in areas of existing geothermal springs, it should be no problem to encounter this potential at distances of greater than one (1) mile in a downgradient ground water table direction from any existing decreed geothermal water right owner or resource user.

PEIS Section IWRQ pg. 4-45, **Reclamation and Abandonment - "Improper abandonment could allow the wells to serve as pathways for geothermal fluids to migrate to other aquifers, affecting both the geothermal resource and other ground water quality. Proper well closure and capping would reduce the risk of these impacts".**

C-26-13

Well closure and capping may not reduce the risk of these impacts. In fact, use of final production wells will not reduce this risk. As prior stated, it is very difficult to maintain longer term well seals between the well casing and the borehole, and between aquifers within a specific well. It almost has to be assumed that long-term there will be contamination between aquifers within any well drilled for geothermal production.

PEIS Section PAA Item 2.5.1 pg. 49 - **"The cost in exploration of geothermal resources for direct use is a limiting factor in many direct use proposals. Drilling exploration wells is cost-intensive and there is no guarantee of finding a sufficient resource on first attempt".**

C-26-14

This cost concern will lead to the desire to drill geothermal wells in proximity to known geothermal spring/well areas. Thus, it is important to establish the reasonable 2-mile area lease notice and the one mile 'off limit' drilling zones to protect known geothermal water right owners and resource users as part of this PEIS.

PEIS Section on Cumulative Impacts and Other Considerations (CIOC) - Water Resources 5.4.6, pg. 5-20 - **"There is potential for energy facilities to concentrate in areas abundant with the resource. In such areas, there is greater potential to contribute to cumulative depletion of water resources. Ground water depletion is not one of the issues addressed in the proposed lease stipulations, except indirectly through the requirement for compliance with applicable laws and regulations. The state engineer is responsible for assigning water rights and managing ground water resources..."**

C-26-15

PEIS Section CIOC pg. 5-26 - WHAT IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES WOULD BE INVOLVED WITH IMPLEMENTATION OF THE ALTERNATIVES? Section - **"... If any of the reasonably foreseeable development scenario facilities were to come on-line together in a resource area and were concentrated within a small geographical area, there could be some irreversible and irretrievable commitments of local geothermal resources"**... Under the Hydrology and water quality portion of this section - **"Because of the large volume and long duration of geothermal fluid production, the production stage of resource development is likely to have the greatest potential for impact to hydrologic resources. These impacts could occur in terms of changes to the hydraulics of the geothermal and ground water reservoirs and spent geothermal fluid disposal. Hydraulic head pressures in the geothermal and**

adjacent ground water reservoirs could change during production. The result could include reduction in spring discharge rates and lowering of water levels in wells. Disposal of spent fluids by injection could also affect hydraulic heads and could introduce low-quality fluids to ground water pathways that discharge at springs or wells..."

Statements under PEIS Section CIOC pgs. 5-20 and 5-26 shown above demonstrate the need to address broader ranging water resource issues regarding protection of existing decreed geothermal water rights and resource users up-front within this PEIS. BLM and FS BMP's and procedures may vary from area to area, which ultimately creates confusion. Experience shows enforcement of BMP's is dependent upon dictates from Washington, D.C., which could potentially vary every four years. It is much more prudent, and it is the BLM and FS responsibility, to deal with the broader ranging water resource issues, primarily protection for existing geothermal water right owners and resource users, as part of this PEIS. In this manner, the BLM and FS will be minimizing the potential for negative impacts to the existing socioeconomic conditions in many of the communities which utilize the existing geothermal resources. In addition, this approach will ease some of the uncertainty faced by potential geothermal resource lease applicants and development companies.

I appreciate your consideration of the recommended inclusions for items 1), 2) and 3), as stated on pages 2 and 3 of this report, to the PEIS for Geothermal Leasing in the Western United States.

If you have any questions or comments please call.

Very Truly Yours,

MINION HYDROLOGIC

by Wayne Goin

Wayne E. Goin
Hydrogeologist

89-05/94-06/05-13(08)

cc: Dunton, LLC
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Wiesbaden Spa and Lodgings

C-26-1

Water impacts are better assessed at the local level due to variations in site-specific impacts. Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

C-26-2

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts, including impacts on existing geothermal water right owners and resource users. Appropriate site-specific mitigation would be developed, as necessary.

C-26-3

As discussed in Section 1.5.1, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 3200, and 3280). The PEIS is not proposing to amend or change any of the laws or regulations. Addressing site-specific issues is evaluated during the subsequent permitting process. The BLM and FS can apply conditions of approval on such permits to avoid and minimize any impacts to specific resources. While the BLM manages the geothermal resource (namely the heat), the state has primacy over the associated water resource. In accordance with state regulations, a lessee/operator must secure permits from the state before the BLM can issue a permit to drill either a temperature gradient well or a full-diameter exploration well.

C-26-4

As stated above, .site-specific impacts on water resources, including groundwater and water importation would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement as appropriate. BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed as necessary.

C-26-5

As stated above, the PEIS is not proposing to amend or change any of the laws guiding geothermal leasing. Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, as the BLM and FS recognize that states typically manage and have regulatory authority for water rights. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

C-26-6

As stated above, site-specific impacts on water resources, including groundwater, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, and the BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

C-26-7

As stated above, site-specific impacts on water resources, including groundwater, would be addressed as part of the environmental analysis for the permitting process prior to development or utilization of the resource. Furthermore, as discussed in Section 1.5.1, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 32000, and 3280). The PEIS is not proposing to amend or change any of the laws or regulations.

C-26-8

The comment is noted.

As stated in Section 4-4, impacts of development, utilization, and reclamation of geothermal resources include the potential for groundwater contamination. Appendix D provides BMPs to address methods to minimize contaminations. Federal, state, and local regulations ensure that operators will conduct drilling in a prudent manner.

C-26-9

As stated above, site-specific impacts on water resources, including groundwater and water quality, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. Appendix D provides BMPs to address methods to minimize water contamination. Federal, state, and local regulations ensure that operators will conduct drilling in a prudent manner.

C-26-10

See response to comment 1-2-4 and comment 1-2-6 for discussion of development of high steam areas.

Geological faulting depends on the geological characteristics of the area where the geothermal fluids are extracted, or where any other groundwater source used for cooling may be extracted. These conditions and the potential to impact them vary by location and by the proposed development. Prior to making leasing decisions, BLM will assess whether the existing NEPA is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis.

C-26-11

The comment is noted. There may be unique cases where testing could have an adverse impact; however, the intent of testing is to design a sustainable operation. Potential impacts to groundwater depend on many site-specific characteristics (e.g., soil type and fracturing). Potential for such impacts would be evaluated prior to subsequent development permits. In addition, as the commentor noted, water rights and state regulations also affect this issue.

C-26-12

As stated in responses above and discussed in Section 1.5.1, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 32000, and 3280). The PEIS is not proposing to amend or change any of the laws or regulations. Addressing site-specific issues is evaluated during the subsequent permitting process. The BLM and FS can apply conditions of approval on such permits to avoid and minimize any impacts to specific resources. While the BLM manages the geothermal resource (namely the heat), the state has primacy over the associated water resource. In accordance with state regulations, a lessee/operator must secure permits from the state before the BLM can issue a permit to drill either a temperature gradient well or a full-diameter exploration well.

C-26-13

As stated in Section 4-4, impacts of development, utilization, and reclamation of geothermal resources include the potential for groundwater contamination. Appendix D provides BMPs to address methods to minimize contaminations. Federal, state, and local regulations ensure that operators will conduct drilling in a prudent manner. Potential for contamination based on local soil types and groundwater conditions would be assessed prior to issuance of permits for development.

C-26-14

As stated above, site-specific impacts on water resources, including groundwater, would be addressed as part of the environmental analysis for the permitting process. BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

As discussed in Section 1.5.1, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 32000, and 3280). The PEIS is not proposing to amend or change any of the laws or regulations.

C-26-15

The PEIS provides a standard set of BMPs for BLM and FS offices. Due to variations in local resources, the implementation of BMPs would necessarily be varied. As stated above, prior to leasing, the BLM or FS would collaborate with appropriate state agencies. Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process. The BLM and FS would work with interested and affected parties to identify and resolve user conflicts, and appropriate site-specific mitigation would be developed, as necessary.

As discussed in Section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

SAGUACHE COUNTY GOVERNMENT

501 FOURTH STREET
SAGUACHE, COLORADO
AREA CODE 719 ZIP CODE 81149

September 2, 2008

BLM/Forest Service

To Whom It May Concern:

The Saguache County Board of County Commissioners are writing to inform you of our support for Alternative B – proposed action – concerning PEIS on Geothermal Energy on public lands. A-27-1

Alternative B – which will access all public and NFS land I the 12 Western states (in. Alaska) with geothermal potential as being open or closed to leasing for both direct (space heating and spas and indirect (electricity generation) use development use development; adopt a comprehensive list of stipulations, best management practices, and procedures to serve as consistent guidance for future geothermal leasing and development; amend BLM Resource Management Plans (RMPs) to adopt the reasonable foreseeable development scenarios (RFDs); and make decisions to issue or deny geothermal lease applications on BLM and NFS lands pending as of January 1, 2005.

Thank you for allowing Saguache County to comment on the proposed Geothermal Energy Development on public lands.

Sincerely,

Sam Pace
Chairman

Michael Spearman
Commissioner

Linda Joseph
Commissioner

A-27-1

The commentor's preference for Alternative B is noted.

This message has been automatically forwarded from geothermal_eis@blm.gov.

mktolbert@cot.net
09/09/2008 09:00 AM

To geothermal_EIS@BLM.gov
cc
bcc
Subject Geothermal @ Medicine Lake

My husband and I are against geothermal in the Medicine Lake area. We have a cabin there and just live 30 miles due west in a small, beautiful, quiet town of Tennant, Ca. I can't understand why geothermal would even be considered in such a pristine area like Medicine Lake, especially when there is no significant amount of heat. I have yet to see why they even call it "green energy" because there is nothing "green" or clean about the way they produce it. Thank you for your time. Krista Tolbert I-28-1

I-28-1

The commentor's preference for no geothermal development in the Medicine Lake area is noted.

THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
5000 W. CAREFREE HIGHWAY
PHOENIX, AZ 85086-5000
(602) 942-3000 • WWW.AZGFD.GOV

September 4, 2008

Geothermal Programmatic EIS
c/o EMPSi
182 Howard Street
Suite 110
San Francisco, CA 94105-1611

Re: **Western Geothermal Programmatic EIS**

Dear Sirs:

The Arizona Game and Fish Department (Department) reviewed the Draft Programmatic Environment Impact Statement (PEIS) to evaluate Geothermal Leasing in the Western United States. The Department supports the Bureau of Land Management's (BLM) efforts in developing the PEIS and provides the following comments for your consideration.

The Department supports the development of alternative energies, such as geothermal, provided detrimental effects to wildlife and wildlife habitat are avoided. Potential impacts to wildlife and their habitats should be fully addressed and analyzed, as well as impacts associated with the loss of public use which includes wildlife dependent recreation. This PEIS should not negate the need for NEPA on individual projects, allowing the Department and the public the opportunity to review and comment on specific projects affecting public lands. A-29-1

Both the PEIS and individual project NEPA analyses should evaluate alternatives to using public land for geothermal power generation. Geothermal projects appear to eliminate all other public uses of multiple-use land, including wildlife habitat and public recreation. The PEIS should evaluate alternatives to using public land for geothermal energy generation such as supporting utility scale geothermal generation on private lands. If public lands are determined to be appropriate for utility scale geothermal development, suitable placement will be crucial in ensuring natural resource protection. The identification of inappropriate areas on BLM administered lands including those areas already identified as sensitive in BLM's Resource Management Plans (including Wildlife Habitat Areas, areas with wilderness characteristics, etc.) will aid in focusing geothermal development in the appropriate areas. The Department recommends the use of previously disturbed lands, BLM lands identified for disposal, and other less environmentally sensitive land for geothermal energy development. A-29-2

Further, the Department is concerned with any net loss of groundwater. Although the use of groundwater is not regulated by BLM or the U.S. Forest Service, we believe the use of water for geothermal leasing should be part of the analysis for a lease. A-29-3

The Department appreciates the opportunity to provide comments on the draft PEIS. For further coordination or questions regarding this letter, please contact me at (623) 236-7606.

Sincerely,

Ginger Ritter

Ginger Ritter
Project Evaluation Program Specialist, Habitat Branch

cc: Laura Canaca, Project Evaluation Program Supervisor
Dave Dorum, Habitat Program Manager, Region I
Rick Miller, Habitat Program Manager, Region II
Habitat Program Manager, Region III
Russ Engel, Habitat Program Manager, Region IV
Joan Scott, Habitat Program Manager, Region V
Russ Haughey, Habitat Program Manager, Region VI

AGFD # M08-06161248

A-29-1

The comment is noted. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

A-29-2

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations, such as Endangered Species Act Section 107 consultation and National Historic Preservation Act Section 106 consultation. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

A-29-3

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. BLM and FS would work with interested and affected parties to identify and resolve resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

Great Basin Group
Sierra Club
P.O.Box 8096
Reno, Nevada 89507

September 7, 2008

BLM Geothermal Programmatic EIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105

Dear BLM Representative:

This letter is in response for public comment on the draft PEIS for Geothermal Leasing in the Western United States, dated May 2008.

This letter is written on behalf of the Great Basin Group of the Sierra Club. The Great Basin Group has over 2500 Sierra Club members and spans northern and central Nevada, which includes undoubtedly the largest potential for geothermal energy of any state. Please accept our comments on the PEIS.

Volume I: Programmatic Analysis

The Great Basin Group, Sierra Club, supports the Preferred Alternative as outlined in Chapter 2. We agree with the list of areas designated as closed to geothermal leasing. O-30-1

Volume II: Chapter 14: Humboldt-Toiyabe National Forest/Battle Mountain District: Environmental Analysis for Pending Lease Application NVN 074289

The following comments address the single lease proposal in this PEIS for Nevada.

We support the Preferred Alternative as set forth in this chapter, **with the following changes and clarifications**. We note that a total of 320 acres of public land are contained in the lease area and that this is fairly small area of impacted public land. We feel that the scope of analysis and proposed action are commensurate with the scale of the project proposed by the lessee. O-30-2

p. 14-9 Lessee proposes less than 20 acres of disturbance if there is full buildout of a geothermal field which will produce about 12 MW. Power lines are not addressed here, but this seems to avoid O-30-3 a significant issue. Surely the agencies and the lessee know where the potential tie-ins are. Surely they can estimate what the total area of disturbances would be for transmission line structures which would allow tie-ins at the potential points. I suspect this total area may be significant in relation to the 10-20 acres envisioned for the plant itself. **Please supply justification for ignoring the probable transmission line impacts.**

p. 14-13 The text says "The NFS portion of the lease sites is within an Inventoried Roadless Area. Development in this area would be consistent with this designation as long as no new roads are constructed to access the sites." This statement is obvious, but what it does not say clearly is that no new roads will be constructed within this area to access the sites. The language leaves it very unclear whether new roads will, or will not, be allowed in the Roadless Area. **We support a clear position saying they will not be.** This, of course, would effectively prohibit development of the geothermal field out into the Roadless Area. We don't think that such development is possible without roads. Are we wrong? 0-30-4

p. 14-15 Under "Alternative B (Proposed Action)", it says "Issuing leases for the proposed lease sites could indirectly result in the development of geothermal resources at the sites...." **We believe the use of "could" is too weak.** Surely the lessee is fairly sure of the geothermal potential -- otherwise why lease this public land? The PEIS should be examining cumulative impacts, including full development as envisioned by the lessee, as stated below. 0-30-5

p. 14-23 We feel that the language of the first two sentences under "Impacts" is strange. Of course the act of leasing itself has no environmental impact. Why should this even be stated? Other such statements occur in this chapter -- **please eliminate them**. It simply is confusing to the reader. 0-30-6

p. 14-29 Treatment of the sage grouse here may need to be redone if, before the final PEIS, the listing status of the sage grouse is changed. In line 8 on this page: should the text read "in cooperation with other agencies"? 0-30-7

p. 14-29 The presence, or not, of the speckled dace should be established before the final PEIS and suitable mitigation measures proposed. 0-30-8

Respectfully submitted,

David von Seggern

David von Seggern, Conservation Chair
Great Basin Group, Sierra Club

O-30-1

Thank you for your comment. The commentor's support for Alternative B is noted.

O-30-2

Thank you for your comment. The commentor's preference for Alternative B is noted.

O-30-3

The following text and references have been added to the Final PEIS to address transmission lines:

> Great American Energy plans to connect to the existing 29 kV line that parallels the highway and runs through the Darrough's fee lands. The 29 kV line connects to the Round Mountain substation on the 230 kV line. No additional transmission lines or routes are contemplated (Great American Energy 2008b).

O-30-4

The existing case law regarding the Roadless Rule is inconsistent. On August 12, 2008, the Wyoming District Court found the 2001 Roadless Rule violated NEPA and the Wilderness Act (State of Wyoming v. US Department of Agriculture). The District Court ordered the 2001 Roadless Rule "set aside" and "permanently enjoined." This order is subsequent to a 2006 California District Court ruling that set aside the 2005 State Petitions Rule and reinstated the 2001 Roadless Rule. The United States Justice Department, on behalf of the Department of Agriculture, has filed motions with both the Wyoming and California courts seeking adjustments of those courts' conflicting judicial orders. Neither the Wyoming nor California District Court rulings bar the Department of Agriculture from promulgating other roadless area regulations. To address this inconsistency, the PEIS includes the following Department of Agriculture Roadless Area Stipulation, "If future legislation or regulation change the roadless area designation, the restriction would be revised along with any appropriate environmental review." An appropriate NEPA review would be required prior to any changes to the Roadless Area Stipulation.

O-30-5

This language has been strengthened to "would likely."

O-30-6

This and other similar statements have been removed.

O-30-7

Text has been revised to read "in cooperation with other agencies."

O-30-8

Species-specific mitigation measures would be developed prior to ground-disturbing activities (exploration or development). NEPA analysis would be required prior to any ground disturbance that could affect the dace.

This message has been automatically forwarded from geothermal_eis@blm.gov.

"Lovelace, Bonnie" <BLovelace2@mt.gov>

To "'geothermal_EIS@blm.gov'" <geothermal_EIS@blm.gov>

cc

09/10/2008 01:29 PM

bcc

Subject Comments from Montana Department of Environmental Quality

Mr. Jack Peterson
Bureau of Land Management

RE: Geothermal Programmatic EIS

Dear Jack:

The Department of Environmental Quality would like to thank you for taking the time to meet with us in Helena prior to the public meeting. At the meeting you especially requested comments regarding the regulatory description for Montana in Volume III.

Your description is fine as far as it goes. The role of EPA in implementing the Underground Injection Control permits and the overall Clean Water Act descriptions are accurate. However, I would like to add a few regulatory descriptions in a table format (attached) that might prove useful. The permits for air emissions are dependent upon whether or not a system is closed. If there are no air emissions, of course, no permitting would be required. For water, likewise, there would need to be a discharge either to surface water or groundwater. In Montana, state groundwater discharge permitting may duplicate the UIC program to some extent.

A-31-1

Thank you for the opportunity to comment.

Bonnie Lovelace
Director's Office
Department of Environmental Quality
406-444-1760

(See attached file: State Permits.doc)

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERMITS AND APPROVALS

Table 1

Permit/Approval Name	Nature of Permit	Authority
Section 401 Water Quality Certification	Provides a review of potential adverse water quality impacts potentially associated with discharges of dredged or fill materials in wetlands and other waters of the U.S.	Section 401 of the Clean Water Act
MPDES Wastewater Discharge Permit	Permits the discharge of wastewater to waters of the state. There is also a requirement to look at a proposal's plans and specifications to determine if a permit is needed (MCA, 75-5-402)	Montana Water Quality Act (75-5-401 et seq., MCA)
General Discharge Permit for Stormwater Associated with Construction Activities	Permits construction and industrial activities that would result in the discharge of stormwater to waters of the state.	Montana Water Quality Act (75-5-401 et seq., MCA)
General Permit for Stormwater Discharges Associated with Industrial Activity	Permits construction and industrial activities for the Generation Plant that would result in the discharge of stormwater to waters of the state.	Montana Water Quality Act (75-5-401 et seq., MCA)
Air Quality Preconstruction Permit	Permit for the construction, installation and operation of equipment or facilities that may directly or indirectly cause or contribute to air pollution.	75-2-211, MCA : Preconstruction permit
Air Quality Operating Permit	Permit for the construction, installation and operation of equipment or facilities that may directly or indirectly cause or contribute to air pollution.	75-2-217, MCA: Operating permit
Prevention of Significant Deterioration Permit (PSD)	Permit when a major new source of air pollution is proposed to constructed or modified in an area designated as attainment or unclassified for an ambient or quality standard.	ARM 17.8.801 et seq.
New Source Review in Non-attainment Areas	Permitting for major new or modified sources of air pollution construction in or near areas that are designated as non-attainment for an ambient air quality standard.	ARM 17.8.901-906
Montana Joint Application: 310 Permit	Permits construction activities in or near perennial streams on public and private lands.	Montana Natural Streambed and Land Preservation Act (75-7-101 et seq., MCA)
Montana Joint	Allows construction activities within a	Montana Floodplain

Application: Floodplain Development Permit	designated 100-year floodplain.	and Floodway Management Act (76-5-401 through 406, MCA)
Montana Joint Application: 318 Authorization short-term turbidity	Authorizes short-term exemptions from certain surface water quality standards.	Montana Water Quality Act (75-5-318, MCA)
Public Water Supply Approval	Review of engineering plans and specifications for a new public water supply for more than 25 people daily for period of at least 60 days in a one year period.	75-6-112, MCA: Plan Review and Approval
Open Cut Permit (if new gravel sources are needed for the project)	Permit to excavate 10,000 cubic yards or more total aggregate from one or more pits regardless of surface ownership.	Open Cut Mining Act (84-4-401 et seq., MCA)

A-31-1

Thank you for your comment. Regulatory descriptions provided were reviewed for consistency with Appendix A.

From:	Mommy Jackson
To:	Zoe Ghali
Subject:	Geothermal Leasing Project Comment
Date:	Wednesday, September 10, 2008 4:16:20 PM

Subject: Geothermal Leasing Project Comment
To: geothermal_eis@blm.gov, Mommy Jackson <momjackson3@gmail.com>

To the Geothermal Leasing Project Board,

I would like to submit for comment to the Geothermal Leasing Project. I oppose the proposed site within the Willamette National Forest, North Santiam site. This would impact the areas drinking water source to 147,250 residents of Salem, 7,505 residents of Stayton and other towns along the North Santiam. It would also impact those whose wells are provided for from the aquifers located throughout this region. The Three Basin Rule was established in1976 by the Environmental Quality Commission to provide safe drinking water for the major populations of Oregon. Businesses, local governments, utilities, recreational representatives and the public worked together to establish the Three Basin Rule. I want this rule enforced. This would prohibit the Geothermal Project from discharging hazardous wastes, therefore denying the project to proceed in this region.

I-32-1

Dozens of species have successfully recovered given the careful and beneficial protections of the Endangered Species Act. This law protects the endangered species and protects the balance of nature and the environment. The impacts to the endangered species and the wildlife within this area from the proposed geothermal project are unacceptable. I want the Endangered Species Act enforced. It is not acceptable to sidestep the laws to bring this project to such a delicate environmental area!

I suggest that the geothermal projects be located in other sites that would not impact the environment to vital areas of resources in Oregon. The North Santiam Site within the Willamette National Forest area in unacceptable to me. This is my drinking water source.

Sincerely,

Irene Jackson

487 N. Myrtle Avenue

Stayton, Oregon 97383

503-769-6992

momjackson3@gmail.com

I-32-1

Lands designated as open to leasing are subject to existing laws, regulations, and formal orders. In complying with these laws, regulations, and orders, some of the open lands may not be available for leasing. Chapter 2 explains, under *Procedures Prior to Leasing*, that the BLM and FS would comply with the requirements of the Endangered Species Act, including determining if any listed or proposed threatened or endangered species, or critical habitat, is present on nominated lease parcels and may be affected by any decision to lease. Chapter 6 of the Final PEIS, in turn, explains that the agencies have determined that the decision to lease has no effect on listed species or critical habitat.

To provide further protection for threatened, endangered, and sensitive species, the BLM will impose an ESA stipulation (see Section 2.2.2) on all geothermal leases.

QUECHAN INDIAN TRIBE
Ft. Yuma Indian Reservation

P.O. Box 1899
Yuma, Arizona 85366-1899
Phone (760) 572-0213
Fax (760) 572-2102

September 10, 2008

Draft Geothermal Leasing PEIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

Dear Sir/Madam,

Thank you for notifying us of the Draft Programmatic Environmental Impact Statement for the Geothermal Leasing in the Western United States.

We have reviewed the document and have a few concerns that we believe should be taken into consideration, especially when projects are proposed within the Tribes' traditional land area. The Tribe, who was here prior to the arrival of the Spaniards or Europeans, had several villages scattered throughout what is now Arizona and California. The traditional land area of the Tribe encompasses the lands from Blythe, CA into Mexico and from Gila Bend, AZ to Ocotillo, CA. It is within this geographic area that resources were utilized and the Tribe lived. Plants, animals, landforms, water, and cultural resources must all be considered as they are all used together to tell the history of the Tribe. A-33-1

On page ES-7, it is stated that long-term loss of vegetation, habitat, and soil; short-term impact to ground water during drilling; and short-term increase in air emissions from drilling and construction activities are adverse impacts that are expected. The potential destruction of traditional plant gathering areas and clay sources located within the project areas is quite concerning to the Tribe. The potential for animals of traditional importance to the Tribe to leave the area due to loss of habitation is also concerning.

On page 2-41, it is mentioned that during the Phase One: Geothermal Resource Exploration that "surveys may require creating access using four-wheel drive vehicles, or by helicopters or on foot to areas with no roads or very poor roads." We are requesting that all access routes be surveyed for biological and cultural resources. Unless there is an established, paved road, all access routes need to be surveyed. A-33-2

Due to each geothermal project having the potential to encompass 350 acres, we are requesting that the clustering of these projects be prohibited. As mentioned previously, the Tribe has a large traditional land area with an extensive network of cultural resources and TCP's located within. With each project the Tribe faces the loss of their culture as impacts to cultural resources affiliated with the Tribe, as well as the spiritual landscapes in which they are located, are impacted. A-33-3

To alleviate the potential for impacts to cultural resources and/or spiritual landscapes we request to be consulted with at the inception of the project, prior to any plans being finalized. Experience has shown us that once the plans for a project are in place people are less open to discussing suggestions from us for mitigation. By contacting and consulting with the Tribe when the project is first proposed, it is our hope that we will be able to work through any potential concerns during the planning process. A-33-4

Thank you again for your notification. If you have any questions, please do not hesitate to call me at (760) 572-2423.

Sincerely,

Bridget Nash-Chrabascz

Bridget Nash-Chrabascz
Historic Preservation Officer/Archaeologist

A-33-1

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public and tribal involvement, as applicable. This document covers only the land use planning and lease issuance stages.

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases.

A-33-2

Any exploration activities that result in ground-disturbing activities would require permitting coordination with the local BLM or Forest Service office prior to being conducted.

A-33-3

Geothermal resources are typically concentrated in specific geographic areas; therefore, the BLM cannot prohibit clustering of leases. Prior to inclusion of a parcel(s) in a competitive lease bid, consultation would occur with the appropriate tribes and/or State Historic Preservation Officers.

A-33-4

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers prior to inclusion of a lease in a lease sale. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases.

Geothermal Programmatic EIS
c/o EMPSI
182 Howard St, Ste 110
San Francisco, Ca 94105

7 Sept. 2008

Public Comment on a draft interagency Programmatic Environmental Impact Statement (PEIS):

It is my firm conviction that the BLM & the Forest Service should withhold all geothermal leasing decisions until individual Environmental Impact Statements are completed for each of the specific areas that are contemplated for geothermal leasing nominations on 19 million acres of public lands. F-34-1

I write to ask you to exclude Mt. Shasta & the Medicine Lake Highlands from all geothermal leasing. F-34-2

Sincerely yours,

Faith M. Willcox
47 Junction Rd.
Westport, Me. 04578

F-34-1

It is not clear what the commentor is referring to by "specific areas that are contemplated for geothermal leasing nominations on 19 million acres…" For the programmatic document, the Proposed Action does not identify specific areas for leasing. The pending lease areas identified in Volume II consist of 19 leases in 7 geographic clusters. Volume II contains additional analysis for each of the pending lease applications and also tiers to the analysis in the PEIS.

Decisions for the pending lease applications will be contained in separate Records of Decision from the Decision for the Programmatic Document.

F-34-2

As described in Section 2.2.2 *Procedures Prior to Leasing*, prior to inclusion of a lease in a competitive bidding process, the BLM or FS would review the lease area for sensitive resources and provide the necessary stipulations to protect these resources. This review would include consultation with appropriate Native American Tribal Governments, as necessary.

Nevada Power.
nevadapower.com

Sierra Pacific
sierrapacific.com

Submitted electronically via e-mail
Friday, September 12, 2008

September 11, 2008

Geothermal Programmatic EIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105

Whom It May Concern:

Nevada Power Company and Sierra Pacific Power Company (the Companies), subsidiaries of Sierra Pacific Resources serving communities of southern and northern Nevada and a portion of California, appreciate the opportunity to review and provide comments to the Draft Programmatic Environmental Impact Statement (PEIS) for Geothermal Leasing in the Western United States. The Companies understand the goals of the PEIS are to amend land use plans to facilitate geothermal leasing decisions in an environmentally responsible manner, and does not authorize any ground-disturbing activities to explore for or develop geothermal resources. The Companies appreciate and support the planning criteria for this action that includes, "*Environmental protection and energy production are both desirable and necessary objectives of sound land management practices and are not to be considered mutually exclusive priorities.*" The Companies hereby provide some comments and questions related to this action. C-35-1

The Companies have a three-part energy strategy to meet an overall goal of providing clean, safe, reliable electricity to their customers at reasonable and predictable prices. This strategy includes increasing energy efficiency and conservation programs, expanding renewable energy initiatives and investments and also involves a diversified energy portfolio with a balanced mix of fuels for energy generation. This is in the best interest of their customers, shareholders, the communities they serve and the state.

Nevada is composed of over 85% federal lands, with over 50% of these federal lands managed for conservation of specific natural resources (DOE, 2007). Some of the potential commercially viable renewable energy resources (i.e., solar, wind, geothermal) in Nevada are constrained by access, land conservation boundaries and military ground and air restrictions. Specific to geothermal leasing and resource development, non-discretionary closures regulated by Executive Orders, laws and regulations such as the Geothermal Steam Act of 1970 (GSA), as amended (30 USC, Section 1001) and the Geothermal Resources Leasing Rule (GRLR; 43 CFR 3201.10 and 3201.11), identify federal lands that are available and not available for geothermal leasing, further constraining the potential development of this resource for commercial electrical generation and direct use. C-35-2

P.O. Box 98910, Las Vegas, Nevada 89151-0001 • 6226 West Sahara Avenue, Las Vegas, Nevada 89146
P.O. Box 10100, Reno, Nevada 89520-0024 • 6100 Neil Road, Reno, Nevada 89511

In the PEIS, it is not quite clear in Section 2.2.1, pages 2-6 and 2-7, how many acres of land are proposed to be closed for geothermal leasing over what is already unavailable by such orders, laws and regulations stated above (i.e., the baseline condition). The Companies interpret the nine bullets listed on page 2-6 as non-discretionary closures of federal lands that "*are excluded from geothermal leasing on the basis of existing laws, regulations and Executive Orders.*" This seems to be the baseline condition (i.e., Alternative A: No Action). **Of the 142 million acres of federal BLM land identified in Table 1-1, how many acres are currently closed under the baseline condition from these existing laws?** C-35-3

The Companies interpret the six bullets on page 2-7 as proposed closures, separate from the existing closures described above, on federal BLM land under Alternative B: Proposed Action of the PEIS. **Table 2-1 on pages 2-8 and 2-9 shows a total of 25 million acres as "proposed closed". Do the 25 million acres listed in Table 2-1 include both the existing baseline closures plus the proposed action closures? If so, the Companies request further clarification to this point to show the two separate acreage amounts under Alternatives A and B.** C-35-4

The bullets on page 2-7 reference a list of ACECs that are currently open and closed to fluid mineral leasing. The list, found in Appendix C, includes ACEC designations that are currently not authorized yet by Records of Decision for local land use plan revisions (e.g., Stillwater ACEC in Winnemucca RMP). Table 2-3, page 2-26 states that this PEIS will have a Record of Decision prior to completion of Records of Decision for these as land use plans are still under revision. **If an ACEC has been proposed, but not yet authorized, what is BLM's approach to this issue?** C-35-5

Table 2.5 on page 2-30 shows a comparison of two of the three alternatives; however, Alternative A is not included. This makes it confusing to evaluate the two action alternatives against the baseline no action alternative, especially if the Companies' interpretation of the baseline condition, as described above, is correct. **The Companies request that the Agencies include acreage allocations under Alternative A in Table 2-5 to facilitate a more complete evaluation of the three alternatives.** C-35-6

The Companies feel this is a significant point to clarify, as it apparently seems that Alternative A would have the least amount of acres that would be closed for geothermal leasing, whereas Alternative B would progressively add to the closed acreage amount and Alternative C would have even more acres closed.

Section 2.2.3 on page 2-26 lists one rationale for amending existing land use plans as, "*the land use plan does not allocate areas as being open or closed to geothermal leasing*"; however, there are Executive Orders, laws and regulations (see Section 2.2.1) which designate lands as open or closed (i.e., Alternative A: No Action). **Are the land use plans required to be amended in order to incorporate existing orders, laws and regulations?** C-35-7

On page 2-26, there are four reasons given as to why some land use plans within the project area are excluded from amendment under the PEIS. Reasons (2) and (3) state that previously amended plans adequately address geothermal leasing and development, and plans currently being amended will address geothermal leasing and development. This appears to present a situation where applicants and project proponents will still experience inconsistent processing of applications as not all land use plans will have the same policies between field offices. **What criteria were used to determine that existing land use plans excluded from the PEIS "*adequately address geothermal leasing and development*"? Do these previous and currently amended land use plans also contain the same stipulations, Best Management Practices and procedures of this PEIS as proposed in Section 2.2.2? Or are they less or more rigorous? How does this PEIS support consistency in the processing and authorizing of geothermal leasing and development applications between field offices under this situation where land use plans will not be the same?** Future leasing approvals between field offices will inevitably have varied stipulations as well as mitigation and reclamation measures. C-35-8

Section 2.3.1, the No Action Alternative, on page 2-30 contains two paragraphs that appear to be contradictory to each other. The first paragraph states that no land use plans would be amended, and that no lands would be identified as open or closed to geothermal leasing. As previously stated already in the PEIS (see Section 2.2.1), existing orders, laws and regulations identify federal lands as open or closed, whether or not existing land use plans do the same. The 2nd paragraph correctly describes the no action alternative, simply that all new geothermal leasing applications would be handled on a case-by-case basis, with independent review under NEPA and other laws, as well as amendments to local land use plans as needed. So essentially, under Alternative A, land use plans would most likely be amended, but only as specific projects are proposed and would most likely not be consistent with plan amendments between field offices. The PEIS would be clearer to understand if there was a more thorough description and comparison represented in Alternatives A and B. C-35-9

Alternative C, as described in Section 2.3.3 on page 2-31, obviously limits utilizing the vast potential geothermal resources across the project area based on locations of existing transmission lines. There is no relation to the locations of existing transmission lines with all of the potential geothermal resource locations. Furthermore, this alternative does not address any future transmission lines not yet planned or proposed over the coming decades through, at a minimum, the 1) State of Nevada Governor Jim Gibbons' Nevada Renewable Energy Transmission Access Advisory Committee task force, and 2) the Department of Energy's Westwide Corridor Programmatic Environmental Impact Study. This alternative severely reduces the potential to tap into much of the geothermal resources in the west, and does not adequately serve the need to meet Section 211 and 222(d)(1) of the Energy Policy Act. The Companies do not support this alternative. C-35-10

The 2nd paragraph on page 4-5 states a figure of "*676,000,000 acres in the western U.S.*" to support a disturbance calculation in the preceding paragraph; however, this figure includes land outside the scope of the planning area of this PEIS and therefore reflects an inaccurate representation of disturbed land under the Reasonably Foreseeable Development scenario (RFD). According to Table 2-5 and Section 4.2.2, the correct figure to use should be 248,672,710 acres of BLM and FS lands in the planning area. C-35-11

In Chapter 4, the various resource sections with the sub-heading, "*Impacts under Alternative A*" do not appear to be consistent between themselves, or with the description of Alternative A as given under Section 2.3.1 on Page 2-30. For example, Section 4.2.4 on page 4-6 states, "*…all federal lands…would be open to geothermal leasing unless closed based on existing land use plans or congressional designation*" whereas Section 4.3.4 on page 4-22 states, "*…public lands would be designated as open or closed...by the individual field offices and ranger districts*" and further makes a new statement not seen in the PEIS until this point, "*Some field offices have developed resource management plans that standardize leasing approvals and operational stipulations for the field office planning area, reducing the need for case-by-case decision making. In other cases, geothermal leasing for direct and indirect use would continue to be approved on a case-by-case basis.*" Section 4.8.4 on page 4-55 states, "*…BLM…and FS…would continue to update their RMPs and forest plans, respectively, at their own pace*". The Companies request that Alternative A be consistently described throughout the PEIS to avoid confusion, and to more specifically identify the differences compared to Alternative B. C-35-12

The cumulative impacts on Energy and Minerals as described in Section 5.4.3 on page 5-19 contain the following statements: "*An increase in development of geothermal resources would have a cumulative impact of reducing the demand for nonrenewable energy. Based on the RFD, there is the potential to triple the megawatts produced with geothermal resources, which would offset power demand from coal, oil and gas.*" These statements assume that demand for electricity remains relatively constant, which will probably not be the case throughout the electrical service territories within the project area; especially in Nevada which continues to be the fastest growing state in the nation. Given that geothermal projects are small and can take years to permit, explore, design and construct, the cumulative impacts described in this section may need to be reconsidered. Over half the nation's current electricity generation is derived from fossil fuels (i.e., coal, gas and oil) and many experts believe this trend will continue for at least the next few decades. C-35-13

Best Management Practices (BMP)

The BMPs listed in Appendix D is an exhaustive list of measures. The Companies understand and include as a normal course of practice in project design and planning, efforts to avoid natural resources to the greatest extent practical, and where avoidance is not practical, mitigating activities to reduce impacts within non-significant C-35-14 levels. This is a fair and common sense approach to ensure safety of crews and equipment during construction and operation, as well as ensuring environmentally sound measures in conserving resources. However, the BMPs as presented in the PEIS by activity (i.e., Exploration, Drilling, Utilization, and Reclamation) appear to be redundant, contradictory and some of which are part of other processes in the federal right-of-way application process (see below).

Page D-3, 3rd bullet: this is already required under NEPA and not necessary to specify as a BMP
Another example is the varied BMPs for access roads, as follows:

- *Existing roads should be used to maximum extent feasible* (p. D-3)
- *The project shall be planned to utilize existing roads…to the maximum extent practicable* (D-3)
- *Existing road shall be used, but only if in safe and environmentally sound locations* (D-5; Please define what is meant by "environmentally sound locations")
- *Access roads shall be surfaced with aggregate* (D-5)
- *Access roads shall be located to follow natural contours and minimize side hill cuts* (D-5)
- *Roads shall be designed so that changes to surface water runoff are avoided* (D-5)
- *Road use shall be restricted during the wet season* (D-5)
- *Access roads shall be located to minimize stream crossings* (D-6)
- *Roads shall be located away from drainage bottoms and avoid wetlands* (D-6)
- *Existing roads should be used to the maximum extent feasible* (D-9)
- *If new access roads are necessary, they should be designed and constructed to the appropriate standard* (D-9)
- *Existing or new roads should be maintained to the condition needed for facility use* (D-9)
- *Existing roads should be used to the maximum extent feasible* (D-10)
- *New access roads should be configured to avoid high-quality habitats and minimize habitat fragmentation* (D-10)
- *Site access roads should minimize stream crossings* (D-10)

A project proponent can easily become confused with this inconsistent list of varied requirements just for access roads. A reader's first reaction is to assume access roads cannot be built anywhere with all of these restrictions listed as BMPs. Project proponents understand the technical feasibility of siting, designing, constructing and/or maintaining roads from a civil engineering perspective to ensure that the equipment and materials planned for the project can safely be transported across such road; and from an environmental impact perspective, understand the natural resources present that can be avoided and/or mitigated to the extent feasible. The Companies suggest more consistent description and applicability of BMPs.

Some BMPs don't seem to be feasible; for instance,"*Existing sites shall be used in preference to new sites*" is included under Exploration, Drilling, Utilization and Reclamation. Obviously the Agencies copied most, if not all, of the exact same BMPs into each activity section. From a practical standpoint, using existing sites for each of the four activities is not appropriate and in fact, does not help to meet the goal of increasing geothermal energy generation on federal lands in the project area. The Companies understand that the BMPs are intended to be a laundry list that individual field offices would draw from in selecting appropriate measures for specific projects; however, the experiences the Companies have had are that field offices do not have the personnel or the time to utilize this approach and typically an entire generalized list of measures are included in right-of-way grants issued for projects. The Companies feel that close coordination between project proponents and the federal agency on site-specific projects should warrant site-specific measures based on the environmental analyses to avoid confusion, allow for an efficient implementation of projects and give specific and clear direction to project proponents. C-35-15

The Companies appreciate this opportunity to submit comments on the PEIS and look forward to continuing to participate in this process to help find responsible, fair and common sense solutions to geothermal leasing and development on the federal lands in the western states.

Sincerely,

Eileen Wynkoop
Manager, Environmental Services

Citations

U.S. Department of Energy, Draft Programmatic Environmental Impact Statement, *Designation of Energy Corridors on Federal Land in the 11 Western States* (DOE/EIS-0386). October 2007.

C-35-1

Thank you for your comment. The comment is noted.

C-35-2

The comment is noted.

C-35-3

The non discretionary closures are lands that are currently closed based on laws and regulations and are therefore part of the baseline condition. The baseline condition also includes discretionary closures as identified by specific local land use plans for geothermal resources. Some land use plans have made such allocations, but many plans have not made discretionary allocations for geothermal leasing, and as such, are inadequate to make leasing decisions. This means that lands within these planning areas are neither open nor closed to leasing until a formal land use plan amendment is undertaken. Because many plans do not have allocations for leasing, it is not possible to provide baseline acreage of open or closed areas. As stated in Section 1.2, *Purpose of the Action*, the Proposed Action seeks to amend all inadequate plans and bring consistency to the leasing process.

C-35-4

The six bullets are the proposed discretionary closures for BLM lands. Most existing land use plans that address geothermal leasing include these six types of closures. The acreage in Table 2-1 accounts for both the non-discretionary and discretionary closures under the Proposed Action (Alternative B). As noted above, it is not possible to classify and calculate acres for the baseline (Alternative A: No Action), because of the non-allocated status of most BLM lands for geothermal leasing.

C-35-5

Appendix C has been revised to only include existing ACECs. ACECs that are part of an ongoing land use plan revision will be allocated as open or closed for leasing as part of the planning effort.

C-35-6

As noted above, it is not possible to classify and calculate acres for the baseline (Alternative A: No Action), because of the non-allocated status of most BLM lands for geothermal leasing.

C-35-7

All public lands are managed in accordance with laws, regulations, and orders. Plans do not have to be amended to incorporate the laws. Plans are reviewed to ensure that the decisions within the plans are still consistent with any new laws, regulations, or orders.

C-35-8

Differences in the way that land use plans address geothermal leasing and development are a necessary outgrowth of localized characteristics of the resources in the planning area. Language has been added to Section 2.2.3 to clarify this.

C-35-9

The first paragraph states what would occur as part of this process if No Action is taken; hence, no plans would be amended and no allocations would be made. Existing laws and regulations are part of the baseline, so taking No Action does not change that condition.

The second paragraph is correct in that it provides the current process for handling lease applications. BLM has added some clarifying language to the first paragraph.

C-35-10

The commentor's concerns with and lack of support for Alternative C are noted.

C-35-11

This figure is an accurate number for lands managed by the BLM and the FS in the Western US, as stated in the sentence. The intent of this statement was to demonstrate that the total amount of disturbed land is small compared to the total amount of public and NFS land in the west.

C-35-12

"Impacts under Alternative A" has been revised for consistency for all resource sections.

C-35-13

While demand for electricity may increase in the future as noted in this comment, the increase in development of geothermal resources would decrease the amount of this electricity that must be obtained from nonrenewable sources.

C-35-14

The BMP appendix has been revised to increase readability and decrease redundancy.

C-35-15

The intent of the referenced BMP is that other disturbed sites (e.g., an oil and gas facility or mining site) would be used if possible, not necessarily that the same site be used between geothermal development phases.

At the programmatic level, a specific list of applicable BMPs cannot be developed that would fit the wide diversity of conditions found within the Western US. The BMPs are meant to be a general list that can be used proactively by lessees in preparing their permit applications or would be included in the approved use authorization by the BLM as conditions of approval. As noted in the introduction section of the appendix, the list is not all inclusive, and other BMPs can be developed by applicants and the BLM. The introduction also highlights the importance of the dialogue between the BLM and applicants in determining the appropriate BMPs for a given activity.

Helene Murawski, R.N.
P. O. Box 1386
Mt. Shasta, CA 96067
September 10, 2008

Geothermal Programmatic EIS
C/o EMPSI
182 Howard Street, Suite 110
San Francisco, CA 94105

Attn: Jack Peterson

I am writing to you about the leasing of public lands for the use of Geothermal projects. What I'm especially concerned with is The Medicine Lake and it's high-lands. A pristine mountain lake, recreation area and park.

People come from miles around to enjoy the pristine beauty of the lake and surrounding mountain. Part of the beauty is that you have to go for miles to get to it. One of the reasons it's so pristine .

Local Native American tribes revere the lake as a healing grounds and sanctuary. A sacred place. A place to rest and relax in such special surroundings. I-36-1

Also people live the summer months there and enjoy the fresh air, clean water, and sporting. A lot of people enjoy this place. Without industrialization. Without pollution.

So why spoil this place of beauty? So a select few corporate hooligans can make a big profit? And any placement of geothermal works in the area won't benefit anyone or any-thing at Medicine Lake .

I'm against the streamlining of the leasing process for geothermal projects in the Medicine Lake Highlands and the Mt. Shasta area. Streamlining the leasing process is akin to cheating on an exam. You don't really have to study and it's allowing someone to get away with something they don't deserve.

Not only are the projects large, ugly and polluting, their noisy drill rigs, lighting and pipelines will impact water, air and other natural habitats. Plus what about the dangers associated with geothermal power like blowouts, and runaway wells spewing hydrogen sulfide gas in the atmosphere and killing everything within 10 miles.

Geothermal projects industrialize an area. Why would you want to make an area as pristine as Medicine Lake Highlands into an industrial wasteland while trying to make money for a corporation. Stop the industrial-exploitation of Medicine Lake.

Sincerely,

HMurawski, R.N.

Helene S. Murawski R.N.

I-36-1

As described in Section 2.2.2 *Procedures Prior to Leasing*, prior to inclusion of a lease in a competitive bidding process, the BLM or FS would review the lease area for sensitive resources and provide the necessary stipulations to protect these resources. This review would include consultation with appropriate Native American Tribal Governments as necessary.

The resource uses compatible with geothermal use are likely to vary depending on site-specific conditions. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

Bureau of Land Management and Forest Service
Geothermal Leasing in the Western United States Draft PEIS

We encourage you to provide your comments by filling out and submitting this comment form ***by September 19th, 2008.*** Please fax your completed form to 1-866-625-0707 or mail it to the address on the opposite side. You are also welcome to e-mail your comments to: geothermal_eis@blm.gov

Your Name WILLIAM L. D'OLIER Date 12 September 2008
Mailing Address 310 Hume Lane City/State/Zip Bakersfield CA 93309
Telephone (optional) 661 832 9592 E-Mail Address (optional) gepca@sbcglobal.net
Would you like to be added to this project's mailing list to receive future project-related information?
Yes ☑ No ☐
Please indicate your affiliation by checking **one** of the following boxes:
☑ Individual (no affiliation) ☐ Private Organization ☐ Citizen's Group
☐ Federal, State, or Local Government ☐ Elected Representative ☐ Regulatory Agency

Name of organization, government, group, or agency (if applicable)__________

The BLM and FS want to hear from you! Please provide your comments on the Draft PEIS in the space below.

Having examined the 3-volume Draft PEIS and attended the Sacramento Public Meeting on 30 July 2008, I want to thank the BLM and FS for their joint effort to expedite leasing, exploratory drilling and development of geothermal resources on the federal mineral estate. Regarding former public lands conveyed into private surface ownerships, it is encouraging that the BLM deems these subsurface federal mineral rights to be available for Geothermal Leasing. C-37-1

From its oil, gas and geothermal leasing experience the BLM knows that greater complications and higher costs/risk attach to divided surface vs. mineral ownerships on any land parcel or leased area. PEIS Vol. I indicates the BLMs intent to use the nomination/competitive bid process to offer federal mineral leases under private lands. While this path would ease Geothermal Leasing workload for BLM, it promises two negative impacts. It could deflect the interest of qualified geothermal explorers/developers, particularly those pursuing geothermal electric grade targets. It could diminish BLM responsibility to enable the discovery of significant economic values even in the lesser inventory of isolated federal mineral estate tracts. C-37-2

I would request BLM's consideration of an additional path or option to approach prospects burdened by severed surface and federal mineral estates. This concept might best be called an exploratory drilling agreement, to be proposed by a qualified venture group (QVG).

The QVG would negotiate with BLM to expeditiously drill/flow test, at QVG's cost/risk, a geothermal reservoir target below 6000' depth. This deep, full hole exploratory well is to be accomplished within 5 years of the federal GT lease issue date. QVG would meet all leasing, environmental and permit costs. An integrated post-drilling report would compare well results vs. the pre-drilling basis for the target tested and be provided to BLM at no cost. C-37-3

I would urge the BLM to add this "initiative option" as an appropriate additional tool to tackle the more complex exploration challenge posed when only isolated federal mineral estate is offered for Geothermal Leasing.

Respectfully,

Wm L D'Olier
William L. D'Olier
Geothermal Consultant and
Professional Geologist, CA Lic.

C-37-1

Thank you for your comment.

C-37-2

The comment is noted.

C-37-3

This is outside the scope of the PEIS.

geothermal_eis

From: Mary_Christensen@blm.gov [Mary_Christensen@blm.gov] **Sent:** Mon 9/15/2008 8:42 PM
To: geothermal_eis
Cc:
Subject: Mail forwarded from geothermal_eis@blm.gov
Attachments:

This message has been automatically forwarded from geothermal_eis@blm.gov.

Alex Sifford
<alexs@oregoncoast.com>
09/15/2008 09:41 PM

To: geothermal_eis@blm.gov
cc:
bcc:
Subject: Geothermal PEIS

Hello,
This communication is to voice support the Alternative B: Proposed Action as the Preferred Alternative to the Geothermal Programmatic EIS undertaken by the BLM.
1. The PEIS Alternative B is very reasonable and allows geothermal development only on lands legally open to geothermal leasing and subject to existing laws, regulations, formal orders, stipulations. C-38-1
2. The PEIS preferred Alternative will benefit not only geothermal but other renewable resources such as wind and solar energy on BLM lands. Alternative C, which limits development to a 20-mile corridor from existing transmission lines, could limit development of those renewable resources as well.
Thank you for the opportunity to comment.
Regards
Alex Sifford

Sifford Energy Services
PO Box760/ 48390 Breakers BlvdNeskowin, OR97149-0760503.392.3965 t
541.992.2956 calexs@oregoncoast.com

C-38-1

The commentor's support for Alternative B is noted.

geothermal_eis

From:	Mary_Christensen@blm.gov [Mary_Christensen@blm.gov]	**Sent:**	Mon 9/15/2008 8:34 PM
To:	geothermal_eis		
Cc:			
Subject:	Mail forwarded from geothermal_eis@blm.gov		
Attachments:			

This message has been automatically forwarded from geothermal_eis@blm.gov.

Patricia Simmons
<psimmons@imt.net
>

09/15/2008 09:33
PM

Please respond to
psimmons@imt.net

To
Geothermal_EIS@blm.gov
cc

bcc

Subject
Protect Yellowstone, Ensure
Responsible Geothermal Energy
Development

All energy projects need to be located in areas that do not damage national parks or other wild places valued for their wildlife habitat, recreation and hunting opportunities, and stunning natural beauty. Stay away from Yellowstone National Park! C-39-1

Patricia Simmons
1123 Woodland Drive
Bozeman, MT 59718-2767

C-39-1

Leasing is not permitted in Yellowstone National Park or any National Park System Units. Prior to inclusion of any specific parcels in a lease sale, the BLM and FS would coordinate with the National Park Service to determine if there would be any impacts to thermal or hydrological features within NPS units in proximity to a proposed lease. Language has been added to Section 2.2.2 *Procedures Prior to Leasing* to reiterate this point.

In addition, should development be determined to be reasonably likely to have an "adverse effect" on a significant thermal feature, the BLM would include appropriate lease stipulations to protect the park unit.

If it is determined in advance of leasing that exploration, development, or utilization of the lease parcel would "reasonably likely result in a significant adverse effect on a significant thermal feature of a National Park System unit," then the lease would not be issued (30 USC Section 1026(c)). While preexisting leases and permits are beyond the scope of this PEIS, the statute also provides that, if it is determined that use of an existing lease or permit would be "reasonably likely to adversely affect" any significant thermal feature within a National Park System unit, then stipulations are included on leases and permits to protect the thermal features (30 USC Section 1026 (d)).

geothermal_eis

From: Mary_Christensen@blm.gov [Mary_Christensen@blm.gov] **Sent:** Tue 9/16/2008 6:27 AM
To: geothermal_eis
Cc:
Subject: Mail forwarded from geothermal_eis@blm.gov
Attachments:

This message has been automatically forwarded from geothermal_eis@blm.gov.

Nancy Wedow <nvwedow@sbcglobal.net>
09/16/2008 07:24 AM
Please respond to nvwedow@sbcglobal.net

To Geothermal_EIS@blm.gov
cc
bcc
Subject Protect Yellowstone, Ensure Responsible Geothermal Energy Development

Renewable energy development is a critical part of the solution to the challenges facing our nation?s energy future. However, all energy projects need to be located in areas that do not damage national parks or other wild places valued for their wildlife habitat, recreation and hunting opportunities, and stunning natural beauty.

We can ensure that geothermal energy is developed intelligently and responsibly as long as proper siting is a key part of the equation. Please insure the Final Geothermal Energy Plan is consistent with the following: F-40-1

* Yellowstone National Park?s geothermal features must be fully buffered from geothermal leasing outside the park?s boundary ? including full protection of the Yellowstone Controlled Goundwater Area, the Island Park Geothermal Resource Area, and a fifteen-mile buffer along other park boundaries. F-40-2

*Geothermal development should be prohibited in roadless areas, important wildlife habitat, and all areas that have been specially designated to protect their natural values. F-40-3

*All lands proposed for wilderness designation, including citizen-proposed F-40-4 wilderness and Wilderness Study Areas, should be excluded from consideration. When necessary the agencies should inventory lands to confirm the existence of wilderness characteristics and then remove them from geothermal consideration.

*Besides avoiding sensitive and special wildlands, the agencies should prioritize geothermal projects that are in already degraded lands or in proximity to existing or planned energy corridors. The agencies should avoid redundant or overly extensive transmission lines and co-site geothermal projects with solar energy projects when possible as a means for reducing the energy footprint on our public lands. F-40-5

Guiding industrial geothermal development to those areas where it is most appropriate and will have the least impact on wild land values will ensure a win for both our public lands and our energy needs.

Nancy Wedow
228 N. Middleton
Palatilne, IL 60067

F-40-1

The comment is noted. Stipulations, best management practices, and procedures have been added in the PEIS to provide protection for other resources and resource uses.

F-40-2

Given that impacts on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for NPS lands.

Island Park Geothermal Areas is designated as a non-discretionary closure (see Section 2.2.1).

F-40-3

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations, such as Endangered Species Act Section 107 consultation and National Historic Preservation Act Section 106 consultation. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

F-40-4

Decisions regarding the management of areas with wilderness characteristics are made at the field office level as part of the local land use planning process and not in this PEIS. This allows wilderness characteristics to be evaluated at a finer scale than afforded at a programmatic level. The management and level of protection of the wilderness characteristics on non-WSA lands is discretionary and not bound by requirements of the Wilderness Act of 1964 or the WSA Interim Management Policy (IMP, H-8550-1; BLM 1995); thus, these areas have no official status that removes them from consideration for leasing. Nonetheless, the BLM must consider in its NEPA analyses possible impacts on wilderness characteristics, if present, and may manage the lands to protect and/or preserve some or all of those characteristics through the local land use planning process.

As noted in Chapter 2 of the Draft PEIS, before making any leasing decisions, the BLM will assess whether the existing NEPA documentation is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis. For example, additional NEPA analysis may be required in light of new information or from a potential change in management approach regarding resources identified for special management (e.g., travel management planning or areas under consideration by BLM for management for wilderness characteristics).

F-40-5

Citing of leases in relation to transmission lines or solar projects is outside the scope of this PEIS. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations, such as Endangered Species Act Section 107 consultation and National Historic Preservation Act Section 106 consultation.

Contact Information
San Juan Public Lands Center
Gary Thrash (gthrash@blm.gov) or Matt Janowiak (Matthew_Janowiak@blm.gov)
15 Burnett Ct.
Durango, Colorado 81301

Comment-Number 2008-001

Chapter: 2.5.1 RFDs for Electrical Generation (Indirect Use) Table 2-7 Page: 2-39

Document Section Table 2-7 Commercially Viable Geothermal Capacity for Electrical Generation by High Potential Area and Associated BLM Field Offices and National Forests O-41-1

Associated National Forest Column lists San Juan(Poncha), Gunnison (Pagosa,

Comment Pagosa Hot Springs should be San Juan NF not Poncha

Comment-Number 2008-002

Chapter: 2.2.1 Identify Lands for Leasing Page: 2-6

Document Section The BLM and FS have determined that certain lands within the planning area are excluded from geothermal leasing on the basis of existing laws, regulations (see 43 CFR 3201.11), and Executive Orders. These non-discretionary closures O-41-2

Comment Needs to be clarified with section 1.9.1 Programmatic Scope which does not list National Monuments, NCA's.

Comment-Number 2008-003

Chapter: 2.2.1 Identify Lands for Leasing Page: 2-7 O-41-3

Document Section 75 million acres of NFS lands would be open by statute to leasing.

Comment Clarify what statute?

Comment-Number 2008-004

Chapter: 2.2.2 Lease Stipulations, Best Management Practices, and Page: 2-15

Comment-Number 2008-005 O-41-4

Document Section Applicability of Stipulations Stipulations provided in this PEIS would serve as the minimal level of protection

and would be adopted into local land use plans upon signing of the ROD. For example, if an administrative unit has eligible wild and scenic rivers, the wild river stipulation would apply. If an existing land use plan offers more protective measures or has resource specific commitments (e.g., memorandum of understanding for cultural resources), those more protective measures would

Comment Need to confirm list of plans that would change,.

Comment-Number 2008-005

Chapter: 2.2.3 Amend BLM Land Use Plans Page: 2-23

O-41-5

Document Section Table 2-3 Land Use Plans Proposed for Amendment under the PEIS

The rationale for amending these plans includes the following:
• The land use plan does not address geothermal leasing.
• The land use plan does not allocate areas as being open or closed to geothermal leasing.
• The land use plan does not assess the reasonably foreseeable development scenario for geothermal development, or the analysis requires updating.
• The land use plan does not have adequate or appropriate stipulations or best management practices to apply to geothermal leases to protect sensitive resources.

Comment San Juan/San Miguel Plan is not listed in this table. Should it be?

Pg 2-26 to 2-27 Do Criteria for plans excluded from amendment under this PEIS apply? (3) the plan currently is being amended or revised in a separate NEPA review and that amendment or revision will address geothermal leasing and development. The BLM anticipates that the analyses contained in this PEIS would be incorporated into those amendments and revisions, as appropriate.

Include of a table with plans that meet this criteria.

Comment-Number 2008-006

Chapter: 2-30 Draft PEIS for 2.3 ALTERNATIVES Page: 2-30

O-41-6

Document Section Table 2-5 Comparison of Geothermal Resource Allocations between the Action Alternatives

Comment For both Alternatives B & C: Acreages do not add up for Public lands open to indirect use + Public Lands Closed to Indirect use = Public Lands in Planning Area. Same for Indirect Use.141,671,723 vs 142,188,175

Comment-Number 2008-007

Chapter: 3.4 ENERGY AND MINERAL RESOURCES Page: 3-34

O-41-7

Document Section Statement: Oil, Gas and Geothermal leasing is guided by the Energy Policy Act of 2005.

Comment Should the references be the Mineral Leasing Act of February 25, 1920; Geothermal Steam Act of 1970 (30 U.S.C. 1004)
As amended by the Energy Policy Act of 2005.

Comment-Number 2008-008

Chapter: Appendix E. Review of Paleontological Resource Sections of Page: E-10 O-41-8

Document Section Table E-1 Review of RMPs and PFYC Estimates

Comment Table lists an RMP in Colorado that does not exist: San Juan Silverton August 2004 .
2004 document was a plan amendment for the San Juan/San Miguel RMP to permit a developed ski Area.

Comment-Number 2008-009

Chapter: Draft PEIS for Geothermal Leasing in the Western US 3-47 Page: 3-47 O-41-9

Comment-Number 2008-010

Document Section Paleontological sensitivity maps based on the PFYC are available for only two of the affected states: Colorado and Utah. **These are appended to provide**

Response Checked for maps in appendix. Not found.

Comment-Number 2008-010

Chapter: 3.7 WATER RESOURCES AND QUALITY Page: 3-84 O-41-10

Document Section Surface Water. In southwestern Colorado, summer monsoonal flow produces…

Comment: Not always true. Recent drought years have not had significant monsoonal moisture.

Comment-Number 2008-011

Chapter: 3.14 Cultural Resources Page: 3-163 O-41-11

Document Section Appendix I provides detailed discussions of the prehistoric and historic cultural resources and patterns of these regions.

Comment Maps of tribal areas reflect more recent cultures. Question is on how Puebloan cultural attachments to SW Colorado are addressed in this document. Seems to be a lack of discussion on the importance of the Anasazi cultures in SW Colorado and our Field Offices are not identified in Appendix I pages 54;
Maps show current tribal distribution but do not recognize significance of ancestral puebloan occupation in SW Colorado. Revise description of Cultural Areas to indicate Southwest Cultural Area extending through 4 corners area of Colorado and to reflect the significant use of this area by the Puebloan cultures.

Comment-Number 2008-012

Chapter: 3.14.7 Southwest	Page: 3-175	O-41-12

Document Section	The Southwest culture region covers all of Arizona, the western majority of New Mexico, the southern tip of Nevada, southern Utah, extreme southern and western Texas, and parts of southwest Colorado (Figure 3.21 – Southwest Tribal Ranges). Within the project area, the Southwest culture region includes portions of FS Regions 2 and 4 and all of Region 3 and all or portions of the western BLM Field Offices.
Comment	Southwest cultural region should encompass portion of southwest Colorado with significant prehistoric cultural resources as typified by Mesa Verde & Hovenweep National Parks and Canyons of the Ancients National Monument. Figure 3.21 using historic tribal ranges does not adequately recognize this resource.

Comment-Number 2008-013

Chapter: Appendix I. Cultural Resource Regional Ethnohistory	Page: I-54	O-41-13

Document Section	SOUTHWEST Cultural Region. The USFS regions included in the Southwest region include portions of Regions 2 and 4 and all of Region 3. BLM Field Offices in the region include all or portions of all field offices in New Mexico and Nevada with the exception if the Arizona
Comment:	Dolores Field Office and Canyons of the Ancients National Monument should be reflected in this Cultural region. Figure numbers in Appendix I do not correspond to Figures in chapter 3 of Volume I.

O-41-1

The change was made as suggested.

O-41-2

Section 1.9.1 lists lands that are closed to geothermal leasing by statue. Non-discretionary closures included in Section 2.2.1 *Lands Identified for Leasing*, include lands closed by law, regulation, and executive orders. Details of closures are included in Section 4.2. *Land Use, Recreation, and Special Designation*.

O-41-3

The sentence has been revised to read as follows:

> In addition, 75 million acres of NFS lands have been identified as not being closed by statute, regulation, or orders, and as such, would be open for evaluation for leasing.

O-41-4

See list of plans to be amended in Table 2-3.

O-41-5

The San Juan/San Miguel Plan has been added to the list of plans for amendment.

O-41-6

Table 2-5 has been revised.

O-41-7

The following text has been inserted:

> Geothermal Steam Act of 1970 (30 USC 1004), as amended by the Energy Policy Act of 2005.

O-41-8

Thank you for your comment. The RMP mentioned has been deleted.

O-41-9

Data for the Appendix are provided in tables, not maps. References to maps have been removed.

O-41-10

The text in Section 3.7 has been amended as follows:

> Precipitation varies greatly with location and elevation and from year to year. Droughts of several years have been known to occur. The precipitation occurs in the form of winter snows and heavy autumn rainstorms. In southwestern Colorado, summer monsoonal flow generally produces ample rain in non-drought years.

O-41-11

In all cases, broad-scale figures are provided for illustrative purposes for the PEIS. The commentor is correct that the regional maps reflect the territories of more recent cultures and that any boundaries shown could be debated on the basis of past occupations, linguistic ties, oral histories, archaeology, and cultural influences. A consistent, standard source, the volumes of the Smithsonian Handbooks of North American Indians, was used for the maps in this generalized overview. Clearly Ancestral Puebloan sites are present throughout the southwest in territories assigned to non-Puebloan groups and further into Colorado than may be implied by the figure. Tribal consultation would not be limited by these boundaries. Clarifying text was added to Section 3.14.

O-41-12

See response to comment O-41-11 above.

The overviews and maps provided are not designed to be a comprehensive source for information on resources or the extent of cultural influence. There would be follow-on work to identify resources and consultation required to address any site-specific lease applications.

Mesa Verde & Hovenweep National Parks and the Canyon of the Ancients National Monument are closed to application.

O-41-13

The text has been changed to include all southern Colorado field offices.

Figure numbers have been revised.

Oregon Natural Desert Association

VIA E-mail (geothermal_eis@blm.gov) without enclosure and First Class Mail with enclosure

September 17, 2008

Jack G. Peterson
Bureau of Land Management – Geothermal PEIS
c/o EMPS, Inc.
182 Howard Street, Ste 110
San Francisco, CA 94105

Re: Draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States

Dear Mr. Peterson:

Please accept these comments from the Oregon Natural Desert Association ("ONDA") on the interagency Draft "Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States" ("DPEIS"). ONDA is a non-profit public interest organization dedicated to preserving and protecting the public lands of eastern Oregon. ONDA has a long history of interest and involvement in eastern Oregon's public land management. ONDA's mission is to protect, defend, and restore forever the health of Oregon's native deserts. The members and staff of ONDA use and enjoy the public lands, waters, and natural resources within the project area for recreational, scientific, spiritual, educational, aesthetic, and other purposes. ONDA and its members also participate in information gathering and dissemination, education and public outreach, commenting upon proposed agency actions, and other activities relating to the federal government's management and administration of the public lands of eastern Oregon. Our comments on the DPEIS focus on the effects of the proposed action and alternatives in the State of Oregon. O-42-1

ONDA recognizes the potential importance of geothermal energy and other alternative sources of low-carbon-emission energy for reducing this country's reliance on fossil fuels and beginning to reverse the effects of global climate change. However, renewable "green" energy is not truly "green" if it results in the careless or thoughtless sacrifice of other resources on our public lands. Reasonable development of geothermal energy begins with a carefully-considered scheme of leasing, which identifies and protects, from the PEIS stage, lands and resources which should be sheltered from the most destructive consequences of energy development. ONDA is concerned that the DPEIS is not adequate to support a decision to designate lands for geothermal leasing because it fails to analyze sufficient alternatives, does not adequately evaluate the wilderness characteristics of the lands that would remain open to leasing or on the wildlife and plants for which these lands are important habitat, lacks analysis of impacts from foreseeable projects within the project areas under the various alternatives, and contains inadequate assessment of the cumulative impact of opening up to 192 million acres of public lands to geothermal leasing in conjunction with dozens of energy production and transmission projects currently under development or on the drawing board throughout the West.

The result is a draft programmatic environmental impact statement that is too limited in its evaluation of impacts to the environment from the proposed action. Despite the proposal to facilitate the process for leasing geothermal resources on up to 192 million acres of land managed by the Bureau of Land Management ("BLM") and U.S. Forest Service ("Forest Service"), the agencies have not adequately evaluated the effects that leasing and subsequent development of geothermal resources would have on listed and sensitive species and their habitat. Nor does the DPEIS assess whether there are alternatives or combinations of closed lands or protective buffer zones that could significantly decrease the detrimental effects of future geothermal power projects on wildlife and wild lands and yet still allow for development of this important alternative energy source in appropriate locations.

I. The Agencies Must Consider More Than Two Alternatives in the Final PEIS.

The DPEIS considers only the proposed action and an alternative ("Alternative C") which would limit leasing to lands within 10 miles each side of existing transmission lines, together with a "no action" alternative that is not given serious considation.[1] NEPA requires that federal agencies provide a detailed evaluation of alternatives to the proposed action in every NEPA document. 42 U.S.C. § 4332; 40 C.F.R. § 1502.14(a). This discussion of alternatives is essential to NEPA's statutory scheme and underlying purpose. See, e.g., Bob Marshall Alliance v. Hodel, 852 F.2d 1223, 1228 (9th Cir. 1988), cited in Alaska Wilderness Recreation & Tourism Ass'n v. Morrison, 67 F.3d 723, 729 (9th Cir. 1995); Muckleshoot Indian Tribe v. U.S. Forest Serv., 177 F.3d 800, 813 (9th Cir. 1999). Indeed, NEPA's implementing regulations recognize that the consideration of alternatives is "the heart of the environmental impact statement." 40 C.F.R. § 1502.14. Pursuant to this obligation"[a]n agency must look at every reasonable alternative, with the range dictated by the nature and scope of the proposed action." N.W. Envtl. Defense Ctr. v. Bonneville Power Admin., 117 F.3d 1520, 1538 (9th Cir. 1997). Because of the vast expanse and variety of lands and resources which would be affected by the proposed leasing, limiting the alternatives considered to two action alternatives is inadequate to satisfy NEPA. O-42-2

The purpose of the PEIS is to consider the effects on the environment of potential exploration and development of geothermal resources throughout the West. Because the DPEIS contemplates that additional, site-specific environmental analysis may *not* occur, DPEIS at 1-26, it is incumbent upon the agencies to conduct a comprehensive review of alternatives and affected resources at the programmatic level. The proposed alternative ("Alternative B") makes the vast majority of the lands considered in the DPEIS available for leasing without adequate analysis or protections for sensitive resources. O-42-3

[1] The "no action" alternative is described as a "baseline" against which the two action alternatives are measured, rather than a genuine alternative. DPEIS at 2-30. O-42-2

The agency's obligation in its environmental review is to "[r]igorously explore and objectively evaluate all reasonable alternatives" in order "to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of [the agency's] actions upon the quality of the human environment." 40 C.F.R. §§ 1502.14(a), 1500.2(f). Analysis of alternatives must be "sufficiently detailed to reveal the agency's comparative evaluation of the environmental benefits, costs and risks of the proposed action and each reasonable alternative." Id. The agencies should prepare a set of genuine reasonable alternatives that include several different configurations which would designate fewer lands for geothermal leasing, that identify lands which could be leased without controversy, such as those already degraded or located immediately adjacent to existing transmission lines, and that consider phased development of geothermal resources based on a hierarchy of protection for sensitive species habitat and preservation of wilderness values. The alternatives should focus more attention than the DPEIS currently does on limiting the area available for geothermal leasing to protect sensitive areas of the public lands and the creatures that live on them. Where site-specific decisions are being made in a programmatic EIS—such as here, where large but distinct areas of land are being segregated for potential leasing without further environmental review—and potentially designating different and more limited areas is a reasonable alternative, considering only two alternatives is inappropriate under NEPA. See, e.g., IlioUlaokalani Coalition v. Rumsfeld, 464 F.3d 1083, 1096-01 (9th Cir. 2006). O-42-3

II. The Agencies Should Undertake a Comprehensive Environmental Analysis Before Opening Public Lands to Geothermal Leasing.

Though the DPEIS, the agencies are planning to designate millions of acres of public land as open to geothermal leasing. The agencies accordingly should use the PEIS process to undertake a comprehensive review of the potential that geothermal energy development has for fragmenting important wildlife habitat and eliminating wilderness values throughout the West. In addition, BLM, which administers the majority of federal land where leasing would occur, has a substantive duty to ensure that the decision complies with the multiple use mandate in the Federal Land Policy and Management Act ("FLPMA"). This includes FLPMA's unnecessary or undue degradation and "without permanent impairment" provisions, the Section 603 nonimpairment duty, and the duty to act consistently with BLM's land use plans (which contain standards, goals, objectives, etc. for wildlife, habitat, and other values/resources associated with wilderness). The practical result is that this PEIS presents the proper occasion for a full assessment of the impacts to wilderness, wildlife, plant life, and the cultural, scenic, and historic values of the lands on which geothermal leasing may occur. Comprehensive analysis of these factors is necessary to properly assess—and minimize—the effects of future projects on the environment. O-42-4

As discussed further below, wilderness values, wildlife, and largely-intact native ecosystems could be threatened by geothermal exploration and development. In eastern Oregon, any project developed away from the immediate vicinity of existing road or energy transmission infrastructure has the potential of impairing intact roadless areas which contain some of the remaining strongholds for shrinking populations of sage grouse and pygmy rabbits, and which serve as important habitat for pronghorn, bighorn sheep, and native plant species. The PEIS must fully analyze the wilderness values of these lands where geothermal exploration or development would inevitably lead to roadbuilding or associated transmission projects that could eliminate their wildness forever.

In addition to the proposed consultation with FWS and NOAA Fisheries (the "Services") related to species listed under the Endangered Species Act, the presence in the proposed action area of significant habitat for other sensitive species warrants evaluation in the PEIS and consultation with the Services. Development of geothermal resources could further fragment habitat that is necessary to ensure the survival of sage grouse and pygmy rabbits, two species that are currently under review for listing as threatened or endangered. Only through consultation with FWS during the preparation of the PEIS can the agencies make an informed decision about whether the lands they might designate as open for leasing appropriately minimize potential harm to these and other sensitive species from future geothermal energy projects. Once the lands have been opened to leasing, it will be too late to comprehensively assess whether geothermal exploration and development will have undue impacts on these species at the landscape and habitat level.

III. Impacts of the Proposed Action on Roadlessness and the Wilderness Resource.

The proposed action covers all public lands managed by the agencies in Oregon east of the Willamette Valley. The high desert lands east of the Cascade Mountains include some of the most important remaining intact habitat for Greater sage grouse, pygmy rabbits, and pronghorn, along with large tracts of Forest Service and BLM lands that remain roadless and retain wilderness characteristics. Because of the remarkable concentration of wilderness-quality land and relatively unspoiled wildlife habitat in this region, ONDA urges the agencies to develop alternatives that would close public lands that retain roadless or wilderness characteristics to geothermal leasing. O-42-5

Under the Roadless Area Conservation Rule ("Roadless Rule"), a "road may not be constructed or reconstructed in inventoried roadless areas of the National Forest System." 36 C.F.R § 294.12(a); 66 Fed. Reg. 3,244, 3,270 (Jan. 12, 2001). The Forest Service promulgated the rule in large part to protect the values and characteristics of these roadless areas from adverse impacts caused by road construction, road reconstruction and road use. These values and characteristics include high quality or undisturbed soil, water and air; sources of drinking water; diverse plant and animal communities; habitat for special status species; scenic beauty; reference landscapes; locally identified unique characteristics; cultural properties, and recreation. 36 C.F.R. § 294.11 (defining Roadless area characteristics).

The DPEIS recognizes that road construction or reconstruction would be necessary for exploration, drilling, and development phases of geothermal energy production. DPEIS at 2-40 to 2-46. Because construction of roads in inventoried roadless areas is prohibited under the Roadless Rule, the agencies must include inventoried roadless areas among the National Forest System lands closed to geothermal leasing.

The DPEIS also acknowledges that BLM has the *authority* to consider the effects of the proposed action on the wilderness resource even on lands that have not formally been designated as wilderness or as Wilderness Study Areas. DPEIS at 1-25. However, a recent court decision makes clear that BLM's has certain *obligations* to identify and manage lands for the protection O-42-6 of wilderness characteristics. Under FLPMA, BLM must inventory public lands and resources on a continuing basis. 43 U.S.C. § 1711(a). As the U.S. Court of Appeals recently held, wilderness and roadlessness are resources for which BLM must keep a current inventory. Ore. Natural Desert Ass'n v. BLM, 531 F.3d 1114, 1119, 1138 (9th Cir. 2008).[2] Having inventoried lands with wilderness or roadless characteristics, BLM then must provide for the management of these wilderness and roadless resources in its land use plans, and consider "whether, and to what extent, wilderness values are now present in the planning area outside of existing WSAs and, if so, how the Plan should treat land with such values." Id. at 1143.

The U.S. District Court for the District of Oregon has held that impacts to such proposed wilderness areas must be considered in conducting environmental impact evaluations under NEPA. The court held that the BLM "was obligated under NEPA to consider whether there were changes to or additions to the wilderness values within [the project area], and whether the proposed action in that area might negatively impact those wilderness values, if they exist." Ore. Natural Desert Ass'n v. Rasmussen, 451 F. Supp. 2d 1202, 1213 (D. Or. 2006). The court enjoined a BLM decision to develop grazing infrastructure within the project area until the agency had completed its inventory of wilderness values, requiring BLM to inventory wilderness values and prepare a valid NEPA document that considers the impact of the proposed action on wilderness characteristics. Similarly, leasing for geothermal exploration and development cannot proceed until BLM has ensured that it has an up-to-date inventory of lands with wilderness characteristics and until BLM has evaluated the impacts of geothermal exploration and development on those lands.[3]

Because the Geothermal PEIS is intended to amend up to 122 land use plans, BLM should conduct the required inventory and protection of lands with wilderness characteristics as part of this planning process, and close lands with wilderness characteristics to geothermal leasing to protect this essential public resource. This planning process should result in BLM evaluating information previously obtained from citizen groups for proposed wilderness designation, and, based on that information, BLM should include citizen-proposed wilderness areas and other lands with wilderness characteristics among the lands closed to geothermal exploration and development.

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[2] In addition to roadlessness, "wilderness characteristics" include naturalness and providing opportunities for solitude or primitive recreation. Ore. Natural Desert Ass'n v. BLM, 531 F.3d at 1137.

[3] Litigation is currently pending in federal courts against the Department of the Interior concerning impacts to wilderness values in many areas in eastern Oregon where citizen-proposed wilderness areas are at issue and where BLM has not adequately inventoried wilderness characteristics—for example, Ore. Natural Desert Ass'n v. BLM, No. 05-35931 (9th Cir.) (regarding the South Eastern Oregon RMP), Ore. Natural Desert Ass'n v. Shuford, No. 06-242 (D. Or.) (regarding the Andrews-Steens RMP), Ore. Natural Desert Ass'n v. Gammon, No.07-35728 (9th Cir.) (regarding the Lakeview RMP), Ore. Natural Desert Ass'n v. Freeborn, No.06-1311 (D. Or.) (regarding the Louse Canyon GMA), in addition to administrative appeals over several other projects and plans.

ONDA has previously submitted five sets of citizen inventories and proposed Wilderness Study Areas to BLM's district offices in Oregon. These inventories are as follows: O-42-7

September 2002:	Andrews Resource Area (Steens) Wilderness Inventory
November 2002:	Supplement to Andrews Resource Area Wilderness Inventory
February 2004:	Vale District Wilderness Inventory
April 2005:	Lakeview District Wilderness Inventory
September 2007:	Three Rivers Resource Area Wilderness Inventory

The map at Exhibit 1 below (originally prepared to illustrate areas of potential wind power development) provides the most current overview of the location of these proposed Wilderness Study Areas, marked on the map as "roadless areas." With the hard copy of these comments, ONDA is enclosing a CD-Rom containing detailed maps of each citizen-proposed Wilderness Study Area contained in these submissions, the reports that accompanied the submissions, and GIS layers corresponding to the proposed Wilderness Study Areas. The lands depicted on the enclosed maps contain wilderness characteristics, and BLM should close these lands to leasing for geothermal exploration and development.

IV. Impacts of the Proposed Action on Wildlife and Plant Habitat

Part of the process of developing a PEIS that accurately assesses the west-wide impacts of designating areas for geothermal leasing is early and comprehensive consultation with fish and wildlife management agencies on the impacts to listed and candidate species from the exploration and development that is almost certain to occur on some of these leased lands. Although specific impacts from particular projects will still need to be analyzed at the project level, a comprehensive assessment at the programmatic level will ensure that leasing is allowed only on lands that will minimize detrimental effects to plant and animal habitats. O-42-8

This is of particular concern in the sage-steppe environment of eastern Oregon and other interior western states, where fragile lands and species that depend on them are already seriously threatened by chronic overgrazing, increasing pressures from oil and gas development, and growing threats from destructive wildfires, drought, and climate change. Because of its relative remoteness and lack of development, eastern Oregon remains a stronghold for several species which are federally protected or are being considered for federal protection.

Eastern Oregon is one of the largest relatively intact sections of sage-steppe habitat remaining in the West. The public lands on and surrounding the proposed Hart Mountain and Beaty Butte WSAs comprise a significant, critical swath of habitat linking Hart Mountain National Antelope Refuge to the northwest to Sheldon National Wildlife Refuge in northern Nevada, and connecting with designated wilderness and WSAs to create a corridor to Steens Mountain to the northeast. The area supports a vast array of wildlife, and includes critical winter and migratory habitat for pronghorn, as well as important habitat for sage grouse, pygmy rabbits, Western big-eared bats, ferruginous hawks, burrowing owl, desert and short-horned lizards, and countless other birds and mammals. The neighboring Hart Mountain and Sheldon refuges are unique in that they comprise the largest area in the Great Basin no longer grazed by livestock.

This area is the heart of the proposed Sage Grouse National Conservation Area, depicted in the map in Exhibit 2. The Greater sage grouse population has declined as much as 45–80 percent over the past 20 years due to habitat destruction, degradation and fragmentation, with the current breeding population estimated at 140,000 individuals, representing only about eight percent of historic numbers. A 2004 survey by state and federal scientists found that sage grouse are in long-term decline, with the report concluding it was "not optimistic about the future of sage-grouse because of long-term population declines coupled with continued loss and degradation of habitat and other factors (including West Nile Virus)."[4] Sage grouse depend on unbroken, healthy expanses of sagebrush habitat such as that present within the proposed Sage Grouse NCA.

Recognizing that Oregon is an area of critical importance for the species's survival, Oregon's Department of Fish and Wildlife ("ODWF") has adopted a conservation strategy for the sage grouse,[5] underscoring that human activities and structures decrease the quality of sage grouse habitat and can result in habitat loss and direct bird kills. The strategy, at pages 83–84, recommends that land management agencies carefully evaluate actions that could lead to harm to sage grouse habits. Specifically, new energy development and associated transmission projects "should avoid surface occupancy within 3.2 km (2 mi) of known/occupied sage-grouse habitat" and follow "existing utility corridors and rights-of-ways to consolidate activities to reduce habitat loss, degradation, and fragmentation by new construction." If geothermal energy projects and their associated transmission lines could not be built immediately adjacent to existing transmission lines, ODWF recommends that planners "seek to minimize disturbance to known breeding, nesting, and brood-rearing habitats by placing power line corridors >3.2 km from these areas." ODWF's strategy highlights the importance of preserving habitat integrity and connectivity, noting that O-42-9

> Habitat loss and fragmentation are probably the 2 leading causes for the long-term decline in sage-grouse. Current and future land management will need to examine landscape patterns of sagebrush habitat and seek strategies to ensure that large connected patches of sagebrush are present. The implementation of the connectivity model and habitat monitoring techniques suggested in the Plan will help minimize the impacts of habitat loss and fragmentation.

Greater Sage-Grouse Conservation Assessment and Strategy for Oregon at 84.

Similar guidance, stressing the importance of maintaining intact habitat, is found in the BLM's National Sage Grouse Habitat Conservation Strategy and BLM's guidelines regarding Special Status Species such as sage grouse.

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[4] Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

[5] Oregon Department of Fish & Wildlife, Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: *A Plan to Maintain and Enhance Populations and Habitat*, available at http://www.dfw.state.or.us/wildlife/sagegrouse/.

In December 2007, the U.S. District Court for the District of Idaho ordered the FWS to evaluate properly whether the Greater sage grouse should be listed as threatened or endangered under the Endangered Species Act. The FWS has begun its new review of the sage grouse's status. Federal agencies proposing actions as significant as designating millions of acres of public lands as open to geothermal leasing must be particularly careful that their decisions do not have adverse impacts on species whose status is so precarious that they may be listed under the ESA. This is particularly true in light of the well-documented and devastating effect that oil and gas development has had on sage grouse populations in the Rocky Mountain states. Because the agencies have analogized geothermal energy leasing and development to oil and gas development, DPEIS at 2-6, and noted similar effects, it is particularly important that the agencies tread carefully when deciding which lands within their jurisdiction should be opened to new energy development. O-42-10

The agencies' discussion of the sage grouse in the DPEIS at 3-139 to 3-140 and 4-81 to 4-85 does acknowledge that geothermal energy projects are likely to harm sage grouse, recognizing that the birds need contiguous, undisturbed areas of high-quality habitat, and that geothermal exploration rigs and production facilities, associated transmission lines, pipelines, and access roads may adversely affect habitats important to sage grouse by causing fragmentation, reducing habitat value, or reducing the amount of habitat available. Power plants, transmission lines, pipelines, and other structures can also provide perches and nesting areas for raptors and ravens that may prey upon gallinaceous birds. However, the information about the potential harm to sage grouse does not actually inform the agencies' decision of what lands should be leased for geothermal energy development, and whether there are alternatives that would avoid disrupting the "contiguous, undisturbed" sage grouse habitat present throughout southeastern Oregon.[6]

Without consultation with FWS regarding sage grouse, and the absence of alternatives that might designate certain lands—for example, all lands within 3.2 km of known sage grouse leks—as closed to leasing to protect sensitive species habitat, the DPEIS contains no adequate analysis of the effects of the proposed action alternative on sage grouse and other sagebrush-dependent wildlife. The agencies have a duty to consider "cumulative effects" under NEPA, and consider alternatives—such as closing essential sage grouse habitat to geothermal leasing—that would preserve the relatively intact sage-steppe habitat in this area.

The project area in eastern Oregon is also habitat for pygmy rabbits. On January 8, 2008, the U.S. Fish & Wildlife Service announced a positive 90-day finding on a petition to list the pygmy rabbit under the ESA, beginning the listing review process. Pygmy rabbits, like sage grouse, are dependent on large areas of intact sage-steppe habitat for their survival. Any activities that fragment pygmy rabbit habitat—including exploration and development of geothermal energy—could lead to increased pressure on the species and its continued existence. As a result, the PEIS should include consultation with FWS on the status of the pygmy rabbit, and the potential impact of geothermal exploration and development on the rabbit and its habitat. O-42-11

[6] The discussion also appears to omit a text box or figure, no. "4.10-1," that is referenced elsewhere in the text. See, e.g., DPEIS at 3-140, 4-67, 4-78, 4-81. O-42-10

O-42-1

The comment is noted.

O-42-2

In accordance with 40 CFR Section 1502.13, the purpose of and need for the proposed action is used to define a range of reasonable alternatives (purpose of and need for action is defined in Sections 1.2 and 1.3). The BLM is making an allocation decision here, and adopting a list of stipulations, BMPs, and compliance procedures to be incorporated in the land use plans. The PEIS analyzes in detail the Proposed Action, a No Action alternative, and the Leasing Near Transmission lines alternative. The Final PEIS incorporates input from public comments on the Proposed Action. Another alternative considered but eliminated from detailed study included no leasing or development of geothermal resources on public or NFS lands (Section 2.4.1). As explained in Section 2.4.1, this alternative, which would have been most protective (from a ground disturbance standpoint), was eliminated because it would violate the multiple use provisions of FLPMA and is inconsistent with the President's National Energy Policy, the Energy Policy Act of 2005, and Executive Order 13212 and would not have fulfilled the purpose and need for the proposed action. O-42-12

The alternatives analyzed represent a range of acreages as potentially available for leasing. See CEQ's *Forty Most Asked Questions Concerning the CEQ's NEPA Regulations*, Question 1b ("When there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in the EIS."). In particular, the Leasing Near Transmission Lines alternative was developed based on public scoping comments to represent a limited development alternative. Instead of inventing a variety of alternatives that would lie between the alternatives presented, the BLM and FS elected to include protective measures (i.e., stipulations, BMPs, and compliance procedures) in each of the action alternatives. Further, those planning areas whose plans include more protective measures may elect to keep those measures in place, instead of the stipulations, BMPs, and compliance procedures presented in the Final PEIS. O-42-13

O-42-3

See response to comment O-42-2, above.

O-42-4

The analysis in Chapter 4 is commensurate with the scope of the proposed action for the PEIS.

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages. O-42-14

The PEIS designates lands as open to geothermal leasing subject existing laws, regulations, and policies that may result in decisions to not lease or to lease with stipulations, terms, or conditions. O-42-15

O-42-5

The existing case law regarding the roadless rule is inconsistent. On August 12, 2008, the Wyoming District Court found the 2001 Roadless Rule violated NEPA and the Wilderness Act (*State of Wyoming v. US Department of Agriculture,* 07-CV-17-B, Wyoming District Court, Cheyenne, Wyoming [2008]). The District Court ordered the 2001 Roadless rule "set aside" and "permanently enjoined." This order is subsequent to a 2006 California District Court ruling that set aside the 2005 State Petitions Rule and reinstated the 2001 Roadless Rule. See *California ex re. Lockyer v. US Department of Agriculture*, 459 F.Supp.2d 874 (N.D. Cal 2006). The United States Justice Department, on behalf of the Department of Agriculture, has filed motions with both the Wyoming and California courts seeking adjustments of those courts' conflicting judicial orders. Neither the Wyoming nor California District Court rulings bar the Department of Agriculture from promulgating other roadless area regulations. To address this inconsistency, the PEIS includes the following Department of Agriculture Roadless Area Stipulation, "If future legislation or regulation change the roadless area designation, the restriction would be revised along with any appropriate environmental review." An appropriate NEPA review would be required prior to any changes to the Roadless Area Stipulation.

Decisions regarding the management of areas with wilderness characteristics are made at the field office level as part of the local land use planning process and not in this PEIS. This allows wilderness characteristics to be evaluated at a finer scale than afforded at a programmatic level. The management and level of protection of the wilderness characteristics on non-WSA lands is discretionary and not bound by requirements of the Wilderness Act of 1964 or the WSA Interim Management Policy (IMP, H-8550-1; BLM 1995); thus, these areas have no official status that removes them from consideration for leasing. Nonetheless, the BLM must consider in its NEPA analyses possible impacts on wilderness characteristics, if present, and may manage the lands to protect and/or preserve some or all of those characteristics through the local land use planning process.

As noted in Chapter 2 of the Draft PEIS, before making any leasing decisions, the BLM will assess whether the existing NEPA documentation is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis. For example, additional NEPA analysis may be required in light of new information or from a potential change in management approach regarding resources identified for special management (e.g., travel management planning or areas under consideration by BLM for management for wilderness characteristics).

O-42-6

See above response to comment O-42-5 for response to lands with wilderness characteristics.

O-42-7

See above response to comment O-42-5 for response to lands with wilderness characteristics.

O-42-8

This has been noted and attention has been paid to sagebrush habitats and sagebrush species in the PEIS. The stipulations and BMPs provided in the PEIS focus on maintaining healthy sagebrush habitats and protecting species and allow individual Forest Districts and Field Offices to utilize the most effective measures to protect sagebrush resources.

O-42-9

As noted above, attention has been paid to sagebrush habitats and sagebrush species in the PEIS. The stipulations and BMPs provided in the PEIS focus on maintaining healthy sagebrush habitats and protecting species and allow individual Forest Districts and Field Offices to utilize the most effective measures to protect sagebrush resources.

The BLM and FS have added the following procedure prior to leasing in Chapter 2:

> The authorized officer of the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states manage and typically have regulatory authority for water quality, water rights, and wildlife.

O-42-10

The sensitive species-specific stipulation in Section 2-19 states:

> For agency-designated sensitive species (e.g., sage grouse), a lease stipulation (NSO, CSU, or TL) would be imposed for those portions of high value/key/crucial species habitat where other existing measures are inadequate to meet agency management objectives.

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> The authorized officer of the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states manage and typically have regulatory authority for water quality, water rights, and wildlife.

O-42-11

Lands designated as open to leasing are subject to existing laws, regulations, and formal orders. In complying with these laws, regulations, and orders, some of the open lands may not be available for leasing. Chapter 2 explains, under *Procedures Prior to Leasing*, that the BLM and FS would comply with the requirements of the Endangered Species Act, including determining if any listed or proposed threatened or endangered species, or critical habitat, is present on nominated lease parcels and may be affected by any decision to lease. Chapter 6 of the Final PEIS, in turn, explains that the agencies have determined that the decision to lease has no effect on listed species or critical habitat.

To provide further protection for threatened, endangered, and sensitive species, the BLM will impose an Endangered Species Act stipulation (see Section 2.2.2) on all geothermal leases.

O-42-12

Thank you for your comment. The BMPs and stipulations provided in the document include guidance for identifying and avoiding essential habitat as well as ungulate and other wildlife migratory corridors in making decisions on individual projects.

O-42-13

The US Fish and Wildlife Service would be consulted for individual leasing decisions.

O-42-14

Additional discussion has been added to the cumulative impact analysis, including discussion of other energy projects. As noted in Chapter 5, past, present, and reasonably foreseeable actions, including commercial uses of public and federal lands, are documented and analyzed.

O-42-15

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energy API

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September 19, 2008

Bureau of Land Management
Geothermal Programmatic EIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105

Comments to Draft Geothermal Resources Leasing Programmatic EIS

Via E-Mail to geothermal_EIS@blm.gov

This letter is submitted on behalf of the American Petroleum Institute ("API"), in response to the joint Programmatic Environmental Impact Statement (PEIS) to analyze and expedite the leasing of BLM-and FS-administered lands with high potential for renewable geothermal resources in 11 western states and Alaska. API represents nearly 400 companies that are involved in various aspects of the geophysical, oil and natural gas exploration, production and service industries.

America needs a balanced, energy policy that promotes energy efficiency and conservation and greater supplies of all forms of energy, including geothermal energy resources and domestic oil and natural gas. C-43-1
Multiple use public lands in the American West offer both geothermal and hydrocarbon resources. It is vitally important to wise planning for America's energy future that opportunities for development of one energy resource do not come at the expense of the other. Full access to hydrocarbon resources under multiple use public lands is of particular concern to the oil and natural gas industry that API represents, because only 17 percent of non-park, non-wilderness federal lands administered by the federal government is open to energy development under standard lease terms.

In its landmark "Facing Hard Truths" energy study, published July 18, 2007, the National Petroleum Council (NPC) described the importance to America's economy of full access to all forms of energy. To mitigate the risks of continued dependence on the present mix of energy resources, NPC said "expansion of all economic energy sources will be required, including coal, nuclear, renewables, and unconventional oil and natural gas". To safeguard the nation's energy and economic future, a balance must not only be sought among the mix of energy resources to be utilized in the American economy; a balance must be achieved in policies, regulations and decision-making to address the infrastructure requirements for development and delivery of these resources.

Geothermal resources represent an emerging technology of increasing importance with respect to generation of electricity and in specialized applications such as heat for greenhouses and aquaculture. Some API member companies are directly investing in geothermal energy projects. As BLM has noted, half of the nation's geothermal energy production occurs on federal lands, much of this production

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occurring in California and Nevada. It is estimated that 90% of the potential geothermal resource may be found on public lands as well.

The primary concern of the oil and natural gas industry with respect to the prospect of leasing multiple use public lands for geothermal resources is that every effort be made to avoid the possibility of conflicts between developers of hydrocarbon and geothermal resources on those public lands where both types of resources may be found. This should be achievable, but it should be remembered that exploration and development for both hydrocarbon and geothermal resources below the surface can require use of portions of the surface as well as the subsurface. In the case of hydrocarbons, seismic surveys and/or geoscience interpretation may be necessary. If initial exploration drilling succeeds in locating oil or natural gas accumulations, and a decision is made to pursue development, engineering design, permitting and construction of the gathering, compression and other facilities and equipment will be required to handle the production of the resources identified through exploration drilling. Because geothermal resources are also fluid mineral resources, similar activities are generally required for their development. The draft PEIS suggests in Section 3.4 that development of the two types of resources on the same public lands tracts could be sequential, but it is important that planning and consideration of possible impacts to development contemplate the possibility that there could also be concurrent development of hydrocarbon and geothermal resources on the same tract or tracts. C-43-2

In the event BLM were to grant concurrent hydrocarbon and geothermal leases covering the same public lands tract or tracts, both lessees possess a right to reasonable use of the surface estate necessary to explore for and to produce the leased resources, in accord with applicable statutes and regulations and lease terms and conditions. In the majority of cases, the lessees' exercise of their leasehold rights to develop their leasehold interest, and the accompanying right to use of the surface should be achievable without conflict.

API recommends that rules developed by BLM following final approval of the PEIS specify that in the event of conflicts between exercise of the leasehold rights by the geothermal and hydrocarbon lessee that cannot otherwise be resolved through negotiated agreement, the lessee whose lease is senior in time should enjoy a preference. This is in accord with generally accepted principles of natural resource law. Clarification of this approach by BLM would benefit lessees from both industries, as it would strongly encourage lessees to undertake due diligence to learn the resource potential of the public lands in which they are interested. Through due diligence lessees learn what can be learned concerning the identities of other leasehold interest owners and – to the extent possible – about foreseeable exploration or development scenarios that could potentially affect exercise of their own leasehold rights and interests. C-43-3

It is in the public interest to manage multiple use public lands for maximum benefit, and to permit full opportunity for exploration and production of energy resources consistent with multiple use and sustainable development. BLM administration of a geothermal resources leasing program, and ongoing management of lands for the development of geothermal resources in a multiple use context should take cognizance of active and ongoing exploration and production of hydrocarbon resources on many of the same lands. It is in the national interest that development of both categories of resources proceed to the extent feasible in a manner that does not constrain or limit the development of either resource. Toward this end, BLM needs to develop rules and guidance documents along with lease terms and conditions that

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set this as a priority for lease administration in situations of concurrent hydrocarbon and geothermal leases, with recognition of the priority of the senior leasehold interest in those situations where no other resolution is possible.

Thank you for considering these comments.

Very truly yours,

Richard Ranger

Richard Ranger
Senior Policy Advisor

C-43-1

Thank you for your comment. The comment has been noted.

C-43-2

It is beyond the scope of the PEIS to prepare leasing rules and regulations.

C-43-3

It is beyond the scope of the PEIS to prepare leasing rules and regulations for addressing conflicts between geothermal and hydrocarbon lessees that cannot otherwise be resolved through negotiated agreement.

OFFICE OF ENERGY RESOURCES

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c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

RE: Programmatic Environmental Impact Statement Comments

The state of Idaho thanks you for the opportunity to comment on the Bureau of Land Management's "Draft Environmental Impact Statement (PEIS) for Geothermal Leasing". Idaho's comments are divided into general comments on the three alternatives and comments that are more specific to the PEIS.

General Comments on the Alternatives

Under the proposed action, the Bureau of Land Management (BLM) and the U.S. Forest Service (FS) have identified three Alternative proposals. Alternative B represents the federal agencies' preferred option and it includes approximately 192 million acres of land that would be open to geothermal leasing. Leases under this proposal would be subject to existing laws, regulations, formal orders, stipulations, and other terms and conditions of the standard lease form. This Alternative makes it clear to potential developers that National Parks, wild rivers, wilderness areas, and national recreation areas are closed to geothermal leasing. Many of these areas are currently considered statutorily closed. Identifying these areas as closed is perceived to assist developers by helping them avoid applications that would essentially be unrealistic to move forward.

Idaho's review of the Draft PEIS supports Alternative B as the most reasonable option toward improving the geothermal leasing process. Alternative B appears to represent the best alternative to facilitate decisions on future lease applications and nominations on the federal mineral estate in the western United States. By excluding acreage that is statutorily off limits, potential developers will be able to focus attention on parcels that have legitimate opportunities for projects. This ultimately improves the leasing process by reducing risk and time delays. A-44-1

In assessing the status quo option (Alternative A), it provides no guidance or potential process enhancements. Alternative A (business as usual) would still allow applications to move forward on a case-by-case basis, but if the desire is to facilitate a more rapid development of renewable resources, this option offers no enhanced benefits.

Regarding Alternative C (Leasing Lands Near Transmission Lines), this option respects the realization that electric generation via geothermal resources is dependent on access to transmission. However, this alternative ignores the possibility that the generation capacity of a potential project could support the cost of extending transmission lines to the site. Accordingly, an arbitrary proximity to existing transmission should not by itself preclude project development. Another factor to consider in rejecting Alternative C is the potential federal requirements could have on the financial viability of renewable low-carbon projects that today might be considered too distant from existing transmission capacity.

It is recognized that an awarded lease is not approval to begin geothermal exploration. Developers still must obtain appropriate approvals to initiate drilling activity and accordingly must adhere to NEPA/EIS considerations. When projects emerge, Idaho reserves its right to provide site-specific comments related to indirect impacts and cumulative effects analysis pertaining to fish and wildlife resources and associated recreation and that management practices and mitigation ensure these resources are sustainable. The Sate of Idaho also recommends that full consideration be given to those species and habitats identified as those of greatest conservation need in the Idaho Comprehensive Wildlife Conservation Strategy (CWCS) (http://fishandgame.idaho.gov/cms/tech/CDC/cwcs_table_of_contents.cfm). A-44-2

Specific Comments on the Draft PEIS

The State of Idaho offers the following comments related to specific sections of the Draft PEIS. These comments are not intended to encourage closure of additional parcels to geothermal development. Instead they are offered to encourage full disclosure of potential considerations associated with sites in an effort to provide potential developers with necessary information to assess risk. Idaho also encourages the BLM and FS to identify potential barriers to development for a location (road access, known habitat for endangered species, etc). Whenever possible, stipulations on parcels should be posted in advance to any lease process in an effort to provide developers with information necessary to making informed decisions about specific sites. A-44-3

Volume1: Programmatic Analysis

Each geothermal plant will require ½ mile to nine miles of access roads. There are many negative effects of roadways on wildlife and wildlife habitat and they are well documented. We are concerned and interested in how these new geothermal plants will mitigate for the direct and indirect effects of increased roadways on wildlife and their habitat, including related issues such as noxious weed invasion, fire occurrence and frequency, and other disturbances reducing habitat access and use. We specifically recommend the final PEIS stipulate how mitigation for these and other effects on fish and wildlife and fish and wildlife recreation will be assessed, identified, and implemented. If possible, the PEIS should state how mitigation actions will help insure no significant and preferably, no net loss of wildlife habitat in relation to geothermal development. A-44-4

Each plant will require 5 – 50 miles of electric transmission lines. Each mile of transmission line would disturb approximately one acre via its footprint but would likely have much broader effects through direct and indirect effects of transmission towers, clearing, human disturbance, noxious weed introduction, and the increased potential for fire. In many cases, the specific effects of electric transmission lines on wildlife such as sage-grouse are suspected but undocumented (e.g. increased predator perching and nesting opportunities, behavioral avoidance, etc.). It is recommended that the final PEIS stipulate how mitigation for these and other effects on fish and wildlife and fish and wildlife recreation will be assessed, identified, and implemented and help realize no significant loss of wildlife habitat. A-44-5

2.2.2 Lease Stipulations, Best Management Practices, and Procedures
Lease Exceptions, Waivers, and Modifications, page 2-14
The draft PEIS states "*During the review process, coordination with other state or Federal agencies should be undertaken, as appropriate, and documented.*" A-44-6
The following language change is recommended: "During the review process, coordination with other state or Federal agencies *will* be undertaken and documented."

No Surface Occupancy Lease Stipulations, page 2-16
It is unclear how the No Surface Occupancy (NSO) lease stipulation will be applied. The draft PEIS states that NSO stipulations are a "*major constraint as they do not allow for surface development.*" It goes on to state that "*These NSO stipulations apply only when standard lease terms included on the standard lease form, Best Management Practices (Appendix D), and other stipulations would not adequately achieve resource protection.*" As noted below, BMPs may not A-44-7 be a required element of the lease application. There is a perception that adequate resource protection may not be achieved through BMPs if they are not a required element of a lease application and/or are not a BLM condition of approval, i.e. voluntary. Addressing this issue in the final PEIS could provide the necessary clarity.

Best Management Practices, page 2-20
The draft PEIS states "*Best Management Practices are state-of-the-art mitigation measures and may be incorporated into the permit application by the lessee or may be included in the approved use authorization by the BLM as conditions of approval.*" "Best management practices" can be viewed as the state-of-the art level by which projects will be implemented. In terms of fish and wildlife, such practices might include construction timing, weed control, access restrictions, revegetation, etc. A-44-8 Such practices are separate from mitigation, which are actions taken to balance unavoidable project impacts such as loss of habitat due to the project footprint or wildlife disturbance and exclusion due to project operations. It is recommended the above statement be changed as follows: "Best Management Practices *will* be incorporated into the permit application by the lessee or *will* be included in the approved use authorization by the BLM as conditions of approval."

Procedures Prior to Leasing, pages 2-20 to 2-22
Under this section, there is no required consultation with state agencies prior to developing leases. While this may not be required under federal law and regulations, it would be a prudent measure to include given the wealth of knowledge state agencies have concerning fisheries and A-44-9 wildlife distribution, critical habitat designations, migration corridors, information regarding special status species, and energy resource development potential.

Site Specific Comments
Of the sites identified (1-page Geothermal Power in Idaho Current Developments and Future Potential) in Region 6 IDFG, the Rexburg Caldera is primarily developed and intensively farmed; we would expect few negative effects of geothermal development there with the exception of farmland game species. The Willow Springs site would likely require more consideration for wildlife species should geothermal development occur. Both big game and ground-lekking birds are common around the Willows Springs area. A-44-10 There might be potential interruption of migratory patterns if above-ground piping were used. This area is also within IDFG's Mule Deer Initiative focus area and as such is one of extremely high value in terms of big game habitats in this area. It would be prudent to make potential developers aware of these considerations prior to nominating these parcels for lease.

Areas of Critical Environmental Concern

There are a significant number of notable Areas of Critical Environmental Concern (ACEC) included as potential geothermal leases. For example, in southwest Idaho, such areas total ~330,000 acres as being open to geothermal leasing. In terms of wildlife, these include areas of: Owyhee bighorn sheep habitat (Owyhee and Bruneau field offices, 168,399 acres), long-billed curlew habitat (61,000 acres), Columbian sharp-tailed grouse habitat (4,200 acres), Boise Front
(12,000 acres), and the Bruneau-Jarbidge River (bighorn sheep habitat and cultural resources, A-44-11
85,224 acres). Several of these ACECs have special management requirements, including NSO and Timing Limitation (TL) that may or may not limit leasing opportunities. These areas, because of their special management considerations for wildlife, will pose more complexity and will probably be more restrictive to work with for geothermal development than other, less management restricted areas.

Of the sites identified (1-page Geothermal Power in Idaho Current Developments and Future Potential) containing geothermal power potential with potential wildlife concerns include Vulcan Springs, White Lick, the Bennett Mountains, and the Raft River. The Vulcan Springs area provides important summer range for elk and mule deer. The route most likely to be used for electric transmission from White Lick would pass through important winter range for mule deer
and elk. The Bennett Mountains are especially important as mule deer and elk winter and A-44-12
summer ranges; the Bennett Mountain winter range supports the third highest density of wintering mule deer in Idaho. The Raft River area provides important winter habitat for mule deer, seasonal habitat for sage-grouse, nesting habitat for ferruginous hawks and other raptors, and year-round pygmy rabbit habitat. Recognition of these considerations will provide potential developers with useful information as they consider leases on these parcels.

While the Draft PEIS focuses on federal land leases, the possibility that state lands could be impacted due to proximity is worth considering. An example of an associated impact includes the potential need for new transmission lines to serve geothermal resources located on federal lands. These transmission lines could possibly require access to state lands. Accordingly, it is of some benefit to understand the concerns associated with access to state lands.

As background, the Idaho Department of Lands, at the direction of the State Board of Land Commissioners, manages Endowment Trust Lands within the State. All Endowment Assets of the State of Idaho must, per the Idaho Constitution [Article 9], be managed "in such a manner as will secure the maximum long term financial return" to the Trust Beneficiaries. The Assets will
be managed to provide a perpetual stream of income to the beneficiaries by: A-44-13

- Maximizing long-term financial return at a prudent level of risk;
- Protecting future generations' purchasing power; and
- Providing a relatively stable and predictable payout.

In December 2007, the Land Board adopted the *State Trust Lands Asset Management Plan* addressing the overall management of Endowment Lands within Idaho. The IDL *Annual Report for 2007* . These documents can be viewed at the following internet links:
http://www.idl.idaho.gov/am/am.html and
http://www.idl.idaho.gov/News/annual_reports/ar_2007.pdf.

Keeping in mind the Idaho Department of Lands' mission, the following comments are submitted:

1. Any use of Endowment Lands will require application for, and approval of, term easements with fees based on current market rates. Term easements may include multiple uses in some locations. Final location of any easements should be placed, wherever possible, in locations that will result in minimal negative impact to the function and productivity of Endowment land.

2. The ability of Idaho Department of Lands to manage the Endowment Assets for the maximum benefit of the beneficiaries will be impacted by this project. Among these impacts are:
   a. Spread of noxious weeds. Area-specific management plans will be necessary to protect all abutting land owners.
   b. Potential loss of access to Endowment Lands.
   c. Increased trespass activity due to proximity of new roads to Endowment Land.

3. Geothermal leasing of federal lands should be used as a motivator for an expedited process for land exchange in intermingled ownerships and to remedy current split estates. Management costs for these types of ownership are high and not in the best interest of either the Federal Agencies or State Endowment Lands.

4. The Idaho Department of Lands favors opening as much federal ownership for geothermal leasing as possible. Due to intermingled ownership, limiting federal leasing has a negative impact on possible future revenues for our beneficiaries.

5. Siting and leasing of commercial production improvements on State Endowment Lands is highly desirable.

Thank you for the opportunity to provide comments on the Draft PEIS for Geothermal Leasing of Federal Lands. The State of Idaho looks forward to working closely with the BLM and FS. Please contact me at (208) 287-4903 if you have any questions about the issues identified in this letter.

Sincerely,

Paul Kjellander

Paul Kjellander, Administrator
Idaho Office of Energy Resources

A-44-1

The commentor's support for Alternative B is noted.

A-44-2

The comment is noted. Subsequent environmental analysis prior to development and utilization will fully comply with NEPA and provide the opportunity for comment and involvement of the State of Idaho, when appropriate.

A-44-3

The comment is noted. The procedures prior to leasing identified in Section 2.2.2 would be implemented prior to inclusion of a parcel in a lease sale. These procedures would include identification of cultural resources, habitat for listed species, and other barriers to development.

A-44-4

BMPs designed to mitigate the impacts of geothermal development on wildlife habitat are included in Appendix B.

A-44-5

The PEIS provides analysis for the potential effects on sage-grouse and other sagebrush species from foreseeable on-the-ground actions, including transmission line impacts, and provides BMPs and stipulations to protect these species and habitats. BLM Resource Management Plans would be amended to adopt the stipulations, BMPs, and procedures.

A-44-6

Language in the Final PEIS has been changed to "coordination with other state and Federal agencies would be undertaken, as appropriate, and documented."

A-44-7

Stipulations provided in this PEIS would serve as the minimal level of protection and would be adopted into local land use plans upon signing of the record of decision. If an existing land use plan offers more protection, then those measures would apply instead (see Section 2.2.2 *Lease Stipulations*). The NSO is the most restrictive stipulation; therefore, it is applied if there are no other remedies. BMPs are not applied to leases but can be placed on permit applications as a condition of approval for any subsequent activities on the lease area. This process is handled during the environmental review process for the specific application. Example BMPs are provided in the PEIS to allow the public to see what tools are available and help the public provide input during the permitting process. The list of BMPs is not inclusive, in that local BLM field offices may apply other BMPs specific to the local site conditions. The BLM has added some text to the NSO discussion to help clarify the process.

A-44-8

The text has been revised to make the clarifying point of the comment.

A-44-9

BLM Field Offices collaborate closely with appropriate state agencies, especially in the case of geothermal energy where the states manage and have regulatory authority for water quality, water rights, and wildlife. The following text has been added to the Final PEIS under *Procedures Prior to Leasing*: "Collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states manage and have regulatory authority for water quality, water rights, and wildlife."

A-44-10

Thank you for your comment. It is beyond the scope of the PEIS to provide location-specific data for all potential geothermal development areas. However, this comment will be recorded in the public record and will be available to anyone reviewing the document.

A-44-11

The ACEC list included in Appendix C contains stipulations for each ACEC, as determined under oil and gas regulations.

A-44-12

Thank you for your comment. It is beyond the scope of the PEIS to provide location-specific data for all potential geothermal development areas. However, this comment will be recorded in the public record and will be available to anyone reviewing the document.

A-44-13

The PEIS document is concerned with geothermal leasing on BLM- and NFS-administered lands. Coordination with any affected agencies, including state land boards, would be undertaken as appropriate for specific projects.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

SEP 17 2008

Mr. Tracy Parker
Mr. Jack G. Peterson
Draft Geothermal Leasing PEIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

Dear Mr. Peterson and Mr. Parker:

The U.S. Environmental Protection Agency (EPA) has reviewed the Draft Programmatic Environmental Impact Statement (EIS) for Geothermal Leasing in the Western United States (CEQ #20080240) pursuant to the National Environmental Policy Act, and our authority under Section 309 of the Clean Air Act.

In accordance with the Energy Policy Act of 2005, the Bureau of Land Management (BLM) and the Forest Service (FS) are proposing to make decisions on geothermal lease applications submitted prior to January 1, 2005, in the current planning area of 192 million acres and to facilitate decisions on other existing and future lease applications and nominations covering a total area of 248 million acres. The Draft Programmatic EIS presents both broad impacts associated with the proposed action and alternatives, as well as more lease-specific analysis on 19 pending applications in seven geographical clusters of the planning area encompassing 36.937 acres. The alternatives evaluated included a no action alternative, potential leasing of 192 million acres (proposed alternative), and leasing within a 20-mile corridor from existing transmission lines.

A-45-1

The proposed project area covers 12 states with most of the potential leasing occurring in Nevada, western Utah, Idaho, California and southeast Oregon. The draft EIS states that "groundwater is the primary water resource that is potentially affected by geothermal exploration and development" (pg. 3.72). This is due to potential mixing of geothermal fluids from re-injection with surface or groundwater. With 23 sole-source aquifers located in the planning area, EPA has environmental concerns that the proposed action could potentially result in adverse impacts to groundwater quality, particularly sole-source aquifers. We recommend that the final EIS identify the types of mitigation measures that would be considered to protect these resources and how groundwater will be monitored to detect infiltration of industrial fluids used in geothermal energy production.

The draft EIS states that there are areas designated as non-attainment or maintenance areas for Particulate Matter (PM_{10}) in the planning area. While we understand the general conformity rule will be followed in non-attainment areas, EPA has environmental concerns that without the necessary monitoring and mitigation measures air quality may be adversely impacted by the construction, and other emission sources. The final EIS should address what measures will be implemented to reduce impacts to air quality. A-45-2

The draft EIS states that, "BLM regulations mandate that noise at one-half mile from geothermal operations, or at the lease boundary, if closer, shall not exceed 65 units of decibels A-weighted". However, it appears that all phases of geothermal exploration and development except reclamation and abandonment exceed this threshold. (pg. 4-154) Accordingly, EPA recommends that the final EIS discuss how the project will meet BLM noise regulations including a discussion of appropriate mitigation measures. A-45-3

Consequently, in accordance with EPA's Policies and Procedures, we have rated the draft EIS as Environmental Concerns – Insufficient Information (EC-2). While EPA supports the development of geothermal energy as a renewable energy source, the proposed actions have the potential to have adverse impacts to air quality and groundwater. A-45-4

EPA appreciates the opportunity to review this Draft Programmatic EIS. I am available to discuss our comments if you have questions. I can be reached at (202) 564-5400 or you can contact Jessica Trice of my staff at (202) 564-6646.

Sincerely,

Susan E. Bromm

Susan E. Bromm
Director
Office of Federal Activities

A-45-1

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater would be addressed as part of the environmental analysis for the permitting process. In addition, cement and casing of the well bore is designed to prevent mixing of reservoir zones. Although older casings can leak (more often in reinjection wells than production wells), they are inspected and tested to prevent this occurrence at regular intervals, and can be repaired. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

A-45-2

Appendix D lists specific mitigation measures and monitoring requirements that will be incorporated into issued leases if determined to be appropriate after coordination with state agencies.

Mitigation measures, including lease stipulations, conditions of approval, and the general operation of geothermal developments, would be monitored by the lessee or the appropriate Federal agency to ensure their continued effectiveness through all phases of development. Using adaptive management strategies, where mitigation measures are determined to be ineffective at meeting the desired resource conditions, the BLM and FS would take steps to determine the cause and would require the operator to take corrective action. This information would also be used to inform future geothermal leasing and development.

A-45-3

The normal operations of geothermal plants are typically comparable to common everyday sound levels and would remain under the 65 dB A-weighted threshold (dBA). In extreme situations (e.g., Enhanced Geothermal Systems), noise levels could exceed 65 dBA; however, prior to any construction-related activities, site-specific analysis would be conducted to ensure all noise regulations would be met prior to approval. Additional text has been added to Chapter 4 to clarify this difference.

A-45-4

The BLM appreciates the EPA's review and active participation in the preparation of the PEIS.

geothermal_eis

From:	Mary_Christensen@blm.gov [Mary_Christensen@blm.gov]	**Sent:**	Wed 9/17/2008 10:44 PM
To:	geothermal_eis		
Cc:			
Subject:	Mail forwarded from geothermal_eis@blm.gov		
Attachments:			

This message has been automatically forwarded from geothermal_eis@blm.gov.

raymondBulleiwiLa To
hisdinikkaaji geothermal_eis@blm.gov
allovertherez cc
<rimrockwalker@ya rimrockwalker@yahoo.com
hoo.com> bcc

09/17/2008 11:41 Subject
PM COMMENTS ON DRAFT PEIS

Please respond to
rimrockwalker@yah
oo.com

|--|
| Hello |
| My Name is Raymond Alvarez, I am a Member / Councilman for the |
| Hewisedawi Band Of Pit River Indians. The following are my comments on |
| the Draft PEIS. I believe that the geothermal resources on public lands|
| need to be utilized as long as intensive environmental impact studies |
| are conducted insuring the safety and preservation of all outdoor |
| life. Also I believe that better consultation needs to be conducted |
| with local Federally Recognized Native American Tribes/Bands that still|
| utilize these lands for gathering/spiritual purposes. Should a project |
| be approved, and the impact studies suggest a geothermal plant is | A-46-1
| viable on certain public lands, and the local Tribes/Bands agree and |
| support the project, I believe they should be considered when any |
| royalties are given out. If a project gets approved, tribal |
| Archaeologists/Monitors from the Tribes/Bands of that area need to be |
| fully utilized on any ground disturbance activities. In so, giving the |
| Native Americans full responsibility for the safe handling of any |
| artifacts or remains of previous Native people. Thank you for your time|
| and consideration, |
| Raymond Lee Alvarez, Bulleiwi |
| Hewisedawi Band- Councilman |

A-46-1

As stated in the PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the Federal leases and by potential geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

Royalties are administered consistent with 30 CFR Parts 202, 206, 210, 217, and 218 (Geothermal royalty payment, direct use fees, and royalty valuation; final rule dated May 2, 2007).

Sent via Email: geothermal_EIS@blm.gov
and Certified Mail, Return Receipt Requested

September 17, 2008

BLM Geothermal Programmatic EIS
c/o Environmental Management and Planning Solutions, Inc.
182 Howard Street
Suite 110
San Francisco, CA 94105

RE: Comments on Draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States

Dear EMPSi staff:

Please accept the following comments from Trout Unlimited on the Draft Programmatic Environmental Impact Statement (PEIS) for Geothermal Leasing in the Western United States. Trout Unlimited is offering these comments after reviewing the PEIS document and observing the lack of significant discussion and consideration of geothermal impacts to waters, groundwater contamination, fish and wildlife habitat in the western United States.

Trout Unlimited (TU) will discuss the concern we have regarding the lack of solid analysis with respect to actual environmental consequences of geothermal development O-47-1
and the amending of 122 land use plans covering more than 248 million acres. Additionally, TU notes that this PEIS document requests comments on the 19 pending lease applications (Volume II, PEIS) that have been submitted to the BLM, tiering the analysis of these applications to the future geothermal leasing stipulations which are only broadly discussed in a general way in the first volume of the PEIS. These 19 lease applications, if approved, will have significant impacts to the national forests in which they are located. The lack of any thorough environmental analysis (outside of the few pages devoted to each area in Volume II) is not consistent with performing required NEPA analysis prior to any leasing that results in a meaningful evaluation and analysis. Further, throughout the PEIS, the BLM claims that they are unable to provide anything other than a broad superficial perspective of geothermal impacts to the environment based on the size of the areas impacted. The BLM notes that the Preferred Alternative B will impact 82 percent of public BLM lands and 70 percent of national forest lands (PEIS, p. 4-7). The BLM is doing the public a great injustice by not providing a more careful and comprehensive meaningful document containing information that would

allow the public a more equitable evaluation of the PEIS proposal from which to comment on.

Because the content of the PEIS contains too little information to accurately assess the environmental consequences of commercial geothermal development, TU feels that the BLM should select Alternative A until the agency can more accurately define and implement geothermal impacts and lease stipulations. Alternative A (No Action Alternative) would not amend the 122 land use plans but rather allow the current process of site-specific analysis continue within the individual respective agency field offices using the existing land use plans, many of which are currently undergoing revisions. Though this would most likely require additional NEPA documentation and possible amendments to plans, this alternative would continue to provide analysis while the BLM further evaluates the PEIS for geothermal leasing. 0-47-2

Background

TU is one of the largest private non-profit conservation organizations dedicated to conserving, protecting and restoring North America's trout and salmon fisheries and their watersheds. Established in 1959, TU has more than 155,000 members nationwide supporting the mission for the protection of coldwater fisheries. TU recognizes that the value of public lands is unparallel in providing habitat to coldwater fisheries, drinking water and wildlife habitat. TU's expanding conservation program includes a public lands initiative that recognizes the importance of protecting public lands for the survival and restoration of wildlife and fisheries. TU's public lands initiative is not limited to anglers; TU recognizes that many people who fish also utilize public lands for hunting and wildlife viewing opportunities. TU believes that actions taken on public lands are ultimately reflected in the quality of fish and wildlife habitat and populations.

Of the 12 states where the PEIS has identified areas of geothermal potential, all 12 states have a TU public lands program that is responsible for the preservation, protection and enhancement of public lands. Volunteers and staff in these 12 states provide valuable resources and on-the-ground project development that assist in the protection and enhancement of fish and wildlife habitat. TU has participated in numerous initiatives, campaigns, and actions that offer collaboration, partnerships and recommendations toward the implementation of responsible energy development. TU supports ongoing efforts toward energy sustainability and renewable development, and recognizes the valuable role energy development plays in these 12 western states. However, TU has strong concerns that the current proposal for these lease activities and the proposed leasing program discussed in the PEIS will have lasting consequences and impacts from geothermal development on TU's members and non-members who hunt, fish, recreate, and do business in and around these areas.

The BLM Should Not Make a Decision on the Processing of Active Pending Geothermal Leases until the PEIS for Geothermal Leasing is Completed.

1. **Simultaneous Evaluation of Two Separate Documents in the PEIS Should be Halted.**

Included in the BLM's proposed actions of the PEIS is a separate action that requests the site-specific analysis on current leasing decisions on 19 pending lease 0-47-3 applications in 7 geographical clusters on public lands. These 19 pending leases are what are left of the 198 lease applications that were pending since January 1, 2005 (the BLM was required to reduce the backlog, as directed to do under Section 225 of the EPAct of 2005). According to the BLM, these pending geothermal leases have been backlogged for lack of stipulations for geothermal leasing and development. The BLM is asking the public to comment on both the proposed Draft PEIS on Geothermal Leasing (Volume I) and the PEIS Analysis for Pending Lease Applications (Volume II). This request appears to be inherently conflicting, since the BLM is simultaneously approving leases from the 2005 backlog while also seeking approval for a broad leasing approach under the PEIS, and both documents are in draft stages.

It would seem a more prudent move and reasonable request that the PEIS on Geothermal Leasing be completed prior to the approval of the PEIS Analysis for Pending Lease Applications. It is difficult for the public to evaluate site-specific analysis on actions that have little or no stipulations and are awaiting a broader scope of work analysis and direction in a separate PEIS.

2. The BLM Should Not Commit Lands to Being Leased Prior to the Finalization of the PEIS on Geothermal Leasing.

Because the BLM has not developed or finalized regulations governing geothermal leasing, the assertions that designating lands as available for leasing will not have impacts, and that meaningful NEPA analysis will take place prior to leasing, are not supported. Without any regulations currently in place, and knowing that the regulations will undoubtedly undergo great revision during the public process associated with their promulgation, the BLM simply cannot assure the public that the future NEPA processes will adequately provide a forum for informed decision making with meaningful public participation. It also confounds and misdirects the public's ability to adequately and conscientiously provide thoughtful and meaningful input to 19 pending lease applications. Those 19 pending lease applications should each have a separate and more comprehensive environmental impact analysis prior to any approval under this PEIS. The nature of the impacts to the environment from the type of development required for geothermal production demands this. The lack of detailed groundwater evaluations, hydrogeologic analysis (particularly since so many areas are in earthquake zones), air quality impacts, and climate change analysis completed on any of the 19 applications speaks to this request.

0-47-4

Moreover, under traditional oil and gas leasing principals, once a RMP identifies lands as available for leasing, the lands are committed for leasing with no further NEPA review or public input, with the only exception being a protest to the leases. Without having publicly vetted and finalized regulations in place that will govern the geothermal leasing process, the BLM's assurances that the public will have further opportunity to comment prior to leasing cannot be wholly accepted. Proponents of specific leasing applications could argue, using the conventional fluid minerals program as precedent, that once the RMPs have been amended to allow commercial geothermal leasing, those lands are committed to leasing, subject only to lease stipulations – but not subject to a "no leasing" alternative.

0-47-5

Environmental Consequences of Geothermal Leasing

1. Poor Assessment of Consequences.

Within the content of the PEIS, statements were repeatedly made that it was not possible to identify specific impacts from the decision to approve a geothermal lease or to designate federal lands as open or closed to geothermal leasing. Rather, the PEIS has chosen the route of presenting "common impacts" from geothermal development by analyzing the Reasonable Foreseeable Development Scenarios (RFDS) and trying to assess the potential impacts based on a list of four phases of geothermal development. While TU appreciates the fact that the BLM is trying to consider more "environmentally sensitive" opportunities to develop resources and meet energy demands, we feel that this PEIS is very weak in its analysis. In fact, since the four phases of geothermal development are similar if not exactly like those of oil and gas development (exploration, drilling operations, utilization, and reclamation and abandonment) we feel the BLM has ample examples of the impacts associated with oil and gas development to fish and wildlife habitats, and to air and water quality, and those types of analysis and consequences should be included in this PEIS. By encompassing this generality for such a large expanse of the public's land that has the potential to be impacted (more than 248 million acres covering 12 states) TU feels that the BLM owes the public a more accurate and thorough analysis. This is especially necessary since this analysis of impacts already exists and because the BLM is simultaneously requesting the review of those 19 pending lease applications using the Draft PEIS as a reference source. O-47-6

2. Impacts Should be More Thoroughly Analyzed Given the Available Information

The BLM cannot avoid its obligation to analyze the broad environmental consequences of commercial geothermal development merely by stating the consequences are unclear and will be analyzed later in other NEPA documents. Taken to the logical extreme, if a federal agency were able to defer analysis of environmental consequences in an EIS based on a promise to perform the analysis in connection with later site-specific or smaller projects, no environmental impacts would ever need to be addressed in an EIS. This would render the EIS process meaningless. O-47-7

In the PEIS, the BLM has deferred analysis of environmental impacts to future lease-specific NEPA processes (with the exception of the 19 pending lease applications). While TU does support further NEPA analysis prior to the government's issuance of commercial leases, doing so in the absence a meaningful, existing basin-wide impacts analysis will result in a tyranny of small decisions that will not take into account the large, landscape-level consequences of a commercial geothermal program. The vast water, wildlife, and fisheries resources in the 12 western states would be made subject to a death of a thousand cuts.

The inability of the BLM to perform a meaningful impacts analysis at this time, though, only underscores the flawed nature of this PEIS process. The BLM should perform its analysis of landscape-level environmental consequences now, because to defer such analysis would allow for broad impacts to escape review. Despite the Congress' best intention to facilitate geothermal development by directing the BLM to perform this analysis, the BLM should lay back those 19 pending lease applications until the first PEIS analysis is complete. The only responsible land-management decision on behalf of the public would be to select Alternative A and defer the decision on whether to make available certain lands for commercial leasing until the BLM's commercial leasing regulations are finalized. This selection of Alternative A would also free up the pending 19 leases to a case-by-case decision analysis, of which the previous 89 pending leases were apparently successfully analyzed.

Throughout the PEIS, the BLM has indicated that impacts from geothermal development are difficult to predict. Yet, by its own admission the BLM has now approved 89 leases for development that apparently went through some level of NEPA evaluation and impact analysis. The remaining 19 geothermal leases that are under consideration in the second scope of this PEIS have been identified into 7 geographic clusters and identified for further supplemental environmental analysis. These separate geothermal proposals have evaluations of environmental consequences (Volume 2, PEIS) that are very limited in their scope and analysis. They should not be approved based on the lack of sufficient and meaningful NEPA review. O-47-8

The RFD scenario estimates that 110 power plants could be constructed by 2015 and another 132 power plants by 2025 (PEIS, p.4-5). Further, impacts associated with the utilization of surface area for geothermal plant construction involves significant and most likely permanent impacts of land use (PEIS, 4.2.3, p. 4-6). The generalization applied to the analysis of these impacts in this PEIS is unacceptable given the amount of public land that is at stake for geothermal development. As the PEIS states, the location and installation of one geothermal plant involves land disturbance ranging from 53 acres to 367 acres or more. Thus far, the projects which have been approved by the BLM for geothermal development all occur on U.S. Forest Service (USFS) lands, according to the PEIS. Of the 58.5 million acres of inventoried roadless lands within the USFS, more than 52.9 million of those acres are located within the geothermal project area. The PEIS states that roadless areas are the nation's most highly valued expanses of open space (PEIS, p. 3-12). Headwaters for sensitive native and wild trout species begin most often on USFS lands and west-wide more than 1,000 species of wildlife call the forest their home. The BLM is negligent if they do not expand their efforts to include a more thorough analysis of the impacts to fish, wildlife, air, water, recreation, soils, climate changes, and economic parameters given the incredible amount of acreage predicted to be impacted. O-47-9

3. Four Phases of Development Have Significant Impacts

The first two phases of geothermal development -- exploration and drilling – are consistent with those impacts associated with oil and gas development. These types of impacts have long-term and substantial impacts to soils, waters, air quality, and fish and wildlife habitat and populations. Geothermal utilization (the third phase of development) increases the impacts to the surface and subsurface resources on BLM or USFS lands. The fourth phase, reclamation and abandonment, might have little long-term impact but would most likely not occur for several generations, depending on the productive capability of the geothermal resource itself. O-47-10

Exploration for geothermal activity involves the use of off-road vehicles, helicopters, truck traffic, vibroseis equipment, drilling temperature gradient wells, and heavy equipment to transport those wells. Access roads, including new roads, will most likely be developed. Drilling operations would require production wells, injection wells, fluid sump pits and new access roads to accommodate larger equipment. The PEIS clearly states that this phase of development would impact land use activity, including displacement of activity such as wildlife use. The description of drilling operations also cites the fact that a drill site operation includes a well pad site that ranges between 5 and 50 acres per plant. That is in addition to the plant acreage disturbance estimated at anywhere from 53 to 367 acres. Adding on road miles, pipeline rights-of-ways, staging areas and housing areas, and a geothermal plant site might easily occupy more than a section of forest land. For this kind of permanent imprint onto wildlife habitat, the BLM should prepare more in-depth analysis.

<u>The PEIS is Too Broad and Should Not Be Used to Amend Land Use Plans</u>

The PEIS is extremely broad and effectively useless in its efforts to provide any decent site-specific review or analysis to the 12 states that will be impacted or the 122 land use plans that would have to be amended. TU fears approval of such a broad PEIS would result in amending 122 land use plans without recognizing the significance of special protection or designation areas, sensitive species, or significant cumulative and landscape impacts identified within these 122 land use plans. The PEIS does not consider in any detail the potential consequences of amending 122 land plans, especially in areas that have these special concerns or special management designations. O-47-11

By allowing the amendments of these land use plans to absorb the geothermal PEIS, the public is left out of the process. Leases would be approved without the necessity of further site-by-site analysis and would be against NEPA regulations, despite the BLM's claim that site-by-site analysis would occur within each BLM or USFS region. The BLM should not rely on the PEIS to justify the amendment of 122 land use plans.

<u>Alternative C Should Be More Thoroughly Analyzed Due to its Smaller Footprint and Updated Technologies and Infrastructure Development</u>

Under Alternative C less land (53% less than the Preferred Alternative B) would be open for indirect use of geothermal development (92.6 million acres) and would therefore reduce the impacts to fish, wildlife and those who use our nation's public lands in the West. The flaw that has been identified in the PEIS by the BLM for not choosing Alternative C is that the existing transmission line access to many states does not exist. However, since the publication of the PEIS, many states originally identified as limited in geothermal development potential now are pursuing various options for alternative energy development, including wind and solar, that require the same transmission infrastructure. And in many states, including the most limited states such as Wyoming and Nevada, that structure is being actively pursued and initiated. Therefore, Alternative C needs to be considered in a more updated and thorough manner. TU would consider supporting Alternative C given this more thorough analysis. O-47-12

1. Not Enough Evaluation Conducted on Impacts from Alternative C

The PEIS's discussion on impacts from geothermal development under Alternative C has been primarily dismissed and referred back to Alternative B as similar in nature. Yet, the PEIS fails consistently to identify the fact that under Alternative C, 53% less land would be developed than under Alternative B and therefore, less impacts to fish, wildlife, air, water quality, recreation, etc. would be inflicted. This is a significant number and should be given due consideration. This is especially important in light of the associated and significant impacts oil and gas development is currently having upon the nation's public lands and associated fish and wildlife habitat.

The PEIS broadly discusses the many impacts associated with geothermal development and likens these impacts to those that are similar to oil and gas development. This means an increase in roads, traffic, noise, loss of habitat, increased sedimentation and erosion, increased air emissions and decreasing air quality, loss of wildlife populations, habitat fragmentation, and increased water quality issues, pollution, and degradation. All of these impacts are currently being experienced on public and private lands in the west where oil and gas development is occurring. The PEIS should include a more expansive discussion on the ramifications of additional energy development on environmental resources. O-47-13

<u>Reasonable Foreseeable Development Scenarios Are Not Realistic or Accurate</u>

As discussed in the PEIS, the RFD scenario serves as a basis for analyzing environmental impacts resulting from future leasing and development of federal geothermal resources within the western U.S. over the next 20 years (PEIS p. 2-33). And while the BLM has approved 89 geothermal leasing projects since 2005, the PEIS states that few quantitative evaluations have been conducted on the typical impacts associated with geothermal development. This appears to be irresponsible on the part of the BLM and their management responsibilities to the public land resource. This is especially egregious in light of the fact that in other parts of the PEIS, the BLM states that geothermal development is similar to those actions used to develop oil and gas resources. More than 245 million acres are potentially being committed to geothermal leasing with very little analysis completed to the landscape scale and future impacts of this type of development on our nation's public lands. TU recommends that more analysis be committed to the RFD scenario discussion. O-47-14

In the discussion concerning impacts, the RFD scenario discusses those states expected to be leased for geothermal development. It is noted that Wyoming (with vast amounts of geothermal potential identified in the PEIS, Map 1-A, p. 1-16) is not included in any of the RFD analysis. When TU inquired as to the process for identifying individual states' assessment, the BLM replied that since there had been no previous inquiries in the last few years concerning geothermal development, the RFD scenario for this state (or any state with no inquiries) therefore, would be none. This level of assessment and poorly educated assumption appears to be undervalued in light of the recent push (since 2005) for alternative and renewable energy resource development. While the reason given for some state's low proclivity for development has been that the infrastructure for transmission lines is lacking, the BLM should not assume that because the transmission access has lacked progress in the past, it will therefore not be available in the future. Currently, Wyoming and many western states are strongly pursuing an increase in transmission line infrastructure and development. This action by the state changes the outlook for many types of renewable energy development, including geothermal, and should be fully evaluated in the PEIS. O-47-15

<u>Significant Analysis is Lacking in Water Resources and Water Quality Discussions</u>

The PEIS dedicates a mere 7 pages in discussing the consequences of geothermal development to water resources occurring in more than 248 million affected acres. It is worthwhile to note that within those 7 pages of discussion, the BLM recognized that geothermal activities would have potentially significant impacts from the associated phases of geothermal development. However, the broad cloak of handling these impacts is less than acceptable. In light of the on-going western-wide drought and climate changes affecting the West's water supplies, this lack of analysis is objectionable. TU strongly urges the BLM to readdress the discussion and more thoroughly analyze and quantify the impacts each state will have based on individual state's and region wide water issues. The data is available and the BLM's deferral of impact analysis to future individual lease applications only results in ignoring the significant water-related impacts, both locally and from regional basin-wide perspectives that will result without this analysis. NEPA regulations require that a more comprehensive analysis be addressed in a NEPA document. O-47-16

Water quality impacts that should be thoroughly addressed in the PEIS include the following: O-47-17

- <u>Commingling potential and occurrences during geothermal drilling operations.</u> As briefly discussed, drilling operations can result in contamination between geothermal drilling fluids and aquifers of differing water quality. Given the nature of the landscape habitat in which most geothermal operations will be located, degrees of impacts need to be evaluated and consequences more thoroughly discussed. Many of the geothermal locations exist in areas with shallow groundwater quality and the impacts of any contamination occurrences in these areas need further review.
- <u>The impacts from a region wide and watershed basin wide perspective need analysis.</u> Based on the nature of drilling and waste accumulation in geothermal operations, a more thorough discussion should be required due to the location of geothermal plants. Thus far, all of the already-leased geothermal operations are in US forest lands, including roadless areas. The potential for a large-scale pollution incident remains high without thoughtful discussion on mitigation and stipulations designed to avoid such impacts. O-47-18
- <u>Impacts to rivers, water quality in rivers and downstream reaches.</u> No analysis was presented on impacts to rivers other than a broad statement about Wild and Scenic Rivers being closed to geothermal development. Many rivers in our national forests contain sensitive fish species, provide vital food and water sources for all wildlife, and harbor threatened and endangered species. A more thorough analysis is needed that discusses impacts to river bodies, including downstream reaches should a contamination event occur. O-47-19
- <u>Impacts to fish and wildlife that are threatened or endangered.</u> Many landscapes of terrestrial and aquatic habitat in these 12 western states have various endangered species or sensitive species recovery implementation plans that serve to direct the protection of threatened species. Impacts to water bodies would affect all wildlife and fish species and the PEIS needs to discuss this in a more detailed manner due once again, to the location of the majority of geothermal operations in premiere fish and wildlife habitat. O-47-20
- <u>Setbacks from rivers, streams and riparian areas need evaluation.</u> The description of a geothermal plant provided insight to the size of such an operation. Due to the nature of potential impacts from drilling and utilization of O-47-21

geothermal resources, TU feels that stronger stipulations should be designated than increase controlled surface use and no surface use near riparian or wetland vegetation and streams and rivers. A minimum of one-quarter mile to one-half mile no surface occupancy or setbacks for a plant that will permanently (in our lifetime) be located should be implemented. There are numerous examples within the BLM and the USFS (and some state regulations) that have implemented such setback measures whether for seismic operations or full field development of oil and gas wells (Wyoming and Montana are two most recent examples). This offers protection to water quality and its numerous resource values and functions.

- <u>The increase in air pollution and emissions from geothermal plant activity.</u> Many areas of the western U.S. are experiencing a significant increase in air quality emissions resulting in higher and never-before-seen air pollution. Geothermal production does produce emissions from drilling or associated plant infrastructure. This is of particular concern with respect to fisheries and water quality, especially in the locations where geothermal plants are expected to occur, including backcountry roadless areas containing coldwater fisheries. Many of these backcountry streams and rivers contain threatened or potentially threatened and sensitive fish species. The majority of these wild and native trout species reside their entire lives in these isolated and small patches of headwater tributaries. Any changes in water quality, temperature, or quantity would affect these sensitive and vulnerable fish species and subject them to potential population decreases. Deposition from polluted air particles would negatively impact these species. Research has shown that many cutthroat trout species are particularly sensitive to the slightest change in the aquatic environment. O-47-22

<u>Impacts to Fish and Wildlife are Not Adequately Discussed or Analyzed</u>

The PEIS provides a broad overview of the potential for wildlife and fish impacts from the activities associated with geothermal development but fails to take into account ongoing impacts that are occurring in various states to wildlife and fish from current energy development. The excuse that the BLM is unable to predict future development scenario impacts is unacceptable. Western states such as Colorado, Wyoming, Utah, California, and Montana are conducting research that document negative impacts to big game, sage grouse, fish, water and air quality from increased oil and gas development. This available data might alter the statements the PEIS offers, including the RFD scenario which states "The effects of implementing the RFD scenario would have very little effect on most species populations…and affect relatively small areas of habitat and would typically affect individual species instead of large populations." (PEIS, p. 4-74). In western Wyoming in the Pinedale Anticline gas field, a 46% reduction in a mule deer population has been attributed directly to oil and gas development (Hall Sawyer, West Inc., 2006. *Sublette Mule Deer Study: 2006 Annual Report*). Clearly this example illustrates the effects on a population of animals. Similar studies exist on impacts to antelope (Berger, et al, 2006; 2007) and sage grouse. O-47-23

The PEIS contains two pages of an overview discussion on fish and aquatic biota and neglects to discuss the value of the importance of high mountain streams to many sensitive and threatened fish species. Significant impacts to fisheries have not been discussed or quantified and the PEIS needs to provide a more thorough analysis. O-47-24

Further, the discussion of actions and potential impacts on fish and wildlife includes an additional two pages that are vague in discussion and ignore any discussion of impacts other than the fact that certain closed lands not available to geothermal leasing would protect wildlife and fisheries (PEIS, p. 4-93). This is a poor excuse for what should be a thorough review of potential conflicts, issues, landscape scale impacts, and consequences of loss of wildlife populations. TU adamantly requests that the PEIS reassess their evaluation of this section of analysis. 0-47-25

It is because of the lack of quantifiable data and a poorly demonstrated ability to discuss the impacts to wildlife and fisheries that TU asks the BLM to select Alternative A until more meaningful analysis regarding the actual environmental consequences of geothermal development to wildlife and fisheries be developed.

The PEIS Does Not Adequately Consider Impacts Associated with Climate Change.

The PEIS basically ignores climate change discussion and classifies it under the air quality discussion (p. 4-48). While the discussion on air quality contains some informed analysis, it refers to a 1977 permitting program that is not up to current standards (New Source Review permitting program) of emission controls and limits. And while Table 4-2 (PEIS, p.4-54) compares the carbon dioxide emission estimates from the projected 2015 and 2025 geothermal power plant electricity generation that is discussed in the RFD scenario, these plants are still emitting emissions that will be added to the already polluted air in Class I and II airsheds that are being impacted by oil and gas development. This cumulative scenario needs to be addressed more thoroughly. 0-47-26

The lack of air quality analysis to water resources and aquatic life, as TU pointed out in the discussion under water resources, is unacceptable, especially in light of those impacts likely to result from an increasingly warming climate. The BLM has been given a directive from five federal agencies (U.S. Departments of Agriculture, Interior, Defense, Commerce, and EPA) that order agencies to work to adapt water program management to reflect changing climatic conditions (Memo dated August 22, 2008; "Subject: Federal Agency Cooperation on Adaptation of Water-Related Programs to the Impacts of Climate Change"). Geothermal operations conduct their development operations and activities using large amounts of water resources and in areas located where direct impacts from warming climates affect the surrounding environment, including snow pack, stream and groundwater aquifers, recharge areas, and high elevation lakes. TU respectfully suggests that the BLM comply with this directive and address the climate change issue and its impacts in a more qualitative and quantitative manner. And until the BLM can sufficiently analyze the impacts of geothermal development and its impacts in a reasonably foreseeable climate change consequence, resulting in a decision process that is supportable by their analysis, TU urges the BLM to select Alternative A. 0-47-27

The PEIS Does Not Adequately Consider Impacts Associated with Socioeconomic and Environmental Justice

In addition to those impacts that have the potential to affect air, water, fish, wildlife, and climate, the BLM was directed rather strongly to address economic impacts that could occur from the proposed geothermal development activity (EPA letter to BLM, PEIS p. 4-142). However, despite the BLM referencing this EPA letter requesting specific and detailed evaluations of impacts to minority, low-income populations and 0-47-28 disproportionate impacts to these populations, the PEIS falls far short in this endeavor. Many of the 12 western states contain low-income and highly dispersed human populations. Rather than provide any level of even intermediate detailed discussion, only a cursory broad discussion was offered. Additionally, despite requests from the public to include discussion on the economic costs of loss or degradation of public lands, wildlife habitats, quality of life, and hunting and angling, little effort was made to address this issue in the PEIS. O-47-29

On page 4-144 of the PEIS the discussion centers on the economy of building geothermal plants and how bringing in such plants to communities benefits a society. Yet, there is very little comparative discussion on what is lost by the placement of a geothermal plant and associated infrastructure to the land, its wildfire and fisheries, the communities that might be impacted by loss of recreation, tourism, and hunting and fishing opportunities. The conclusion is that some economic impacts may occur should geothermal activity alter ranching, recreation, hunting or mining activities but the overall impact on recreation-related economics would be minimal. There is no supportive data that references these statements, yet individual states have considerable data illustrating the importance of outdoor recreation activities, including hunting and fishing, tourism, etc., and these data should be incorporated into the discussion of impacts in this PEIS. While the geothermal development activity and electrical plant construction may be considered minimal in terms of long-term environmental impacts, it is still incumbent upon the BLM, as part of the NEPA process for evaluating the environmental consequences, to include the loss or reduction of any number of resource activities when approving an incoming resource use.

Finally, the BLM must consider the impacts that could result to the hunting and fishing heritage based on the Executive Order 13443 (August 2007). This Executive Order directs federal agencies that have programs and activities that have a measurable effect on public land management, outdoor recreation, and wildlife management, including the Dept. of Interior and Dept. of Agriculture, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitats. Evaluation of the PEIS's actions have not been conclusive in this document and TU requests that the BLM conduct further analysis on the 12 state region that considers the economic and recreational impacts and values in the BLM's actions. O-47-30

The PEIS Does Not Adequately Address the Cumulative Impacts Associated with Geothermal Development

Other than a cursory and usually one paragraph review of cumulative impacts that geothermal development might have on another resource or resource use, this PEIS does not adequately begin to offer comprehensive cumulative analysis on multiple resource uses. There is virtually no consideration of existing impacts from current oil and gas development, road density, air quality, fragmented wildlife and fisheries habitat, water quality and quantity, or economic activities. The BLM must consider past, present and reasonable foreseeable future actions that are cumulative in nature and result in environmental consequences. The enormity of landmass that is expected to be impacted by geothermal development demands that a much better cumulative analysis be conducted than what has been presented here. O-47-31

Because of the lack of substantial cumulative consideration, TU strongly requests the BLM consider Alternative A, the No Action Alternative, until a more thorough and insightful NEPA analysis is conducted.

Summary

TU has reiterated throughout these comments that the BLM has produced a document that lacks depth in analysis and poorly presented environmental considerations and consequences from geothermal development. Considerable data and research information is available that would compliment and strengthen this NEPA analysis and TU believes that until the BLM provides better information, they should not approve two scopes of this document--the 19 additional pending applications, and the BLM's Preferred Alternative B. Until a more comprehensive PEIS is completed, TU strongly urges the BLM to choose Alternative A. By choosing the no-action alternative, the impacts to the resource will remain low and a more reasoned decision can be made once the document is supplied with improved and more sufficient information. Thank you for the opportunity to comment on the PEIS. 0-47-32

Sincerely,

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O-47-1

The comment is noted. The analysis in Volume II is commensurate with the scope of the proposed action for the individual leases. During subsequent permitting processes, more site-specific and localized analysis would occur.

O-47-2

The commentor's support for Alternative A is noted.

O-47-3

The impact analysis in Chapter 4 is appropriate for a programmatic-level EIS.

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

The RODs for the 19 pending leases are dependant on the ROD for the PEIS and will be signed separately. Therefore, a timing break between the signing of the RODs for the PEIS and the 19 pending leases is not necessary.

O-47-4

The BLM completed final regulations governing geothermal leasing on May 2, 2007 (72 Fed. Reg. 24,358 (2007)).

The analysis in Volume II is commensurate with the scope of the proposed action for the individual leases. During subsequent permitting processes, more site-specific and localized analysis would occur, as appropriate.

The RODs for the 19 pending leases are dependant on the ROD for the PEIS and will be signed separately. Therefore, a timing break between the signing of the RODs for the PEIS and the 19 pending leases is not necessary.

O-47-5

The authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

It is also important to note that lands allocated as open are subject to existing laws, regulations, and formal orders, which could prohibit some lands from leasing.

O-47-6

Impact analysis in Chapter 4 is appropriate for a programmatic-level EIS. As noted in the above responses, all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

O-47-7

Impact analysis in Chapter 4 is appropriate for a programmatic-level EIS. As noted in the above responses, all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis.

The RODs for the 19 pending leases are dependant on the ROD for the PEIS and will be signed separately. Therefore, a timing break between the signing of the RODs for the PEIS and the 19 pending leases is not necessary.

O-47-8

The analysis in Volume II is commensurate with the scope of the proposed action for the individual leases. During subsequent permitting processes, more site-specific and localized analysis would occur.

O-47-9

The PEIS does not identify lands for which the FS would or would not consent to the issuance of geothermal leases. For geothermal projects on FS lands, the PEIS would facilitate the subsequent NEPA process that would be necessary to provide future leasing consent decisions.

The existing case law regarding the Roadless Rule is inconsistent. On August 12, 2008, the Wyoming District Court found the 2001 Roadless Rule violated NEPA and the Wilderness Act (State of Wyoming v. US Department of Agriculture). The District Court ordered the 2001 Roadless rule "set aside" and "permanently enjoined." This order is subsequent to a 2006 California District Court ruling that set aside the 2005 State Petitions Rule and reinstated the 2001 Roadless Rule. The United States Justice Department, on behalf of the Department of Agriculture, has filed motions with both the Wyoming and California courts seeking adjustments of those courts' conflicting judicial orders. Neither the Wyoming nor California District Court rulings bar the Department of Agriculture from promulgating other roadless area regulations. To address this inconsistency, the PEIS includes the following Department of Agriculture Roadless Area Stipulation, "If future legislation or regulations change the roadless area designation, the restriction would be revised along with any appropriate environmental review." An appropriate NEPA review would be required prior to any changes to the Roadless Area Stipulation.

O-47-10

Please see the standard response GD1.

As stated in the responses above, all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development.

O-47-11

The analysis in the PEIS is commensurate with the scope of the proposed action. A broad analysis in the PEIS and differences in the way that land use plans address geothermal leasing and development is a necessary outgrowth of localized characteristics of the resources in the planning area. As noted in the above responses, all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development.

O-47-12

The comment is noted.

O-47-13

Please see standard responses GD1 and C11.

Additional discussion has been added to the cumulative impact analysis. As noted in Chapter 5, past, present, and reasonably foreseeable actions, including commercial uses of public and federal lands, are documented and analyzed.

As noted above, this document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis.

O-47-14

Please see standard responses GD1 and L11.

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations, such as Endangered Species Act Section 107 consultation and National Historic Preservation Act Section 106 consultation. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

Moreover, as noted in the above responses, this document is not intended to provide full analysis of all phases of development; all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis.

O-47-15

Reasonably foreseeable development scenarios have been added for Montana and Wyoming at levels of 20 MW by 2015 and 50 MW by 2025 for each state. No data were available for these states, but the parallel to Colorado was drawn due to the similarity in resource base across the Rocky Mountain Region.

O-47-16

Pleas see standard response WR3.

The analysis in chapter 4 is commensurate with the scope of the proposed action for the PEIS. During subsequent permitting processes, more site-specific and localized analysis would occur.

O-47-17

Please see standard responses WR1 and WR2.

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water rights and water quality. Site-specific impacts on water resources would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. Appropriate site-specific mitigation would be developed, as necessary.

As stated in Section 4-4, impacts of development, utilization, and reclamation of geothermal resources include the potential for groundwater contamination. Appendix D provides BMPs to address methods to minimize contaminations. Federal, state, and local regulations ensure that operators will conduct drilling in a prudent manner. Potential for contamination based on local soil types and groundwater conditions would be assessed prior to issuance of permits for development.

O-47-18

Please see standard responses WR2 and WR3.

As note above, Appendix D provides BMPs to address methods to minimize contaminations. Federal, state, and local regulations ensure that operators will conduct drilling in a prudent manner. Potential for contamination based on local soil types and groundwater conditions would be assessed prior to issuance of permits for development. Water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

O-47-19

Please see standard responses WR2 and WR3.

As noted above, impacts on water quality would be further assessed at the site-specific level. Potential for contamination based on local soil types and groundwater conditions would be assessed prior to issuance of permits for development. Water rights are administered and adjudicated at the state level.

Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

O-47-20

Please see standard responses WR2 and WR3.

As noted above, impacts on water quality would be further assessed at the site-specific level. Lands designated as open to leasing are subject to existing laws, regulations, and formal orders. In complying with these laws, regulations, and orders, some of the open lands may not be available for leasing. Chapter 2 explains, under *Procedures Prior to Leasing*, that the BLM and FS would comply with the requirements of the Endangered Species Act (ESA), including determining if any listed or proposed threatened or endangered species, or critical habitat, is present on nominated lease parcels and may be affected by any decision to lease. Chapter 6 of the Final PEIS, in turn, explains that the agencies have determined that the decision to lease has no effect on listed species or critical habitat.

To provide further protection for threatened, endangered, and sensitive species, the BLM will impose an ESA stipulation (see Section 2.2.2) on all geothermal leases.

O-47-21

Stipulations provided in this PEIS would serve as the minimal level of protection and would be adopted into local land use plans upon signing of the Record of Decision. For example, if an administrative unit has eligible wild and scenic rivers, the wild river stipulation would apply. If an existing land use plan offers more protective measures or has resource-specific commitments (e.g., memorandum of understanding for cultural resources), those more protective measures would apply instead. Existing land use plans would also be used to help identify locations of applicability, buffer sizes, and timing conditions for the stipulations.

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife.

As discussed in Section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

O-47-22

Please see standard response WR2.

Air quality is discussed in section 4.8. Water quality is discussed in section 4.4. In this section it is noted that development, utilization and reclamation of geothermal resources may include potential water contamination. Appendix D provides BMPs to address methods to minimize contaminations. Federal, state, and local regulations ensure that operators will conduct development in a prudent manner. Potential for air and water contamination based on local conditions would be assessed prior to permits for development.

O-47-23

Please see standard response C11.

Additional discussion has been added to the cumulative impact analysis. As noted in chapter 5, past, present, and reasonably foreseeable actions, including commercial uses and energy development, on public and federal lands are documented and analyzed.

O-47-24

Please see standard responses GD1 and ESA1.

It is not possible to quantify the impacts to fisheries for projects that are only speculative. There is no reason to assume there will be significant impacts to fisheries from geothermal development. Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife.

O-47-25

Please see standard response GD1.

Pages 4-73 through 4-92 of the Final PEIS discuss impacts to wildlife that could occur as a result of geothermal development. The impact discussion on page 4-93 provides a national-level comparison, based on which lands would be open and closed, for the alternatives.

The analysis in Chapter 4 is commensurate with the scope of the proposed action for the PEIS.

O-47-26

The PEIS has been modified to include additional climate change discussion for affected resources. Please see the water, soil, vegetation, fish and wildlife, and other resource sections in the Final PEIS.

In addition, discussion has been added to the cumulative impact analysis. As noted in Chapter 5, past, present, and reasonably foreseeable actions, including commercial uses of public and federal lands, are documented and analyzed.

O-47-27

Please see standard responses GD1 and CL1.

As noted above, the PEIS has been modified to include additional climate change discussion for affected resources. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including analysis of climate change impacts when appropriate.

O-47-28

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-47-29

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-47-30

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-47-31

Please see standard response CL1.

Additional discussion has been added to the cumulative impact analysis. As noted in Chapter 5, past, present, and reasonably foreseeable actions, including commercial uses of public and federal lands, are documented and analyzed.

O-47-32

The comment is noted.

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September 18, 2008

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RE: Comment by Dunton, LLC concerning Draft Geothermal Leasing Preliminary Environmental Impact Statement ("PEIS").

Dear Ms. Ghali and Folks:

I. Introduction.

This PEIS comment letter is submitted on behalf of our clients: Dunton, LLC; Dunton Hot Springs, Inc., and Christoph Henkel (collectively, "Dunton"). Dunton owns a significant amount of property in the West Fork of the Dolores River in Southwest Colorado and on Lizard Head Meadows within the planning area of the Mancos-Dolores Ranger District of the San Juan Forest ("Forest"). Specifically, Dunton, LLC owns the Dunton Hot Springs Resort, approximately 80 acres size; numerous individual parcels along the West Dolores River ("West Fork"), notably including the 80 acre Emma Mine; 23 acres in small West Fork parcels; the 480 acre Cresto Ranch at the mouth of Johnny Bull Creek ("Cresto Ranch"); an 80 acre in-holding east of Dunton Hot Springs which is traversed by the Fall Creek trail ("Timber Tract"); a 320 acre inholding approximately 4.5 miles southwest of

Lizard Head Peak and approximately 6.5 miles northeast of Rico and adjacent to the Lizard Head Wilderness ("Lizard Head Tract"). Virtually all of these parcels are contiguous to Forest lands, and some are underlain by federally-reserved mineral estates.

The Lizard Head Tract recently received a Private Road Easement following a seven year Environmental Impact Statement process (necessitated by erroneous RARE II classification of the Lizard Head Tract and access road as "roadless area"). The Lizard Head Tract is administratively included within the Lizard Head Roadless Area and is less than one mile from the Lizard Head Wilderness Area. Dunton has not yet constructed the access road across Lizard Head Meadows as authorized by the Private Road Easement.

The Dunton Hot Springs Resort ("Resort") is located at the historic Dunton Townsite, a former hard-rock mining camp. The Resort consists of a collection of historic buildings, now restored, a spa which features the Dunton Hot Springs (with an indoor and outdoor **geothermal** spring), yoga and massage, a bar and restaurant, and numerous outbuildings. The Resort is now considered a luxury, high end tourist accommodation which sees year-round occupancy. The Resort owners and guests frequently (and often independently) recreate in the surrounding San Juan National Forest, enjoying horse-back riding, hiking, cross-country skiing, heli-skiing, snowmobiling, hunting, fishing, bicycle-riding, mushroom foraging, picnicking, photography, wildlife watching, and the like. Dunton Hot Springs, Inc. has an outfitters permit from the USFS for tourist-related hiking and horseback riding in the San Juan National Forest.

Dunton regularly employs approximately fifty employees and independent contractors and provides annual sales tax revenues, payrolls and property taxes in an approximate total amount exceeding $1 Million. Coupled with guest sales and development-related expenditures, Dunton easily generates at least $1.5 Million in direct economic impact to Dolores County, Colorado each year.

Dunton is actively trying to increase its resort business at Dunton Hot Springs and has a business plan aiming to double or triple existing business. The success of this effort will depend in large part on the quality of the guest experience. That experience, in turn, is dependent upon resort amenities, the most significant of which are the Dunton Hot Springs themselves, and the natural beauty, solitude, and relatively pristine quality of the surrounding forest and wildlife. Thus, Dunton's economic future is directly tied to the preservation of the San Juan National Forest Lands in the West-Fork and Lizard Head Meadows area.

The Dunton Hot Springs, Inc. also owns the Paradise Hot Springs adjacent to the Geyser Trailhead. The Geyser is the only **geothermal** mudpot geyser in Colorado. Paradise Hot Springs is a unique **geothermal** hot springs on the West Fork and is occasionally used by friends of the Resort's owner for medicinal and recreational purposes. Christoph Henkel owns a private residence adjacent to the Dunton Hot Springs resort and is the primary owner of the above-referenced entities. Dunton also owns numerous decreed water rights on the West Fork, including **geothermal** water rights, associated with its various properties. Dunton's property includes at least several river miles of the West Fork and property along significant tributaries such as Fall Creek and Johnny Bull Creek. Dunton may be the largest private employer and landowner on the West Fork if not Dolores County.

Dunton believes that the Dunton Hot Springs and Paradise Hot Springs were also used and enjoyed by the Ute Indians and their predecessors.

Dunton conceived and financed the extension of high speed internet service up the West Fork. Dunton has previously been actively engaged in various Forest service proposals and projects, including comment on the proposed expansion/upgrade of Dolores County Road 38 (since abandoned), the Geyser Trail trailhead relocation proposal (since modified and mitigated), the recent Travel Management Plan update proposal, and the draft Resource Management Plan amendment. Dunton has informally discussed several potential land exchanges with Forest personnel over the years, including the Lizard Head Tract.

Dunton welcomes this opportunity to comment on the PEIS. By virtue of its land and water right holdings, demonstrated history of involvement with the Forest Service, extensive use of Forest lands, and economic benefit to the West Fork and Dolores County, Dunton considers itself to be a major stakeholder in the LMP revision process. C-48-1

II. Inadequate Analysis of Potential Impacts to Existing Geothermal Resources and Inadequate Analysis of Possible Avoidance/Mitigation of Impacts.

As an owner of two surface geothermal springs and related water rights with high economic value, Dunton would like to see the PEIS take a more proactive approach in evaluating potential impacts to existing geothermal and water resources and related tourist-resort resources. Such impacts will necessarily result from "expediting" geothermal leasing and consequential exploration and development of the 242 geothermal commercial electric generation plants anticipated by 2025, each of which could occupy 55 to 374 acres (Executive Summary, pp 7, 8, 10). C-48-2

Dunton expressly incorporates and strongly endorses the comments set forth in the 3 September 2008 letter to Mr. Ghali Re: Comments on the Draft PEIS for Geothermal Leasing in the Western United States submitted by Mr. Wayne Goin of Minion Hydrologic (the "Minion Letter"). A hard copy of such letter is also enclosed herewith. Specifically, Dunton supports the concepts of a limitation of geothermal exploration within a one-mile area around existing geothermal resources, such as the Dunton and Paradise Hot Springs, and a requirement for notification of decreed geothermal water right owners within two miles of the proposed geothermal development. C-48-3

The PEIS itself provides precedent for such a proposal: alternatives address protecting both the 14,000 acre Island Park Geothermal Area as a buffer around the south and west boundaries of Yellowstone National Park, and a 15 mile buffer around the entire Yellowstone Park. Given the recognition of the obvious need for protection of this most famous geothermal resource, it is curious that the PEIS is almost devoid of any substantive discussion of the need to protect other known, valuable geothermal resources and hot springs as well.

Furthermore, there is precedent for protection of other resource values in requiring a substantial no-surface occupancy buffer for geothermal leases. See Evans-Barton, Ltd., IBLA 2008-17, wherein a geothermal lease stipulation prohibiting surface occupancy within a half-mile area around a privately-owned hot springs site considered to be sacred by Indian tribes, was upheld on appeal.

Dunton participated in the 2004 State of Colorado geothermal rulemaking by the Colorado Division of Water Resources, Office of the State Engineer, which resulted in the current "Rules and Regulations for Permitting the Development and Appropriation of Geothermal Resources Through Use of Wells, 2 CCR 402-10 (the "Geothermal Rules"). C-48-4

The Geothermal Rules provide for notice to owners of decreed water rights within half a mile of a location for which certain geothermal wells are applied for. See, e.g., Geothermal Rules 6.2.3.3. Such owners are accorded a right of objection to an application for a geothermal well permit. While the Rules do not provide for such notice where there is a closed loop system, in Dunton's opinion the risk to existing geothermal resources is identical during the drilling phase. A more protective procedure should be adopted at the federal leasing level.

Among the "general adverse impacts" that the PEIS describes would result from commercial geothermal development, are "*short-term* impacts to ground water *during drilling*". The PEIS fails to adequately describe such impacts, and arbitrarily assumes without evidence that such groundwater impacts would be both short-term, and confined to drilling. The Minion letter documents with existing case studies just how wrong these assumptions are, and demonstrates the potential for intermixing of geothermal and other waters, potential artesian results, and diminution of both flow and temperature of existing geothermal features. Thus, the PEIS understates the potential risk for damage to existing groundwater resources from geothermal development. C-48-5

III. Federally-Reserved Mineral Estates (Split Estates) Do Not Necessarily Include Geothermal Rights.

The PEIS Executive Summary states at ES 1Introduction, without qualification, and without citation of authority, that "a geothermal lease is for the earth's heat resource, *where there is a federal mineral estate*." C-48-6

This assertion is not supported by any citation to authority of any of the various mining acts, homestead, or other federal land disposal laws, in which mineral estates were actually reserved from lands sold to miners or homesteaders that are now owned by different owners. These laws and their concurrent interpretation will control the answer to the question of whether there is any federal right to issue a geothermal lease for exploration and development of the earth's heat resource, language that is absent from most such reservation laws.

One federal case apparently construed the Stock-Raising Homestead Act, and concluded that geothermal energy was included in a reservation of "other minerals". No such authority apparently exists with respect to other reservations under other disposal laws.

Moreover, this assertion - in the guise of an initial definition of a geothermal lease – of geothermal lease issuance authority extending over all not only all federal lands but also federally-owned split mineral estates under private lands, assumes a federal ability to lease for extraction of the earths' heat resource anywhere there are other federal mineral interests or values that have been reserved, regardless of the general or specific nature of the reservation involved based on the succession of public lands laws in effect at the time of the federal reservation. Such a statement is wholly unsupported. Since extraction of geothermal waters involves not mineral rights but water rights, see below, such extraction right is not part of a federally-reserved mineral estate. C-48-7

If federal split mineral estates were excluded from the PEIS analysis in whole or in part as eligible for issuance of a federal geothermal lease, an entirely different description of the extent of the resource, source of impacts, and possibility of mitigation would result. As such the overbroad assumption of the scope of federal geothermal leasing authority has caused vast but unquantified overstatement of the potential energy production benefit of the federal geothermal leasing program. This issue should be addressed in detail, with supporting authority, in any final EIS.

Existing BLM regulations governing disposal of federally-reserved mineral estates define mineral values as follows:

> **[M]ineral values in lands with underlying geologic formations which are valuable for prospecting for, developing or producing natural mineral deposits. The presence of such mineral deposits in the lands may be known, or geologic conditions may be such as to make the lands prospectively valuable for mineral occurrence.**

43 CFR 2720.0-5

A federally-reserved mineral estate whose values are defined as consisting solely of natural mineral deposits, cannot include other non-defined values, such as heat from the earth.

In Colorado, geothermal rights which involve extraction, diversion or release of tributary geothermal waters, legally are water rights, not mineral rights. Water C-48-8 rights are defined by C.R.S. 37-92-103(12) and means the right to use in accordance with its priority a certain portion of the waters of the state by reason of the appropriation of the same. The appropriation of geothermal fluids to recover geothermal resources is recognized as a beneficial use of ground water subject to state administration. C.R.S. 37-90.5-107.

In the event of issuance of a federal geothermal lease on a split estate created pursuant to an act other than the Stock Raising Homestead Act, without a prior judicial determination of federal ownership of the geothermal right, the federal government may be exposed to liability to claims for inverse condemnation, trespass, and other damages.

Water is not a mineral, and the law of minerals and property ownership is inapplicable to water and water use rights. See Board of County Comm'rs of the County of Park v. Park County Sportsmen's Ranch, LLP, 45 P.3d 693 (Colo. 2002). As such, geothermal rights involving wells or diversion or re-injection of geothermal waters are subject to the Colorado water rights administration system, and Colorado or applicable laws re: surface access, entry and occupancy. As water rights, these types of geothermal resources are not within the federally-reserved mineral estate and are not available for federal lease.

The BLM and FS should evaluate the potential effect of the widespread geothermal development anticipated by the proposed action alternative, upon the *federally-reserved water rights* that were created at the time of creation of national forests, parks, monuments and other federal lands. No such analysis appears.

IV. Lease Stipulations Are Inadequately Protective.

Section 2.2 discusses potential Lease stipulations that would be applied as "appropriate". Despite language at page 2-15 suggesting the stipulations would be the "minimal level of protection", elsewhere the PEIS does not clearly mandate the inclusion of specific stipulations in geothermal leases, but rather leaves that decision wither to subsequent Resource or Forest Plan amendment of lease issuance. Moreover, there is no basis to assume the presence or appropriateness of such general stipulations in subsequent leasing, nor is there a basis to describe the impacts of geothermal development by assuming the presence of or compliance with such stipulations. We suggest that the one-mile buffer area from existing C-48-9 decreed geothermal water rights described above, be included as a mandatory major constraint that must be included in all leases.

The similarity of oil and gas drilling exploration and development impacts to geothermal development are recognized in this section. This is somewhat troublesome, as current federal oil and gas leasing practice in Colorado suggests that if a stipulation (such as no surface occupancy) is not specifically prescribed for a specific area in a Resource Management Plan, then such a stipulation may not be imposed upon a lease for a parcel nominated by the oil and gas industry. Moreover, the surface owner is not individually notified when an oil and gas lease is proposed for lease auction. See: 12/14/05BLM Split Estate Report, Energy Policy Act of 2005, Section 1835, Split-Estate Federal Oil and Gas Leasing and Development Practices C-48-10

"Protective Leasing Stipulations:
BLM notifies the public of their opportunity to participate and comment on the preparation of land use plans and amendments. BLM does not specifically notify individual surface owners that land use planning decisions are being made which could affect the oil and gas development actions on their surface. (Planning decisions include: No Lease; Lease with Standard Terms and Conditions; Lease with Major Constraints; Lease with Moderate Constraints; and are typically based on resources such as wildlife, steep slopes, wetlands.)

BLM does not apply any stipulations specific to split estate.

We recognize that the PEIS at p2-28 suggests protection of existing geothermal features through stipulations. Such stipulations are not summarized or characterized at all, let alone with sufficient detail that an assessment of overall national or regional impacts to existing geothermal resources under any of the alternatives is even possible. C-48-11

Without inclusion of an adequate nationwide survey of existing geothermal features and hot springs, a nationwide or programmatic environmental impact statement is unable to systematically characterize the potential impacts to these vital resources. C-48-12

Significantly, the proposed stipulations would not require monitoring of nearby geothermal features that are outside of the geothermal lease area. The potential impact of such an arbitrary segregation is not even discussed.

Dunton supports the proposed stipulation against new roads for geothermal development in inventoried roadless areas, such as the area surrounding the Lizard Head Meadows Tract. C-48-13

V. Conclusion.

Overall, the PEIS is an over-hasty attempt to "facilitate" and "expedite" federal geothermal leasing. In doing so, the PEIS has simplified the analysis and avoided the hard look at geothermal development impacts and possible constraints and mitigations on 117 million acres of BLM land and 25 million acres of USFS lands (non-Alaskan) that would be newly-opened to geothermal leasing. Dunton believes a case by case review needs to be conducted before declaring any federal land open to geothermal development, particularly near existing geothermal features. C-48-14

Absent appropriate supplementation, the PEIS overall fails to meet NEPA requirements for comprehensive description and analysis of impacts to and potential mitigations of existing geothermal resources. Dunton asks that an approach that is highly protective of existing public and private geothermal features and hot springs, and which recognizes that the federally-reserved split estates do not automatically include the right to extract geothermal waters or heat, be adopted in all further environmental review of geothermal development.

Thank you for the opportunity to comment. We request and look forward to receiving notice of all future documents and decisions related the PEIS.

Very Truly Yours,

Stephen B. Johnson Law Firm, P.C.

Stephen B. Johnson

Stephen B. Johnson

Encl.
c. C. Henkel
W. Goin

C-48-1

The BLM and FS note the commentor's role as a stakeholder for this project.

C-48-2

Specific impacts on water resources are more appropriately analyzed at the site-specific level due to variation in the resource by location. Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve user conflicts. Appropriate site-specific mitigation would be developed, as necessary.

C-48-3

As discussed in Section 1.5.1, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 3200, and 3280). The PEIS is not proposing to amend or change any of the laws or regulations. While the BLM manages the geothermal resource (namely the heat), the state has primacy over the associated water resource. In accordance with state regulations, a lessee/operator will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources.

Given that impacts on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for leasing in the PEIS.

C-48-4

As stated above, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 3200, and 3280). The PEIS is not proposing to amend or change any of the laws or regulations. Addressing site-specific issues is evaluated during the subsequent permitting process. The BLM and FS can apply conditions of approval on such permits to avoid and minimize any impacts to specific resources. While the BLM manages the geothermal resource (namely the heat), the state has primacy over the associated water resource. In accordance with state regulations, a lessee/operator must secure permits from the state before the BLM can issue a permit to drill either a temperature gradient well or a full-diameter exploration well.

C-48-5

Cement and casing of the well bore is designed to prevent mixing of reservoir zones. Although older casings can leak (more often in reinjection wells than production wells), they are inspected and tested to prevent this occurrence at regular intervals, and can be repaired. As stated in Section 4-4, impacts of development, utilization, and reclamation of geothermal resources include the potential for groundwater contamination. Appendix D provides BMPs to address methods to minimize contamination. Federal, state, and local regulations ensure that operators will conduct drilling in a prudent manner. Potential for contamination based on local soil types and groundwater conditions would be assessed prior to issuance of permits for development.

C-48-6

As discussed in Section 1.5.1, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 3200, and 3280). In addition, please see U.S. v. Union Oil Co. of California, 549 F.2d 1291 (9th Cir. 1977) and Rosette v. United States, 277 F.3d 1222 (10th Cir. 2002) and Rosette v. United States DOI, 142 N.M. 717, 169 P.3d 704 (2007) for decisions related to the authority of the federal government to issue leases for geothermal resources.

Disputes over land title issues are outside the scope of this PEIS.

C-48-7

As stated above, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 3200, and 3280). The PEIS is not proposing to amend or change any of the laws or regulations. Addressing site-specific issues is evaluated during the subsequent permitting process. The BLM and FS can apply conditions of approval on such permits to avoid and minimize any impacts to specific resources. While the BLM manages the geothermal resource (namely the heat), the state has primacy over the associated water resource. In accordance with state regulations, a lessee/operator must secure permits from the state before the BLM can issue a permit to drill either a temperature gradient well or a full-diameter exploration well.

Disputes over land title issues are outside the scope of this PEIS.

C-48-8

BLM Field Offices collaborate closely with appropriate state agencies, especially in the case of geothermal energy, where the states manage and have regulatory authority for water quality and water rights. New text was added to *Procedures Prior to Leasing* in Chapter 2 on coordinating with state agencies.

Please see response to C-48-6 for laws and court decisions guiding geothermal leasing.

C-48-9

Stipulations would be applied to a land use plan if an administrative unit has the relevant features related to the stipulation (i.e. areas with wild and scenic rivers would have the wild and scenic rivers stipulation applied). Should an exception, waiver or modification occur, the BLM would analyze and document how the exception is in conformance with the land use plan.

Setbacks, if any, from an adjudicated water right would be determined on a case-by-case basis. As states in the above responses, geothermal leasing is guided by law and regulations; the PEIS is not proposing to amend or change any of the laws or regulations. Addressing site-specific issues is evaluated during the subsequent permitting process. The BLM and FS can apply conditions of approval on such permits to avoid and minimize any impacts to specific resources.

C-48-10

The intent of the Proposed Action (specifically Section 2.2.2 *Lease Stipulations*) is to identify specific stipulations and the conditions that would trigger the application of the stipulations. After the Record of Decision, the 120 plans identified in the Final PEIS would be amended to incorporate the stipulations. Thus, if an area has a specific condition, then the appropriate stipulation would be applied (e.g., slopes over 40 percent would have a NSO stipulation). All lease sales will follow the leasing regulations.

C-48-11

Information is included in other *Lease Stipulations-Protection of Geothermal Resources* in Section 2.2.2.

C-48-12

As noted in the comment responses above, site-specific impacts on water resources, including groundwater, would be addressed as part of the environmental analysis for the permitting process. The BLM and FS would work with interested and affected parties, including other geothermal resource users, to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary. Additionally, each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

C-48-13

The commentor's support for the proposed stipulation is noted.

C-48-14

The comment is noted.

Attachments can contain viruses that may harm your computer. Attachments may not display correctly.

geothermal_eis

From: Mary_Christensen@blm.gov [Mary_Christensen@blm.gov] **Sent:** Thu 9/18/2008 3:20 PM
To: geothermal_eis
Cc:
Subject: Mail forwarded from geothermal_eis@blm.gov
Attachments: GeothermalReferenceMapMTH.pdf(590KB) GeothermalReferenceWill.pdf(184KB)

This message has been automatically forwarded from geothermal_eis@blm.gov.

Doug Heiken <dh@oregonwild.org>
Sent by: Doug Heiken <dh.oregonwild@gmail.com>

09/18/2008 04:17 PM

Please respond to Doug Heiken <dh@oregonwild.org>

To: geothermal_eis@blm.gov
cc:
bcc:
Subject: Oregon Wild comments on the Geothermal Leasing Draft PEIS

Please find attached comments on the geothermal DEIS and maps showing relevant management constraints for proposed leases on the Mt Hood NF and Willamette NF.

--
doug's signatureDoug Heiken
Conservation and Restoration Coordinator
Oregon Wild formerly Oregon Natural Resources Council (ONRC)
Protecting Oregon’s wildlands, wildlife and waters since 1974.
PO Box 11648 | Eugene OR 97440
541-344-0675

nder "reasonably foreseeable development scenario is says: "It is expected that a 30-megawatt plant would result in 15 acres of land disturbance, and a 20-megawatt plant would result in 10 acres of land disturbance, for a total disturbance of 25 acres. Existing Forest Service roads would be used to access the sites. Portland General Electric acknowledges that while over 9,000 acres of land are included in the lease area, most of the land is not feasible to develop due to proposed wilderness areas, river riparian setbacks, steep slopes, cliffs, wilderness areas, ski areas, and protected watershed for The Dalles. Exploration activities for a 20-megawatt plant and a 30-megawatt plant are expected to involve approximately 12 temperature gradient holes, disturbing approximately 0.15 acre each, for a total disturbance of approximately 2 acres."] [This application was filed in 1974.] Energy Policy Lacking. The United States lacks a coherent energy policy ? simultaneously pursuing and subsidizing many different non-renewable and renewable energy sources in a haphazard fashion. We strongly urge the development of a comprehensive energy policy that integrates concerns over prices, consumer access, diversity of supply, national security, and environmental impacts including climate change impacts. Geothermal energy is subsidized through renewable energy portfolio standards, renewable energy tax credits, and by granting private parties access to public land and allowing them to degrade public values like clean water, wildlife habitat, and scenic beauty. These are not to be taken for granted. Climate Change We recognize the threat that climate change poses to earth systems, natural systems and human systems, and we share a strong desire to develop energy sources with smaller carbon footprints. Geothermal might be part of a comprehensive plan to avoid and mitigate climate change, but we have not seen the national policy commitment necessary to make a real difference. We are not too enthused about sacrificing public lands in order to develop geothermal energy if it will only reduce the rate of growth in demand for energy under a business-as-usual scenario. It would be much better if geothermal was helping to reduce absolute demand for energy and reducing dependence on fossil energy sources under a strong energy policy that emphasizes conservation and renewable energy. Scope of approval is too broad Basically two thirds of Oregon is proposed to be eligible for geothermal leasing. The area recognized for its geothermal potential is so big and broad that it fails to offer any guidance on places that are more appropriate and less appropriate for development. An important purpose of this analysis and decision should be to point developers toward sensible and less environmentally and sensitive areas, such as already degraded areas near existing power lines and roads. Approval Criteria We urge the government to adopt stringent approval criteria that will avoid impacts to inventoried roadless areas, uninventoried roadless areas, mature & old-growth forests, Late Successional Reserves, Key Watersheds, Municipal watersheds, administratively withdrawn areas, riparian areas, carbon stored in ecosystems and soil, habitat for threatened & endangered and other sensitive wildlife, ACEC, wild & scenic rivers, wildlife refuges, scenic areas. It is vital to carefully avoid and minimize impacts from all aspects of the geothermal development process, including exploration, new power distribution lines, access roads, staging areas, as well as production wells and generating facilities. The decisions resulting from the NEPA analysis must not grant carte blanche approval for lease sales. The analysis must be used to develop priorities where geothermal lease sales will be favored and areas where lease sales will be disfavored. The sensitive resource areas listed above should be generally disfavored. Failure to Consider All Reasonable Alternatives The EIS failed to consider

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alternative criteria and mitigation that would better protect the environment. Such as those suggested in this letter. The EIS underestimates impacts. The EIS estimates that road access will impact 32 acres or less. Most of the proposed facilities in Oregon are likely to be in extremely remote areas, requiring extensive road construction. Furthermore, road impacts are not limited to the roadway itself. Roads have extensive edge effects, hydrologic effects, weed effects, and wildlife disturbance effects that radiate far beyond the road prism. The EIS described old growth forests in the ?affected environment? section but fails to adequately disclose the impacts of geothermal development on these resource in the ?environmental consequences? section. The EIS seems to rely on the Northwest Forest Plan standards & guidelines for Late Successional Reserves (LSRs) to mitigate for the effects of leasing on the LSRs in the Mt Hood and Willamette NFs, but the EIS does not actally put the rubber to the road and apply the standards & guidelines to the specific geothermal proposals. One of the purposes of NEPA is to explain how proposed federal actions will comply with environmental standards, but this was not done. The EIS assumes that the National Forest roadless rule will be followed (no new roads in IRAs) but the EIS fails to disclose the adverse consequences if the Bush administration and their pro-extraction allies succeed in their ill-advised legal challenges to the National Forest roadless rule. The EIS also assumes that old growth forests will continue to be protected under the Northwest Forest Plan, but the EIS fails to recognize that the BLM itself has proposed the Western Oregon Plan Revision (WOPR) which would severely undermine the overall scheme of the Northwest Forest Plan and the protection it affords to old growth forests and LSRs. Even if the WOPR does not propose to directly change the rules for managing LSRs on the National Forests, the WOPR sill undermines the efficacy of the Northwest Forest Plan on the National Forests and its ability to conserve a functional and inter-connected old growth ecosystem as intended. The FS relies on BLM to do its part and maintain old growth habitat along critical connective areas between the different mountain ranges. The EIS completely misunderstands the Western Oregon Plan Revision. The EIS says, ?The Bureau of Land Management is currently revising the Salem RMP to align it with the Northwest Forest Plan.? The WOPR is NOT about alignment. It?s about BLM disengaging from the Northwest Forest Plan. See ONRC?s scoping comments on the WOPR. ‼ HYPERLINK "http://www.oregonheritageforests.org/resources/BLM_WOPR_ONRC.doc" ¶ http://www.oregonheritageforests.org/resources/BLM_WOPR_ONRC.doc┴ Page 4-67 of the EIS says that most sensitive and high quality old growth habitat is off-limits to geothermal development because it is located in ACECs, wilderness, and roadless areas. This is false, false, and false. First, BLM has completely abdicated it?s responsibility to identify extensive high-quality old growth forests as ACECs. See Oregon Wild?s recent proposal for an extensive network of old growth ACECs which was rejected by BLM ‼ HYPERLINK "http://www.oregonheritageforests.org/resources/WOPR_Indyla_ACEC.doc" ¶ http://www.oregonheritageforests.org/resources/WOPR_Indyla_ACEC.doc┴ Second, wilderness areas generally were establish in high-elevation areas with mostly rock and ice and small trees, not in the low-elevation areas with large old growth favored by both the timber industry and endangered species. Third, after decades of dispersed clearcutting and road building, the few remaining inventoried roadless areas are too small to provide functional old-growth ecosystem. Most of the remaining old-growth is either in Late Successional Reserves, riparian reserves, or matrix and are not off

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limits under this geothermal proposal, though they should be and we urge
the government to take the steps necessary to protect the last remaining
old growth forests. The EIS indicates that some mature & old-growth forest
that provides suitable habitat for the Northern Spotted Owl would be
destroyed in pursuit of geothermal resources on the Mt Hood and Willamette O-49-10
National Forests. The EIS falsely assumes that the NWFP functions as a
recovery plan for the owl (EIS p 16-33) and fails to recognize the
requirements of the final recovery plan for the Northern Spotted Owl
(especially recovery action #32) which requires among other things that
substantially all of the high quality spotted owl habitat be protected. See
USFWS. 2008 Final Recovery Plan for the Northern Spotted Owl. ‼ HYPERLINK
"http://www.fws.gov/pacific/ecoservices/endangered/recovery/NSORecoveryplanning.htm" ¶
http://www.fws.gov/pacific/ecoservices/endangered/recovery/NSORecoveryplanning.htm┴
The use of groundwater during geothermal development will alter springs
and surface water with significant impacts on aquatic organisms such as O-49-11
fish, aquatic insects, herptiles, and mollusks. The analysis of leases in
Oregon is inadequate. Chapters 15 and 16 in the EIS are like mini-EISs
within the PEIS. The NEPA analysis of proposed site-specific leases in the O-49-12
Mt Hood National Forest and the Willamette National Forest are inadequate
to support an informed decision whether to approve or reject those
applications. The EIS does not adequately describe the location of the
ground-disturbing activities, the conditions at those sites, all the
sensitive ecological resources at those sites, and the site-specific
ecological impacts at those sites. The reasonably foreseeable development
scenario is merely a hypothetical, so the location and effects of O-49-13
development activities are hypothetical. Actual effects may vary. Actual
effects of a poorly located geothermal energy project could be worse than
described under the reasonably foreseeable development scenario. Further
NEPA analysis will be needed to compare diferent concrete development
proposals and make an informed decision based in the real world. We are
concerned about combining the programmatic EIS and lease-specific EISs. In
promoting this as a Programmatic EIS, many people may not be aware of the O-49-14
local project-specific nature of the proposals for the Willamette and Mt
Hood National Forest. If these projects are approve and developed many
people are going to be surprised. The proposed leases near Mount Hood have
the following problems that should be avoided or mitigated: - Small piece in
an IRA (Bluegrass Ridge addition to Mt Hood Wilderness, FS supports as O-49-15
Wilderness) - Includes lands to be designated as Wilderness by the Lewis and
Clark Mount Hood Wilderness bill. - Includes lands that are in the drinking
watershed of Hood River - Includes lands that are in the drinking watershed
of the city of The Dalles - Overlaps the Wild and Scenic East Fork Hood
River (part of Lewis and Clark Hood bill). - Overlaps Late Successional
Reserve. - Likely other concerns as well. The proposed leases on the
Willamette National Forest have the following problems that should be O-49-16
avoided or mitigated: - Overlaps the Mt Jefferson North IRA - Overlaps Mount
Bruno unroaded area - It's entirely within an LSR. - Likely other concerns as
well. The EIS does not adequately analyze the effect of geothermal
development on the 9 Aquatic Conservation Strategy objectives set forth in O-49-17
the Northwest Forest Plan. The EIS does not adequately describe how
geothermal development will affect the attainment of objectives for Late
Successional Reserves which are to protect and enhance late successional O-49-18
forest conditions (NWFP ROD p C-9, C-11,). Generally, removal of trees >80
years old is not allowed in LSRs (NWFP ROD p C-12). Activities other than
silviculture in LSRs must be ?neutral or beneficial? to late successional
habitat. (ROD p C-16). ?Developments? in LSRs must be planned so as to have

the ?least possible adverse impacts? on LSRs. The potential benefits of new roads in LSRs must exceed the costs of habitat impairment (C-16). Project ?locations? must be chosen to ?avoid? degradation of habitat (p C-17). Removing late successional forests to make way to geothermal development does not seem consistent with those objectives. The EIS also failed to consider the ?management assessments? for the affected LSRs. EIS at pages 15-32 and 15-33 is contradictory. It says that old-growth is both protected by the Northwest Forest Plan and would be removed. The analysis of recreation impacts ignores all recreation occurring outside of officially designated recreation areas. In fact, the Mt Hood NF is located near a large population center (Portland/Vancouver) and virtually the entire forest is used for recreation at various times and intensities. Given the large nearby population center the Mt Hood NF is considered to be crowded. Remote areas where visitors can find solitude are even more rare and valuable. The supposedly site-specific analysis in Chapters 15 and 16 frequently refers to the generic description of effects on the programmatic EIS. The site-specific EIS needs to describe the effects of specific actions at specific locations not generically. The EIS does not disclose the effects of energy transmission corridors. Page 16-9 says that ?The length and alignment of transmission lines are not estimated here since these factors would depend upon the positioning of any power plant and the distance to the nearest electrical tie-in.? This is not adequate to support a supposedly site-specific NEPA analysis. In describing lease areas on the Willamette NF, the EIS (p 16-13) says ?land use is primarily limited to forestry and recreational use.? This ignores other important uses such as clean drinking water for the city of Salem Oregon, wildlife habitat, carbon storage, soil stability, nutrient cycling. The EIS needs to think in terms of ecosystem services, not just traditional human uses that occur in situ. Climate change It would be helpful if the EIS analysis of climate impacts would disclose the amount of fossil fuels that might be offset by specific proposals in Chapters 15 and 16 and compare that to the amount of fossil fuels that would need to be offset in order to reach targets for climate stabilization. On the other hand, the analysis should also disclose how much greenhouse gases would be released from native ecosystems disturbed by geothermal development and by fossil fuels used to design, manufacture, and build geothermal facilities. Please disclose whether proposed geothermal development will help meet increasing demand, or whether it will off-set fossil fuels in an atmosphere of declining energy use. If energy use continues to increase, adding a little geothermal to the mix is like slightly delaying the sinking of the Titanic. The authorized officer must retain the right to reject applications that are not in the public interest. The EIS says ?The authorized officer retains thediscretion to issue leases with stipulations that impose moderate to major constraints on use of surface of any leases in order to mitigate the impacts to other land uses or resources objectives as defined in the guiding resource management plan.? The government must retain even more rights that this. The must retain the right to outright reject projects that are not in the public interest. A programmatic EIS is simply not detailed enough to say that projects on almost 200 million acres can proceed with mitigation. N some cases, mitigation will not be enough and the authorized officer must retain the right to reject geothermal applications. Future NEPA analysis The DPEIS says, ?it is the intent of the BLM that, upon receipt of future nominations or applications for direct use, affected BLM offices would be able to conduct a DNA evaluation to make lease sale decisions without further plan amendments or NEPA analysis ? But this is contradicted by the following:

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?The PEIS does not evaluate site-specific issues associated with geothermal exploration, drilling, utilization, or reclamation and abandonment. A variety of location-specific factors (e.g., soil type, watershed, habitat, vegetation, viewshed, public sentiment, the presence of threatened and endangered species, and the presence of cultural resources) varies considerably from site to site, especially over the 12-state project area.? We feel strongly that this programmatic NEPA analysis must be followed by rigorous site-specific NEPA analysis and that DNAs will not be enough. Given the variation in location-specific factors across the region and the fact that we don?t know what location any given geothermal facility will occupy, or the route that new access roads and transmission lines might follow, specific environmental effects of geothermal development cannot be captured in a programmatic EIS. Impacts on native ecosystems are not fully recognized. The Draft EIS says ?Reclamation is done on areas that are no longer needed for these activities, so the actual area of disturbance for 0-49-26
an operating power plant is generally much less.? This ignores the consequences of exploration or other ?temporary? impacts that may affect old growth forests or other ecosystems in ways that are essentially irreversible. The EIS seems to assume falsely that all impacts are reversible, but they are not. Spreading weeds is essentially an irreversible effect. Page 4-67 of the EIS recognizes that removal of old growth forests is an irreversible impact, but the EIS falsely assumes that most of the high quality old growth is off limits to development. The analysis must be redone to acknowledge the real long-term impact of effectively irreversible development activities. Building roads for exploration or other purposes is another example of an essentially irreversible impact. Unavailable Lands for Geothermal Leasing BLM and the USFS are way behind the times in terms of identifying lands that should be off-limits to development. These agencies have an inherent conflict of 0-49-27
interest in favor of economic exploitation of the lands under their control, while failing to take reasonable steps to protect and conserve the public vales that the American people expect from those lands. ?Public good? like clean water, wildlife habitat, biodiversity, public recreation areas, and carbon storage, are chronically under-produced because of the externalities which prevent landowners from capturing the economic value of those shared resources. Luckily these are public lands and the public can assert themselves to correct those market imperfections caused by externalities. BLM and the USFS should place more lands off-limits to development in order to ensure adequate production of under-produced ?public goods.? Sincerely, Doug Heiken

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O-49-1

The document was prepared in accordance with the Energy Policy Act of 2005 (see Section 1.8.1).

It is outside the scope of this document to amend the policy established by Congress.

O-49-2

The comment is noted.

O-49-3

The authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations, such as Endangered Species Act Section 107 consultation and National Historic Preservation Act Section 106 consultation. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

O-49-4

As noted in the above response, the authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations, such as Endangered Species Act Section 107 consultation and National Historic Preservation Act Section 106 consultation. In addition, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

Please see response to comment O-49-8 for a detailed response to the roadless areas component of this comment.

O-49-5

In accordance with 40 CFR Section 1502.13, the purpose of and need for the proposed action is used to define a range of reasonable alternatives (purpose of and need for action is defined in Sections 1.2 and 1.3). The BLM is making an allocation decision here, and adopting a list of stipulations, BMPs, and compliance procedures to be incorporated in the land use plans. The PEIS analyzes in detail the Proposed Action, a No Action alternative, and the Leasing Near Transmission lines alternative. The Final PEIS incorporates input from public comments on the Proposed Action. Another alternative considered but eliminated from detailed study included no leasing or development of geothermal resources on public or NFS lands (Section 2.4.1). As explained in Section 2.4.1, this alternative, which would have been the most protective (from a ground disturbance standpoint), was eliminated because it would violate the multiple use provisions of FLPMA and is inconsistent with the President's National Energy Policy, the Energy Policy Act of 2005, and Executive Order 13212 and would not have fulfilled the purpose and need for the proposed action. The alternatives analyzed represent a range of acreages as potentially available for leasing. See CEQ's *Forty Most Asked Questions Concerning the CEQ's NEPA Regulations*, Question 1b ("When there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in the EIS.") In particular, the Leasing Near Transmission Lines alternative was developed based on public scoping comments to represent a limited development alternative. Instead of inventing a variety of alternatives that would lie between the alternatives presented, the BLM and FS elected to include protective measures (i.e., stipulations, BMPs, and compliance procedures) in each of the action alternatives. Further, those planning areas whose plans include more protective measures may elect to keep those measures in place, instead of the stipulations, BMPs, and compliance procedures presented in the Final PEIS.

O-49-6

The level of road construction required is likely to vary by location. The RFD discusses the general level of impacts. Prior to development and utilization, further site-specific environmental analysis and permitting will be required.

O-49-7

The analysis of impacts related to old growth forests is found on page 4-67 of the Final PEIS and provides a summary of all impacts that could occur should geothermal development occur in old growth forests. In all cases, site-specific NEPA analysis would occur to assess the impacts of projects within old growth habitats. This would include compliance with the Endangered Species Act, the applicable regional forest plan, and all other laws, policies, and regulations that protect old growth habitats.

O-49-8

The existing case law regarding the Roadless Rule is inconsistent. On August 12, 2008, the Wyoming District Court found the 2001 Roadless Rule violated NEPA and the Wilderness Act (State of Wyoming v. US Department of Agriculture). The District Court ordered the 2001 Roadless rule "set aside" and "permanently enjoined." This order is subsequent to a 2006 California District Court ruling that set aside the 2005 State Petitions Rule and reinstated the 2001 Roadless Rule. The United States Justice Department, on behalf of the Department of Agriculture, has filed motions with both the Wyoming and California courts seeking adjustments of those courts' conflicting judicial orders. Neither the Wyoming nor California District Court rulings bar the Department of Agriculture from promulgating other roadless area regulations. To address this inconsistency, the PEIS includes the following Department of Agriculture Roadless Area Stipulation, "If future legislation or regulations change the roadless area designation, the restriction would be revised along with any appropriate environmental review." An appropriate NEPA review would be required prior to any changes to the Roadless Area Stipulation.

O-49-9

Thank you for your comment. The comment is noted.

O-49-10

While the document states that old growth forest could be removed as a result of geothermal development, the authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

It is also important to note that lands allocated as open are subject to existing laws, regulations, and formal orders, which could prohibit some lands from leasing.

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

In regards to the USFWS 2008 recovery plan, it is not a regulatory document. It provides guidance about how recovery for the spotted owl can be achieved and provides methods to apply to FS and BLM forest management that will benefit northern spotted owl. Changes have been made to the document to clarify this.

O-49-11

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. Appropriate site-specific mitigation would be developed as necessary. As stated in Section 4-4, impacts of development, utilization, and reclamation of geothermal resources include the potential for groundwater contamination. Appendix D provides BMPs to address methods to minimize contaminations. Federal, state, and local regulations ensure that operators will conduct drilling in a prudent manner. Potential for contamination based on local soil types and groundwater conditions would be assessed prior to issuance of permits for development.

O-49-12

The purpose of the analysis in Volume II is to provide supplemental analysis to the PEIS for the site-specific pending lease applications. Until a lease is obtained, an applicant cannot conduct the necessary drilling and data collection for establishing a definitive plan of development. Project-specific NEPA review will be conducted before drilling and any subsequent development.

O-49-13

As noted above, this document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

O-49-14

The purpose of the analyses in Volume II is to provide supplemental analysis to the PEIS for the site-specific pending lease applications. The analyses in Volume II are not stand-alone NEPA reports. The RODs for the 19 pending leases are dependant on the ROD for the PEIS and will be signed separately. Therefore, a timing break between the signing of the RODs for the PEIS and the 19 pending leases is not necessary. All of the backlogged pending lease applications were discussed during the scoping process. The Notice of Intent advertised the fact that the PEIS was assessing the backlogged lease applications, and a list of the pending lease applications were made available during scoping. Additionally, separate notices were published to inform the public about the analysis of pending lease applications on FS lands (see Section 6.2.1).

O-49-15

The comment is noted.

All of the areas mentioned in the comment have been addressed. The Forest Supervisor has the discretion to remove these areas from the lease, to impose stipulations and BMPs on the lease, or to deny the lease to protect specific resources.

O-49-16

The comment is noted. These concerns have been addressed in the analysis.

O-49-17

Sections 16.1.2 and 16.3.2 thoroughly address the requirements of the ACS, including the requirement that no geothermal development occur in Riparian Reserves and the requirement for a Watershed Analysis for development in Key Watersheds. The Forest Supervisor will consider these requirements when issuing a decision notice with a FONSI to the BLM. Effects on the objectives cannot be assessed at this leasing phase of analysis, when concrete development plans are not available.

O-49-18

The document identifies LSRs and states clearly that they are protected under the NWFP. The authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

No development would occur in LSRs if it does not comply with the objectives outlined in the regional forest plan. Site-specific NEPA would also be conducted prior to any ground-disturbing activities that would further analyze the project, the exact location of old growth habitats, and the impacts that would result from any proposed development.

O-49-19

Section 15.3.2 states: "Additional discussion of impacts on land use and dispersed recreation from geothermal plant development is provided in Section 4 of the PEIS, under *Land Use, Recreation, and Special Designations*." The Forest Supervisor would take these potential impacts into consideration when issuing a consent determination to the BLM.

O-49-20

Chapters 15 and 16 do not have specific project proposals or even locations to evaluate, so impacts can only be discussed at a general level. The Forest Supervisor will take potential impacts on resources into consideration when issuing a consent determination to the BLM and may impose stipulations or BMPs on the lease, remove areas from the lease, or deny the lease altogether.

O-49-21

No transmission line would be permitted until a specific project is proposed and a separate NEPA analysis is conducted. This separate analysis would consider transmission line impacts, if applicable. There is no specific project proposed at this time.

O-49-22

Text has been revised to address potential impacts from any future geothermal development to the drinking water aquifer. The analysis has addressed any specific wildlife habitat conservation areas that are protected, including LSRs, Riparian Reserves, and species-specific habitat areas.

O-49-23

The PEIS has been modified to include additional climate change discussion for affected resources. Please see the water, soil, vegetation, fish and wildlife, and other resource sections in the Final PEIS.

A general discussion of the issue of offsets of greenhouse gas emissions is presented in Section 4.8.

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

O-49-24

The authorized officer always retains the discretion to reject geothermal lease applications.

It is also important to note that lands allocated as open are subject to existing laws, regulations, and formal orders, which could prohibit some lands from leasing. For example, if the BLM or FS determines that subsequent exploration, development, or utilization of lands would likely result in a significant adverse effect on a significant thermal feature within a unit of the National Park System, the lease would not be issued pursuant to the Geothermal Steam Act Amendments of 1988 (30 USC Section 1026[c]). Additional text has been added to Chapter 2 to clarify this point.

O-49-25

Although the BLM expects to be able to rely upon this analysis, combined with DNA evaluations to document NEPA adequacy, to make lease issuance decisions in the near term the issuance of a lease does not give the lessee the right to proceed with exploration or development (i.e., any surface-disturbing activities beyond casual use) in the absence of further site-specific permits with associated environmental analysis. Once the plans are amended, the BLM can make decisions whether or not to issue geothermal leases in conformance with the amended land use plan on the basis of this PEIS. Following this amendment process, it is the intent of the BLM that, upon receipt of future nominations or applications for direct use, affected BLM offices would be able to conduct a DNA evaluation to make lease sale decisions without further plan amendments or NEPA analysis, unless special circumstances require additional environmental evaluation. The BLM and FS would conduct other environmental reviews to comply with other laws, including but not limited to the Endangered Species Act and National Historic Preservation Act, prior to issuing leases (see Section 2.2.2 Lease Stipulations, Best Management Practices, and Procedures).

As noted in the responses above, there are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

O-49-26

Discussion of impacts for old growth forests acknowledges the potential for irreversible impacts from future geothermal development activities. The PEIS states:

> Old growth forests, which may have never been physically disturbed by activities such as logging, typically contain centuries-old trees or other plants that cannot be reestablished and would be permanently lost.

O-49-27

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

geothermal_eis

From: Mary_Christensen@blm.gov [Mary_Christensen@blm.gov] **Sent:** Thu 9/18/2008 4:09 PM
To: geothermal_eis
Cc:
Subject: Mail forwarded from geothermal_eis@blm.gov
Attachments:

This message has been automatically forwarded from geothermal_eis@blm.gov.

"Ronald Barr" To
<ronaldcbarr@cox. <geothermal_EIS@blm.gov>
net> cc
<erthpower1@aol.com>
09/18/2008 05:13 bcc
PM
Subject
Geothermal EIS

EARTH POWER RESOURCES, INC.

2407 S. TROOST AVE.

TULSA, OK74114

TEL. 918-743-5593

FAX. 918-743-5595

RONALDCBARR@COX.NET

September 18, 2008

Department of Interior
Washington DC

Dear Mr/Ms:

The idea of the Programmatic Review is premature. Because of the change in the leasing rules promulgated by the Energy Policy Act of 2005, public lands can only be leased through competitive lease sales. The Nevada BLM has not set a date for a new sale following the sale in August 2008 due to lack of nominations for new sales. The results from the August sale were strong but it is important to realize the leases that were offered were on lands where much work had been done over the preceeding 20 years, mostly in the 1970s and early 1980s. Very few lands are available for future sales where similar work and results have been completed and obtained. New exploration is necessary for geothermal to grow but there is no incentive for private industry to explore. C-50-1

The entire leasing process must be revisited and returned to the type of Open Leasing similar to the non-competitive leasing program under which public lands were first offered in 1974. At that time there were monthly simultaneous filing periods whereby leases applications were filed during each month. On the first day of the next month the applications to were opened and those that were not overlapped were eligible for leasing. Applications that overlapped each other by less than 50% were issued by a coin toss for the overlapped lands. When applications overlapped greater than 50% the Director of the BLM would deem the area to be an "Area of Competitive Interest" and a sealed bid auction would be held with the high bidder awarded the lease. In each instance the leases were only issued pending an environmental review. C-50-2

The work done is valuable but the programmatic EIS should not be put in place. The reason is that lands that may be attractive could be located on lands excluded that could be developed with remedial actions or other safeguards. The limitations of available lands set out in the Programmatic Review are too restrictive. Major fields could be needlessly put off limits. C-50-3

In order to reach an output level where geothermal can replace the energy to replace 1 million barrels of oil per day, or comparable production of natural gas, 1 million acres per year must be leased in each of the next 10 years. The type of calculation for this level of issuing leases is contained in a paper presented at the Second United Nations Symposium of the Development and Use of Geothermal Resources May 20-29 1975, "Geothermal Exploration: Strategy and Budgeting" by Ronald C. Barr pp. 2269-2271. The more leases that can be issued sooner, the more quickly geothermal can be used thus replacing natural gas for power generation in meaningful quantities. C-50-3

I urge that the Programmatic EIS not be implemented while industry is allowed time to change the law to enable a new leasing program that will increase the availablity of public lands for exploration. The work done to date can be valuable in this regard.

Sincerely yours,

Ronald C. Barr, President

C-50-1

The comment is noted. The PEIS does not alter the competitive leasing process as defined under Section 222 of the Energy Policy Act of 2005.

C-50-2

The PEIS cannot alter the competitive leasing process as defined under Section 222 of the Energy Policy Act of 2005.

C-50-3

Constraints identified in this document would be applied as appropriate. Where the agency determines that particular stipulations may be inappropriate for a planning area, the procedure for waivers, exceptions, and modifications would be followed (Section 2.2.2 *Lease Stipulation, BMPS, Procedures*).

Lands outside of the planning areas geothermal potential area identified in this document would not be prohibited from leasing; leasing would continue under the existing system outlined in Alternative A (Section 2.31).

C-50-3

The purpose of this PEIS is to facilitate the leasing process. Amending land use plans to include geothermal leasing should allow leasing to occur in a more expedited fashion than under the existing system.

geothermal_eis

From: Mary_Christensen@blm.gov [Mary_Christensen@blm.gov] **Sent:** Thu 9/18/2008 4:40 PM
To: geothermal_eis
Cc:
Subject: Mail forwarded from geothermal_eis@blm.gov
Attachments:

This message has been automatically forwarded from geothermal_eis@blm.gov.

CKEZAR34@aol.com To
geothermal_EIS@blm.gov
09/18/2008 05:37 cc
PM
bcc

Subject
exception for research on
geothermal

BLS needs to add that it is open to exceptions when it comes to geothermal research. Two research areas are deep drilling to capture ten time the power from one well -- see Iceland Research IDDP.
Secondly research needs to be accomplished to test the engineering of hydrogen capture from magma and water interaction -- see www.magma-power.com
The potential hydrogen capture is enormous for example one Icelandic well vents 320 tons per year without any deliberate penetration of the magma. That quantity will run 75 fuel cell cars every day for many generations.

I-51-1

Chuck Kezar
Professor LSC
Research Professor Geothermal

I-51-1

This comment is outside the scope of the PEIS.

GeoThermal Programmatic EIS
COMMENT Re Medicine LAKE

TO WHOM IT MAY CONCERN
FROM THE BLM + Forest Service

IN THIS DAY OF GreeN and Preventing GLOBAL WARMING WHY WOULD TO OF THE AGENCY IN CHArge OF MOST OF our PUBLIC LANDS WANT to give a PUBLIC COMPANY THE POWER TO DO WHAT THEY DAM WELL PLease ON PUBLIC LAND WITH A LISCENCE From Your OrganIZATIONS. I-52-1

I THIS DAY OF CONSERVATION, and Trying TO STOP GLOBAL WARMING and SAVE MANY PARTS OF OUR ENVIROMENT AND MANY OF THE SPECIES THAT ARE ThreaTEND BY. WHY WOULD WE WANT TO DESTROY HABIT, ReCreaTION Area, Wilderness etc TO SEACH FOR A ResoUrce THAT MAY OR MAY NOT BE IN THE GROUND IN NATURAL AMOUNTS. FOUR Mile Hill for Example Should Be an EXAMPLE TO ALL. AFTER ALL THE Resource WAS NOT HOT ENough to RUN A GEOTHERMAL PLANT I-52-2

THAT would produce Electrical Power without adding acids and other artifical means for production - What happen when all of this garbage gets in the aquifer and spreads for miles and destroys habit for fish & game etc. I-52-1

CALPINE says the system is closed which it may be to start out with but what happens when a casing breaks or earth movement causes breakage and lets this garbage into the ground water. I-52-3

Please have enough courtesy to the enviroment and the earth to require that each geo thermal lease have an individual enviromental impact report. Each lease is an individual case and should have individual consideration. You would not build a house with out making sure that the foundation is on solid ground. You would not let a drug company give I-52-4

You Personal A Drug That They Did NOT KNOW WHAT IT Did. To You Body. So Why do IT To The Body of Mother Earth

IT does NOT MAKE sense To KILL The Host Because IS Profitable IN Dollars For CAL Pine, BLM & The forest service. WITHOUT Being Sure WHAT The End Result

Please Require INdividual ENvironmental Impact Reports ON All Geothermal Lease IN The medicine Lake HighLands. I-52-5

Make Dam Shur WHAT You are doing For The Sake Of Future Generations.

THANK YOU
Joe W Hoyle
Melissa A Hoyle
1939 PABLO VISTA
SAN PABLO, CA 94806

I-52-1

The comment is noted.

I-52-2

The comment is noted.

I-52-3

As stated in Section 4-4, impacts of development, utilization, and reclamation of geothermal resources include the potential for groundwater contamination. Appendix D provides BMPs to address methods to minimize contaminations. Federal, state, and local regulations ensure that operators will conduct drilling in a prudent manner. Potential for contamination based on local soil types and groundwater conditions would be assessed prior to issuance of permits for development.

I-52-4

The comment is noted.

I-52-5

There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

As described in *Procedures Prior to Leasing* (Section 2.2.2), prior to inclusion of a lease in a competitive bidding process, the BLM or FS would review the lease area for sensitive resources and would provide the necessary stipulations to protect these resources.

geothermal_eis

From:	Mary_Christensen@blm.gov [Mary_Christensen@blm.gov]	**Sent:**	Fri 9/19/2008 5:28 AM
To:	geothermal_eis		
Cc:			
Subject:	Mail forwarded from geothermal_eis@blm.gov		
Attachments:			

This message has been automatically forwarded from geothermal_eis@blm.gov.

James Witcher <jimwitcher@zianet.com>

09/19/2008 06:24 AM

To <geothermal_eis@blm.gov>

cc

bcc

Subject PEIS error

On page C-4 of Appendix C in Preliminary List of ACEC status for Fluid Mineral Leasing, the District office for Las Cruces is misspelled. Also, an ACEC, Rincon, is noted as "closed" and "no surface occupancy." I suspect this is in error and the "closed and no surface occupancy" designations should be associated with the Organ/Franklin Mtns above Rincon in the table. This is a serious mistake as Rincon is one of the high quality geothermal prospects in the Rio Grande rift. The local BLM office, Las Cruces, should review this issue. The Federal sections around the Rincon area are covered with roads, a no longer used community dump, several communications towers, an aggregate pit or quarry, along with several abandoned manganese mines and prospects. I-53-1

James C. Witcher, Las Cruces, New Mexico

I-53-1

According to the BLM New Mexico State Office and the Las Cruces Field Office, Rincon ACEC is closed to geothermal resource development. The Organ/Franklin Mountains ACEC is also closed. This status is based on the most current RMP update (1991). This has been updated in the Final PEIS, and the Las Cruces spelling has been corrected.

ORMAT®

September 19, 2008

Draft Geothermal Leasing PEIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

Attn: Jack Peterson
Title: National Project Manager

Subject: Ormat Nevada, Inc. comments on Draft Programmatic Environmental Impact Statement (PEIS) for Geothermal Leasing in the Western United States

Dear Mr. Peterson,

Ormat Nevada Inc. is pleased to respond to the Draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States. Our technical staff comprised of geothermal experts with many years of experience reviewed the document. Our comments are attached separately.

If you have any questions or need more information about our comments, please contact Charlene Wardlow at 775-336-0155.

Best Regards

Sincerely,

Daniel Fleischmann

Daniel Fleischmann
Project Initiation Manager
Ormat Nevada, Inc.

ORMAT Nevada
6225 Neil Road, Reno, NV, 89511 • Telephone (775) 356-9029 • Facsimile (775) 356-9039

Ormat Nevada, Inc. official PEIS comments

Volume I: PROGRAMATIC ENVIRONMENTAL IMPACT STATEMENT

Executive Summary
Comment on ES.5 ALTERNATIVES (Page ES-5)
Comment: The Proposed Action, Alternative B, is recommended. Alternative C – Leasing lands near transmission lines, is unacceptable. Future transmission planning in the West will likely be guided, in part, by expanding access to renewable energy resources. The existing U.S. transmission infrastructure is subject to modernization to meet 21st Century energy needs. With State RPS policies and federal incentives towards renewable energy, transmission lines will likely be built near clusters of renewable energy resource areas. Thus, transmission will come to the resource. C-54-1

Comment on ES.6 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO (Page ES-6) *Also mentioned on Table 2-6 on page 2-35
"Most of the development would likely occur in northern Nevada, California, and Idaho, with the least amount in Wyoming and Montana." & "While not evaluated in detail for large scale commercial electrical generation, Montana and Wyoming have potential for small scale direct use electrical generation." C-54-2

Comment: While it is true that we reasonably expect less development in Montana and Wyoming than in other Western States, there is potential for larger-scale generation in both states. We do not understand the extent of the resource in either state. Although development would take place outside of the restricted boundaries at and around Yellowstone National Park and the Island Park KGRA, the existence of these massive geothermal anomalies suggests that Montana and Wyoming should not be written off entirely. This is especially relevant in that hot water may be co-produced with oil and gas wells in the oil and gas producing regions of Montana and Wyoming that may be on federal lands. We suggest that you do not make the statement that Montana and Wyoming only have potential for small scale direct use electrical generation.

Comments on ES.7 Impact Analysis (Page ES-7)
"If geothermal leases were developed, the following general adverse impacts would be expected…" According to the PEIS, these include: C-54-4

"Short-term impact to ground water during drilling" & "Loss of other land uses, such as livestock grazing, on land occupied by geothermal facilities."

C-54-3

Comment on ground water: Can you please explain why the above statement is made that there would be short term impacts to groundwater from drilling operations?

Comment on grazing: We have never heard of grazing as an issue for a geothermal project. There is no reason a project couldn't be designated grazing if this were the area's current use. C-54-4

Chapter 1. Purpose of and Need for Action;
Section 1.6. Areas with Geothermal Potential C-54-5

Comment on Figure 1-5, page 1-16
Comment: In Arizona, the San Francisco Volcanic Field northeast of Flagstaff is not in the study area, despite receiving funding from the US DOE Geothermal Technologies Program for geothermal study for electric generation. Northern Arizona has typically been disregarded as an area of geothermal potential, and was left off the study area in the PEIS despite Ormat's suggestion it be included. The legal tracts encompassing this area are in: T23N, R8E 5 (SE corner), 4, 3, 2, 1; 8, 9, 10, 11, 12 (NW corner); 17, 16, 15 (NNW corner) +T24 N, R8E, 26 (SE corner), 25 (SSE half), 33 (SE corner), 34 (SSE half), 35, 36; T24 N, R9E, 30, 31; T23N, R9E, 5 (NW corner). This is based on public information provided by Northern Arizona University.

Chapter 2. Proposed Action and Alternatives;
Section 2.2. Proposed Action

Comment on Section 2.2.1 Identify lands for leasing, page 2-7
Comment: The COSO geothermal field is a perfect example of military operations working together with a geothermal operation. Thus, why is it stated the military reservations would be closed to geothermal leasing? We believe the Department of Defense should be the agency to make decisions concerning leasing on military lands not the BLM or USFS. C-54-6

Comment on Section 2.2.1 Identify lands for leasing, Figure 2-5, page 2-11
Comment: We believe that the PEIS is incomplete without identifying, on a state by state level, and/or whether any major KGRAs on this map are closed to leasing by statute or otherwise as defined by this document. For example, in Volume III, Appendix F, you list hot and warm springs throughout the Western U.S., but make no mention of which are closed to leasing. Might it be possible to do so? The map labeled Figure 2-5 is confusing because it indicates significant land areas that are closed to leasing in several key areas. The map suggests that much of the federal land in the Imperial Valley may be off limits to leasing. The map also suggests that much of Cascade Range in Oregon may be off-limits to leasing. This sends a confusing signal given the significant potential for geothermal power development in that region. More specific maps would be beneficial. C-54-7

Comment on Section 2.2.2 No Surface Occupancy Lease Stipulations header, page 2-16
Comment: Given the high level Section 106 consultation initiated for the PEIS, how will the areas of important cultural and archaeological resources (bullet 3) be known prior to the BLM/USFS issuing of the leases? These areas are already mitigated during a project development scenario including avoidance as required by existing federal laws. C-54-8

Comment on Section 2.2.2 Other Lease Stipulations header, page 2-18
"Any leases that contain thermal features (e.g., springs or surface expressions) would have a stipulation requiring monitoring of the thermal features during any exploration, development, and production of the lease to ensure that there are no impacts to water quality or quantity." C-54-9

Comment: Sometimes water quality and quantity are subject to natural changes. This statement presumes that all changes would be caused by geothermal operations.

Comment on Section 2.2.3 – Amend Land-use plants, Page 2-26
"The land use plan does not assess the reasonably foreseeable development scenario for geothermal development, or the analysis requires updating." C-54-10

Comment: We understand that some land-use plans up for amendment may not include geothermal because they have not identified areas of high geothermal potential. However, in oil and gas producing areas such as the San Juan Basin in Southwest Colorado and Northeast New Mexico, the Uinta Basin in eastern Utah, and other oil and gas producing areas in the Western U.S. could have geothermal fluids co-produced with oil and gas wells on federal lands. In Utah for instance, over 2,700 drilling permits were issued 2004 and 2005 (with over 54% on federal lands). 2005 broke state records at the time for new permits with 1,628; almost double the amount of permits issued in 2003. With so many wells potentially being drilled in this region, there may be geothermal co-produced with oil and gas wells. We would hope that each individual well that is already permitted to produce oil and/or gas would not be subject to an EIS for geothermal fluids should they want to use this untapped free source of heat energy. Thus, we request that co-production and Enhanced or Engineered Geothermal Systems (EGS) be added to the PEIS so that it will also facilitate geothermal energy development at existing oil and gas operations in the Western United States. An EGS description should also be added as a potential operation at any geothermal resource that is leased given the interest in this technology the United States Government, particularly the Department of Energy.

Comment on Section 2.2.4 and, Table 2-4 Pending Lease Applications, page 2-27
Comment: This should be consistent with Chapter 10 of the PEIS that expands on why these leases need site-specific review to determine whether to lease or deny leasing. C-54-11

Chapter 2: Section 2.5. Reasonably Foreseeable Development Scenario
Comments on Section 2.5.1, RFDs for Electrical Generation (Indirect Use), pages 2-40, 2-41, 2-42, 2-43, 2-45, and 2-46
Comment – Page 2-40, Table 2-8: Drilling 6 temperature gradient wells - .05 to .15 acre/well. This is only a 46 x 46 feet to 80 x 80 feet for a well pad. It may be necessary to bring in a rig that would require a wellpad up to 150 x 150 feet. C-54-12

Comment – 2-42: "Most temperature gradient wells are drilled with a small rotary rig…similar to that used for drilling water wells, or a diamond-coring rig, similar to that used for geologic sampling in mineral exploration and civic works projects. Neither rig of this size requires construction of a well pad or earth moving equipment unless the site is sharply graded." This is inaccurate. It is usually necessary to grade and build a wellpad for the drilling of temperature gradient holes. Can you please explain if you have information and/or data that support the assumption given? C-54-13

Comment – 2-42: "Several temperature gradient wells are usually drilled to determine both the areal extent of the temperature anomaly and where the highest temperature gradient occurs. Each drill site could disturb approximately 0.10 acres." See comment for Table 2-8. C-54-14

Comment – 2-43: "Once exploration has confirmed a viable prospect for commercial development and necessary leases have been secured, the drilling of exploration wells to test the reservoir can proceed." Typically, the first step is leasing a prospective piece of land. Then surface exploration and temperature gradient drilling will commence. Additional leases may be secured for areas around the original leasehold if such testing indicates potential outside the existing leasehold. However, typically, a strong lease position must be secured before any major testing can begin. It is too expensive to perform exploration prior to a lease position today. C-54-15

Comment – 2-45: “a 50 MW (net) power plant could require up to 25 production wells and 10 injection wells” Typically a 50 MW (net) power plant may require between 12 to 15 production wells and 5 to 7 injection wells. Your estimates are quite high and give the indication of far more significant surface disturbance. C-54-16

Comment – 2-45: “A geothermal power plant is typically supported by pipeline systems in the plant’s vicinity…Pipelines are usually 24 to 36 inches in diameter” They could be as small as 8 inches depending on the type of pipeline. C-54-17

Comment – 2-45: “In general, plants have about 1½ to even miles of pipes with a corridor width of about 25 feet.” The word “even” does not make sense and only 1.5 miles of pipeline is a very small number. It would be a very small well field to only have 1.5 miles of pipeline. C-54-18

Comment – 2-46: “Electric transmission lines—Transmission lines may range in length from 5 miles to 50 miles with a corridor width of approximately 40 feet. Wooden poles would most likely support them, and one acre could be disturbed per mile of transmission line.” A 40 foot corridor would disturb almost 5 acres of land, not one. A 230 kV transmission line would require a larger corridor than 40 feet although it could be built on an H-frame wood pole structure. C-54-19

Chapter 3. Affected Environment
Section 3.7. Water Resources and Quality

General Comment on Section 3.7
Comment: Groundwater resources have not historically been impacted by geothermal development. The agencies with oversight for geothermal drilling and well completion insure that the casing and cement design protect any groundwater aquifer. Surface water has been impacted temporarily by spills; however, these have not caused long term impacts nor have they caused cumulative impacts. It is presumptuous to assume that geothermal exploration or development will impact groundwater resources of any kind. C-54-20

Comment on Section 3.7, page 3-72
Comment: “Groundwater is the primary water resource that is potentially affected by geothermal exploration and development”. It is misleading to suggest that groundwater is impacted by geothermal resources. Although a geothermal resource is similar to groundwater, it is not a drinking water source due to its chemistry and its temperature. C-54-21

Comment on Section 3.7, page 3-74
Comment: “Although the boundaries of groundwater and surface water resources do not always coincide, the discussion below is organized by surface water (hydrologic) regions.” Based on geology and hydrology, geothermal reservoirs are separated from cold water ground water aquifers by barriers of rock, usually clay. C-54-22

Comment on Section 3.7, page 3-80
Comment: On the discussion of hot springs at the top of the page, it is assumed that hot springs are connected to drinking water aquifers. This is an incorrect statement as the temperature of the hot springs and the total dissolved solids and mineral content makes them non potable. C-54-23

Comment on Section 3.7, page 3-84
Comment: In the 2nd paragraph, this is the first time "geothermal reservoirs" are mentioned in this section. Although the write-up on hydrologic regions is interesting there needs to be a section explaining the relationship between hydrologic regions and geothermal reservoirs and why it is relevant to the leasing of BLM/USFS lands for geothermal energy. C-54-24

Chapter 3: Section 3.8 Air Quality and Climate
Comment on Section 3.8.1, page 3-96
Comment: The Clean Air Interstate Rule (CAIR), which was struck down by the U.S. Court of Appeals for the D.C. Circuit in July of 2008, applied to states that shared borders with urban areas that are in non-attainment for criteria pollutants regulated by the EPA pursuant the Clean Air Act. This applied to such interstate metropolitan areas such as Washington DC, Virginia, and Maryland, as well as New York, New Jersey, and Connecticut. It was not applied to the Western United States involved with the PEIS. C-54-25

Comment on Section 3.8.2, page 3-98
Comment: "Due to its minute emissions, an operating geothermal energy development would most likely be exempt from air toxics emissions regulations." Add – "depending on the types of technology and local attainment status". C-54-26

Chapter 3: Section 3.13. Livestock Grazing
Comment on Section 3.13, pages 3-160 to 3-162
Comment: Geothermal projects could be designed to minimize impacts to grazing by the routing and design of the pipeline systems. Projects have been designed and are operating that minimize any impact to animals that roam. Grazing should not be a deterrent to leasing for geothermal. C-54-27

Chapter 4. Environmental Consequences
Section 4.15. Tribal Interests and Traditional Cultural Resources

Comment on Section 14.15.2 – How were the potential effects of geothermal leasing on tribal interests and traditional cultural resources evaluated? Page 4-117
Comment: Why can't site specific Section 106 consultation be completed for the lease applications that were pending as of January 1, 2005? This would serve to expedite exploration and development supporting the United States' goal of energy independence. C-54-28

Page 4-118 – Bullets at the bottom of the section
Comment: Please identify the geothermal resource areas that are within the setting of a National Register-eligible site, including traditional cultural properties and areas with important cultural and archaeological resources including Native American sacred sites. C-54-29

Chapter 6. Consultation and Coordination
Section 6.6. Potential Adoption of the PEIS by Other Organizations

Comment on Table 6-1: Consultation Invitation Letter Mailing Address, Page 6-10
Comment: The Shasta Nation of Siskiyou County, California is missing from this list. C-54-30

VOLUME II: ANALYSIS FOR PENDING LEASE APPLICATIONS

12. EL CENTRO FIELD OFFICE LEASES

Section 12.1. Introduction

Comment on Section 12.1.2 page 12-2; State Implementation Plan for PM10 in the Imperial Valley, Executive Summary, Final (1993) C-54-31
"The pending lease application sites fall within the Salton Sea Air Basin, which is classified as a nonattainment area for inhalable particulate matter with a diameter less than 10 micrometers (PM10), based on Federal Clean Air Act standards."

Comment: The Salton Sea Air Basin is also in nonattainment for Ozone. It is suggested that the Imperial Valley Air Pollution Control District be contacted for more current information.

Comment on Section 12.1.2 page 12-2; Imperial County General Plan (2003)
"Growth within Imperial County is directed by the Imperial County General Plan. C-54-32
Geothermal energy development is addressed in one of the Plan's nine elements, *Geothermal and Transmission Element*. Imperial County has no direct land-use jurisdiction over public lands; therefore, neither the General Plan nor the Imperial County zoning regulations are directly applicable to activities proposed on public lands."

Comment: The Geothermal and Transmission Element was updated October 17, 2006. Proposed leases CACA 046142 and 043965 are bounded to the north and south by private lands that would be under the jurisdiction of Imperial County. Thus, it is very likely a project would be developed that involved both the BLM and the County.

Section 12.3. Affected Environment and Environmental Consequences

Comment on 12.3.6 Water Resources – Page 12-20 – Mitigation C-54-33
Comment: As stated in the document, surface water from the Imperial Irrigation District is the primary source of water for this area. Groundwater is generally unusable. Requiring an assessment of a project's impacts should only be required if the project is going to use groundwater in a significant amount.

Comment on 12.3.7 Air Quality and Climate; Page 12-21 under Setting, 2nd paragraph. C-54-34
Comment: This conflicts with page 12-2 and the sentence doesn't make sense. Misspelling of "and" to "are?"

Section 12.4 References

Comment on Section 12.4 References – Page 12-50
Comment: The reference to the 2003 Imperial County General Plan needs to be updated with the October 17, 2006 update listed above. C-54-35

VOLUME III: APPENDICES
Appendix D: Best Management Practices - Mitigation Measures

Comment on Appendix D: Land use, Recreation, and Special Designations, Page D-4 C-54-36
"An access road siting and management plan shall be prepared incorporating existing BLM 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)."

Comment: Historically the "Gold Book" has not been applicable to geothermal operations. Is this a policy change by the BLM? If this is a change, the Categorical Exclusions authorized for the oil and gas should also be applicable to geothermal operations.

C-54-1

The commentor's support for Alternative B is noted.

C-54-2

RFDs have been added for Montana and Wyoming at levels of 20 MW by 2015 and 50 MW by 2025 for each state. No data were available for these states, but the parallel to Colorado was drawn due to the similarity in resource base across the Rocky Mountain Region.

C-54-3

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

C-54-4

The resource uses compatible with geothermal use are likely to vary depending on site-specific conditions. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

C-54-5

As discussed in Section 1.6, Areas with Geothermal Potential, the geothermal potential area used to delineate the planning area for the PEIS was developed in a collaborative manner with Federal and state agencies, universities, industries, research organizations, and experts in the field based on areas with a reasonable likelihood for development activity in the near future.

C-54-6

The discretionary closure referred to states where military lands would be closed to leasing only "where geothermal development would conflict with the military mission." See Section 2.2.1 *Lands Identified for Leasing*.

C-54-7

As noted in Section 1.9.3 (*Scope of Geographic Information System Data and Graphics*), the best available data were used in preparing the PEIS. However, there are limitations with datasets. The figures are meant to be illustrative to provide context. All of the criteria for allocating lands as open or closed are provided textually in Chapter 2 and can be used for assessing site-specific areas.

C-54-8

As stated in the PEIS, Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and the potential for geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

C-54-9

The comment is noted.

C-54-10

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed at the lease site.

Lessees may propose any type of available technology. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis.

C-54-11

The information in these two areas of the document are consistent. Chapter 2 provides an overview, whereas Chapter 10 provides more depth.

C-54-12

Text was added to the footnote that this is a representative average across all exploratory well locations. In general, for exploratory drilling, a large well pad is not required.

C-54-13

The RFD estimate is a representative average across all exploratory well locations. In general, for exploratory drilling, a large well pad is not required.

C-54-14

The RFD estimate is a representative average across all exploratory well locations. In general, for exploratory drilling, a large well pad is not required.

C-54-15

The key point of this sentence is that drilling to produce geothermal fluids cannot occur until a lease is obtained.

C-54-16

The estimate of wells is based on a literature review and input from industry about plants throughout the Western US. The actual number of wells is dependent upon a variety of factors.

C-54-17

Text was added about the size being as small as eight inches.

C-54-18

"Even" was changed to "seven."

C-54-19

One acre was changed to "about five acres."

C-54-20

The PEIS discusses that modern drilling practices reduce the potential for these types of impacts. However, as with any complex activity and natural conditions, the potential for these impacts is always present. Due to the programmatic nature of this PEIS, addressing great variations in location, environment, technology, and methodologies is not possible. The RFD describes the range of potential impacts from future geothermal development.

C-54-21

The text in Section 3.7 has been clarified to read "Geothermal resources primarily involve the presence and characteristics of available heat and geothermal fluids (water, steam, or a mix). Groundwater is more likely than surface water to be potentially impacted by geothermal exploration and development."

C-54-22

The section is discussing groundwater and surface water resources on a regional scale. The interrelation of groundwater within geothermal reservoirs and groundwater outside of geothermal reservoirs is more dependent on local conditions. Text has been added to Chapter 4 to discuss the hydrological connection, or lack thereof, of geothermal reservoirs to other groundwater sources. See response to comment 1-2-4.

C-54-23

The discussion of hot springs is meant to be independent of water quality. The organization of this section of the Draft PEIS was surface water, groundwater, groundwater quality, and then hot springs. This has been changed to surface water, hot springs, groundwater, then groundwater quality to avoid further confusion.

C-54-24

The section is discussing groundwater and surface water resources on a regional scale. The interrelation of groundwater within geothermal reservoirs and groundwater outside of geothermal reservoirs is more dependent on local conditions. Text has been added to Chapter 4 to discuss the hydrological connection, or lack thereof, of geothermal reservoirs to other groundwater sources. See response to comment 1-2-4.

C-54-25

The comment is noted, and references to the Clean Air Interstate Rule have been deleted.

C-54-26

The document was revised as recommended.

C-54-27

The resource uses compatible with geothermal use are likely to vary depending on site-specific conditions. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve user conflicts. Appropriate site-specific mitigation would be developed, as necessary.

C-54-28

The BLM and FS are consulting with the tribes on the pending lease applications. Section 4.15.2 is focused on the programmatic level and acknowledges that consultation would have to occur once there are formal lease nominations in the future.

C-54-29

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and potential geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

C-54-30

The Bureau of Indian Affairs provided the list of federally recognized tribes for consultation. The Shasta Nation of Siskiyou was not included in this list but has been added to the project mailing list. Prior to individual leases being included in a lease sale, coordination with local affected tribes would be initiated.

C-54-31

The comment is noted; however, per the title of the section being referred to, the State Implementation Plan is for PM10, not ozone.

C-54-32

The 2003 General Plan was used in preparation of the PEIS. The comment is noted regarding Imperial County's involvement.

C-54-33

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water rights. Site-specific impacts on water resources, including groundwater, would be addressed as part of the environmental analysis for the permitting process.

C-54-34

The BLM presumes that the perceived conflict is that page 12-21 of the Draft PEIS says the air basin is nonattainment for both PM10 and ozone, whereas page 12-2 only mentions PM10. Page 12-2 does not mention ozone because the subsection is addressing the State Implementation Plan, which relates to PM10 but not ozone.

C-54-35

The 2003 General Plan was used in the preparation of the PEIS.

C-54-36

The "Gold Book" is a well known source for BLM road and construction standards that are directly applicable to the types of development that also occur for geothermal resource development. It is not a change in policy.

Medicine Lake Citizens for Quality Environment, Inc.
Save Medicine Lake Coalition
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Phone: 530- 926-5514 ~ Fax: 530-926-1598

September 19, 2008

Sent via e-mail and US Postal Service

Draft Geothermal Leasing PEIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

Re: Programmatic Draft EIS for Geothermal Leasing in the Western United States

Dear Sirs,

Thank you for the opportunity to comment on the Draft PEIS for geothermal leasing.

The Save Medicine Lake Coalition, which is comprised of the Medicine Lake Citizens for Quality Environment, the Klamath Forest Alliance and the Fall River Wild Trout Foundation, was organized over 10 years ago. We are a diverse group consisting of concerned property owners, environmentalists and recreation users including campers, hunters, fishermen, snow enthusiasts and everyday people who care about protecting the pristine qualities of the Medicine Lake Highlands from the long-term and significant impacts of geothermal industrial development. The natural forest surroundings of the Medicine Lake Highlands are located in the Modoc, Klamath and Shasta-Trinity National Forests in the Cascade Range of northeastern California.

First and foremost, the Medicine Lake Highlands (MLH) must be declared CLOSED to all geothermal leasing and the geothermal industry itself. The on-going controversy surrounding the proposed MLH geothermal projects will never go away if it is not closed. The Draft PEIS fails to mention the pending legal actions that are taking place there; including the federal lawsuits and the geothermal lease renewals that have been deemed invalid by the Ninth Circuit Court of Appeals. O-55-1

Our organization's initial response to the Draft PEIS is one of skepticism and concern in regards to the Bureau of Land Management and the US Forest Service's accelerated and vast approach to geothermal leasing on public lands. A staggering 77% of lands (192 million acres) under their jurisdiction, within the twelve contiguous western states and O-55-2

Alaska, could be impacted by the consequences of the programmatic decisions regarding geothermal leasing. The PEIS opens the door for maximum geothermal leasing and development of our forests and public lands. The existing rules and regulations in the agencies land use plans will be amended to fast track and support geothermal leasing.

We consider the geothermal leasing PEIS to be an enormous undertaking that merits thorough studies of the impacts to public lands and natural resources prior to issuing any leases.

In regards to the general level of environmental review in the Draft PEIS, the PEIS and amendments to the agencies land use plans should require site-specific environmental review prior to project approvals. The review process must include public notification, public comments and a requirement to address the full range of environmental and cumulative impacts. 0-55-3

…………………………………………………………………………………………..

The following comments are based on 10 years of first-hand experiences in dealing with geothermal leasing and the proposed geothermal developments in the pristine and sacred Medicine Lake Highlands. The Highlands are not being directly analyzed in this document, but the decisions and conclusions found in the PEIS may have a distinct and direct affect upon leasing in the Highlands. These comments are meant to be directed at the Draft PEIS through the use of geothermal examples and situations that have occurred in the Medicine Lake Highlands and which could happen anywhere in the vast scope of the PEIS western states leasing scenario. 0-55-4

Geothermal lease holders and developers must not be given *exclusive* rights to explore and develop all geothermal leases (PEIS 4.1.1, vol.1). The PEIS must give the federal agencies a clear and unrestricted right to deny a lease project without the threat of a "takings lawsuit" by the lease holder/developer.

The ***exclusive lease rights*** scenario played out in the Medicine Lake Highlands when the USFS and BLM initially denied the Telephone Flat Geothermal Development Project in a May 31, 2000 Record of Decision (ROD). Shortly after receiving the negative ROD, the developer threatened to sue the agencies via a $100 million dollar lease *takings* lawsuit, subsequently the agencies yielded to pressure and reversed the Record of Decision in favor of the leaseholder. Heated appeals and federal lawsuits still surround the controversial geothermal leases and the proposed geothermal projects in the sacred and pristine Medicine Lake Highlands.

Table 2-7, page 2-35:
The Table shows that the Medicine Lake/Glass Mountain area has a vast commercially viable RFD capacity of 480 mega-watts. Are the Table 2-7 figures based on past geothermal exploration activities and well venting from the 1980's or are the figures based on the more recent Fourmile Hill Geothermal Exploration Drilling Project's meager temperature gradient results at well pad 88-28? Either way, the projected 480MW 0-55-5

figure is exaggerated and misleading in regards to the likely MW capacity of the Highlands. **It is the developer's pipedream….*elevate the MW figures and the Medicine Lake Highlands will never be considered or closed to geothermal leasing or development.***

Unfortunately, Table 2-7 simply raises the red flag of skepticism regarding the accuracy of the leasing information and the MW calculations behind the RFD scenario in the programmatic document.

Table ES-1, page ES-4:
The table shows little difference in Alternatives B and C when it comes to leasing for Direct Uses. The environmental impacts of geothermal leasing/development for Direct Use will most likely be minimal and benign. But the impacts from leasing for the Indirect Use scenario will neither be minimal or benign. The Final PEIS needs to discuss the **West-side Energy Corridor PEIS,** mentioned on page 1-34, vol.1 1.14.3, and the impact it may have on the agencies selecting either Alternative B or Alternative C. 0-55-6

GROUND DISTURBANCE: Table 2-9, pg. 2-47 Cumulative range of Acre Disturbance for the RFD 0-55-7
The PEIS impact analysis mistakenly claims that the typical surface disturbance total for a geothermal generation project is between 53 to 367 acres. The proposed Medicine Lake Geothermal Projects, both the Fourmile Hill Project at 388.5 acres (Vol. 1, pg.2-12, Geothermal Development Project FEIS/EIR) and the Telephone Flat Project at 518 acres ((Telephone Flat FEIS/EIR, pg. ES-1, including 15 acres per transmission line mile, 23 miles) are actually much larger than their FEIS/EIR estimates. The Fourmile Hill 388.5 figure includes a 10 acre power plant site with 2.5 acre drill sites which were actually clear-cut and enlarged to over 20 + acres and 15+ acres each respectfully; see Exhibit 1 Fourmile Hill power plant site photos and Exhibit 2, Fourmile Hill drill site 85-33 photo.

Since the Medicine Lake Geothermal Projects are considered *typical* 48 to 49 MW power plants, the PEIS under-estimates the actual ground disturbance foot print that geothermal leasing, exploration and development will actually create. It is a huge miscalculation which will significantly affect more geothermal leasing acres. The geothermal surface disturbance calculations need to be readjusted and analyzed in the Final PEIS.

IMPACT ANALYSIS, page ES-7
The PEIS claims *to analyze a reasonably foreseeable development scenario to assess the likely impacts from subsequent development and the combined effects from leasing and development in the planning area.* The PEIS's impact analysis is a white wash that barely covers the significant and adverse environmental impacts that could occur via geothermal leasing. 0-55-8

NOISE IMPACTS:
The **PEIS pg. ES-7** erroneously claims that *geothermal operations would have minimal noise impacts.* Figure 3-23 Comparison of Sound Pressure Level and Sound Pressure, 0-55-9

pg.3-219, vol.1 and Table 3-42, pg.3-220, vol.1 should use geothermal drilling rig noises and power plant operational noises to make viable noise comparisons. The noise impacts at rural Medicine Lake would be constant and inconsistent with the peaceful sounds of the surrounding forests. Make-up wells would be drilled throughout the summer months when recreation activities flourish. The silence of the snowbound winters would be shattered by the endless 24-7 drone of the power plant turbines along with well venting and maintenance activities. Noisy wintertime sno-cats hauling men and equipment to and from the power plants would not only assault the auditory senses but would interrupt wildlife patterns as well.

RECREATION LOSSES:

The **PEIS pg. ES-7** claims that there would be *some loss of recreation opportunities from energy infrastructure although new roads could provide access for additional recreation opportunities.* At the Fourmile Hill Geothermal Project, the public was threatened with prosecution and jail time if caught trespassing on the Project roadways. The roads at *the Geysers* in Lake and Sonoma County, California are not open to the public. New roads associated with geothermal development will not likely provide for public access or enhance recreational opportunities. Hunting, hiking and site-seeing, that was once the norm on public lands will now be restricted by geothermal developments and by developers who consider public access *trespassing* as well as a safety liability.

O-55-10

GROUND WATER IMPACTS:

The **PEIS pg. ES-7** claims *short-term impacts to ground water during drilling*. Geothermal drilling is the foundation of geothermal exploration and development. Drilling is the main component of geothermal development. As old wells peter-out, new make-up wells are drilled to maintain sufficient steam supplies to keep the power plant generating. Millions upon millions of gallons of ground water are needed for both drilling and power plant operations. Geothermal drilling and development demands in-depth analysis of water useage.

O-55-11

PEIS pg. 4-40, Vol.1 quote, "Substantially depleted groundwater supplies or interfered substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level; "or "Resulted in uses or facilities that would substantially degrade surface or groundwater quality;" or "Resulted in changing conditions so that the geothermal resource itself was degraded."

PEIS pg. 4-43, Vol.1 quote, "There is a moderate risk for moderate to high impacts on groundwater supplies from the use of groundwater for geothermal activities."

PEIS pg.4-45, Vol.1 states, "withdrawing shallow groundwater or surface water for cooling purposes could affect nearby springs."

The only groundwater in the Medicine Lake Highlands is found in the Medicine Lake caldera. The caldera's shallow fresh water aquifer is also connected to the surface waters of Medicine Lake, Little Medicine Lake, Bullseye Lake, Blanche Lake and Paynes Springs.

All of the lakes and springs in the caldera, including the fresh water aquifer, are recharged by yearly snowfall. Because Medicine Lake and the freshwater aquifer are directly related, geothermal drilling and development will have a distinct and significant impact upon the groundwater and the water levels of the lakes and springs.

California's continuing drought has vastly affected the water level of Medicine Lake, dropping the lake level to near record lows. The drought has also affected water levels in the shallow groundwater aquifer, which in turn has adversely affected the local cabin owner's water well levels.

The proposed dual flash power plants for the Medicine Lake Highlands have a significant potential to deplete the groundwater as well as change the surface and spring waters throughout the caldera; in depth analysis and mitigation measures must focus on eliminating these impacts.

The Geysers have incorporated and now depend on nearby city sewage treatment plants to replenish their dwindling geothermal resources via waste water pipelines. The Medicine Lake Highlands does not have any large suburban populations to draw waste water from for steam resource regeneration. The closest water supply, beyond Medicine Lake, lies to the north in the Klamath Basin where a continuing battle over water rights issues is being waged by local farmers, the fishing industry and Native Americans.

To protect the West's vital watersheds, lakes, rivers and springs the PEIS needs to incorporate in-depth hydrological studies and analysis to fully determine the impacts of geothermal development upon those resources.

AIR EMISSION INCREASES:
The **PEIS pg. ES-7** makes vague claims that *the only time that air emissions will increase is during the drilling and construction phases of geothermal developments*. The PEIS fails to disclose that the projected 480MW power plant capacity of the Medicine Lake Highlands, translates into the construction of ten 48MW power plants in a 7 year span. And the PEIS also fails to mention that each power plant requires make-up wells be drilled to supply new steam resources to the power plants, usually on an annual basis. O-55-12

Ten power plants and numerous drilling rigs spewing toxin laced steam and polluting emissions into the Highlands, once pure atmosphere, could adversely affect the two Class 1 Air Sheds that are located in Lava Beds National Monument, 10 miles to the north.

Geothermal exploration activities, especially during drilling and well testing, regularly requires the venting of highly toxic emissions into the atmosphere which include geothermal gases, steams and brines which have been reported to cause adverse environmental and human health impacts. Construction expansions, periodic maintenance and facility upgrades of the power plants, pipelines and production/injection wells often result in toxic emissions and geothermal fluid releases into the surrounding environment, None of these impacts are analyzed in the PEIS.

CUMULATIVE IMPACTS:
PEIS pg ES-7-8 says that *degradation would occur but it would be relatively minor*. With the proposed fast-tracking PEIS leasing changes, by 2015, less than 7 years, the peaceful and pristine Medicine Lake Highlands recreation area could be transformed into an industrial wasteland by ten 49 MW geothermal power plants producing some 480MW. The degradation will hardly be minor; the cumulative impacts will be long-term, adverse and significant. Cattle won't even be safe grazing there (pg.ES-8). O-55-13

ENHANCED GEOTHERMAL SYSTEMS: (Pg.1-9, vol.1)
The use of Enhanced Geothermal Systems (EGS) should be prohibited until verified technology, research and development proves it to be a safe practice. Calpine Corporation has proposed using the highly controversial and experimental EGS acid process to stimulate the meager stream resource in the Medicine Lake Highlands. Calpine basically proposed to inject a 50,000 gallon cocktail containing extremely toxic hydrofluoric and hydrochloric acids into a production well, that hadn't been used in 20 years, in the hopes of stimulating the insufficient steam resource. O-55-14

The questionable EGS process may be an acceptable practice in 3rd world countries where environmental protection is not an issue, but not in the US, not in the Highlands and not in a 20 year old production well whose casing has been ravished by time and the elements. The direct risks and significant impacts of the EGS acid process are little known and the Medicine Lake Highlands and other sensitive environments should not be a testing ground for them.

EGS requires NEPA analysis and can not be tiered to this PEIS because its impacts have not been analyzed in this document.

SOCIOECONOMIC IMPACTS:
The socioeconomic impact is one-sided in favor of the geothermal industry. It does not analyze the cost to our public lands or the impacts it will have on established recreation areas. It doesn't mention rural communities or counties that depend on recreation income and how industry could effect change. The remote Medicine Lake recreation area has no services…no gas stations, no stores, no restaurants and neither telephone nor electric service. User's totally depends on the surrounding communities, located 25-50 miles away, to provide services. Recreation is the mainstay of Siskiyou and Modoc Counties, the remote Highlands recreation values are an asset to county coffers. O-55-15

Economic feasibility studies (un-biased) need to be analyzed in the Final PEIS.

WILDERNESS /ROADLESS AREAS:
The PEIS will be used to amend the agencies land use plans and it will be tiered to analyze specific projects. Wilderness and Roadless areas must be excluded from geothermal leasing and development. If not closed to leasing and development the Mount Hoffman Roadless Area in the Medicine Lake Highlands will be violated and dissected by the proposed and preferred geothermal transmission line corridor. O-55-16

RECLAMATION AND ABONDONMENT: PG. 4-6, VOL.1
All disturbed lands would be reclaimed in accordance with BLM and FS standards, and land uses and activities could resume. It's been over 20 years, many abandoned drill sites are scattered across the Medicine Lake Highlands, littering the forest landscapes with old well heads, oozing sumps and rusting debris, what standards actually exist for reclamation? Who is responsible or cares about enforcing agency standards? O-55-17

The Final PEIS needs to address financial bonding for reclamation that reflects prevailing expenses that adjust for inflation throughout a projects lifetime.

ALTERNATIVES:
The Draft PEIS really only gives us two alternatives, B&C. Alternative A is not an alternative, but simply a means to compare the action alternatives B&C. The Final PEIS needs to analyze a broader set of alternatives. There is a huge spread between A, *No Action* and B, *192 MILLION ACRES!* O-55-18

Alternative B should not be chosen because of the vast acreage that would be affected without adequate environmental review or protection for places such as the Medicine Lake Highlands or *other* special lands. O-55-19

Alternative C would be somewhat less harmful to the western environment than Alternative B, because fewer acres would be impacted by geothermal leasing and indirect geothermal development. Even though Alternative C limits leasing to a 20 mile corridor, 10 miles from centerline from existing transmission lines, it still does not protect *other* places and special lands from development. O-55-20

……………………………………………………………………………………………….

The Medicine Lake Highlands should never become a geothermal testing ground, sacrificed by new geothermal leasing rules and regulations that allow for controversial and experimental exploration and development practices; geothermal practices and projects that are driven by hefty state and federal subsidies; subsidies for a *questionable renewable energy* source that will <u>never</u> be *the silver bullet* for our country's seemingly insatiable energy appetite. O-55-21

The Medicine Lake Highland's remote and pristine forests and lakes should be preserved for generations to come. The Highlands are steeped in cultural history and abound with sacred sites that are honored by countless Native Americans. The Highlands vast recreational qualities draw thousands of visitors annually enjoying camping, hiking, picnicking, fishing, hunting, scenic vistas or observing the wildlife and botanical species which flourish there. The Medicine Lake Highlands must be closed to controversial geothermal leasing and development forever.

Thank you again for the opportunity to comment on this important PEIS leasing issue. Please keep our group on your information mailing list. We are incorporating by reference any and all comment made by the Mount Shasta Bioregional Ecology Center, the Pit River Tribe and the Stanford Environmental Law Clinic.

Sincerely,

Janie Painter

Janie Painter, chair
Medicine Lake Citizens for Quality Environment/Save Medicine Lake Coalition

Cc:
Debbie Sivas, Stanford Environmental Law Clinic
Kyle Haines, Klamath Forest Alliance
Mike Fitzwater, Fall River Wild Trout Foundation
Michelle Berditschevsky, Pit River Tribe
Peggy Risch, Mount Shasta Bioregional Ecology Center
Laurence Crabtree, USFS, Modoc National Forest
Tim Burke, BLM, Alturas Field Office

O-55-1

As described in Section 2.2.2 *Procedures Prior to Leasing*, prior to inclusion of a lease in a competitive bidding process, the BLM or FS would review the lease area for sensitive resources and would provide the necessary stipulations to protect these resources.

O-55-2

The comment is noted.

O-55-3

There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis.

O-55-4

The authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

It is also important to note that lands allocated as open are subject to existing laws, regulations, and formal orders, which could prohibit some lands from leasing.

The text in Section 4.1.1 has been corrected. As noted in Section 1.11.1 *BLM Decisions to be Made Following Subsequent NEPA Analysis*, "…the issuance of a lease does not give the lessee the right to proceed with exploration or development (i.e., any surface-disturbing activities beyond casual use) in the absence of further site-specific permits with associated environmental analysis." As discussed in Section 1.5.1, geothermal leasing is guided by law (e.g., Geothermal Steam Act) and regulations, including the recently revised geothermal leasing and development regulations (43 CFR 3000, 32000, and 3280). The PEIS is not proposing to amend or change any of the laws or regulations.

O-55-5

As noted in the sources for Table 2-7, the RFD relied on the findings of research by the Department of Energy and a Western Governor's Task Force on geothermal resources, which included experts from government agencies, academia, industry, and research organizations.

O-55-6

Alternative C was analyzed based on existing transmission lines, not on those proposed in the West-Wide corridor EIS.

O-55-7

Disturbance footprints from any given geothermal development vary based on the technology, the location and distribution of the geothermal and hydrological resources, the climate, and many other factors. The RFD in the PEIS is based on a literature review and collaboration with geothermal development experts to contain an average expected range of disturbance.

O-55-8

The comment is noted.

O-55-9

Thank you for your comment. We have included a statement in the Executive Summary and in Chapter 4 to clarify potential changes to noise characteristics in remote areas.

O-55-10

The resource uses compatible with geothermal use are likely to vary depending on site-specific conditions. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

O-55-11

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including surface water, groundwater, and water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed, as necessary.

O-55-12

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

See Section 4.8.3 for the discussion of air quality impacts for all stages of leasing and development.

Although it is occasionally necessary to drill additional wells after a plant goes online, each well would be subject to additional environmental review and state air quality permitting requirements, including mitigation and monitoring, as appropriate.

O-55-13

As stated in the above responses, prior to inclusion of a lease in a competitive bidding process, the BLM or FS would review the lease area for sensitive resources and would provide the necessary stipulations to protect these resources.

O-55-14

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site: therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1 *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

O-55-15

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-55-16

As discussed under Section 2.2.2, areas Congressionally designated as Wilderness Areas would likely be closed to leasing. Regarding roadless areas, the existing case law regarding the roadless rule is inconsistent. On August 12, 2008, the Wyoming District Court found the 2001 Roadless Rule violated NEPA and the Wilderness Act (*State of Wyoming v. US Department of Agriculture,* 07-CV-17-B, Wyoming District Court, Cheyenne, Wyoming [2008]). The District Court ordered the 2001 Roadless rule "set aside" and "permanently enjoined." This order is subsequent to a 2006 California District Court ruling that set aside the 2005 State Petitions Rule and reinstated the 2001 Roadless Rule. See *California ex re. Lockyer v. US Department of Agriculture*, 459 F.Supp.2d 874 (N.D. Cal 2006). The United States Justice Department, on behalf of the Department of Agriculture, has filed motions with both the Wyoming and California courts seeking adjustments of those courts' conflicting judicial orders. Neither the Wyoming nor California District Court rulings bar the Department of Agriculture from promulgating other roadless area regulations. To address this inconsistency, the PEIS includes the following Department of Agriculture Roadless Area Stipulation, "If future legislation or regulation change the roadless area designation, the restriction would be revised along with any appropriate environmental review." An appropriate NEPA review would be required prior to any changes to the Roadless Area Stipulation.

O-55-17

All reclamation activities would be subject to further site-specific permitting and environmental analysis. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages. BLM's new geothermal leasing regulations require bonding for exploration, building a well pad, drilling a well, and developing the resource. See 43 CFR subparts 3214 and 3215; 43 CFR 3251.14, 3261.18, and 3273.19. Under these regulations, bonds will not be released until BLM has determined that all wells are plugged and abandoned and the land is reclaimed.

O-55-18

In accordance with 40 CFR Section 1502.13, the purpose of and need for the proposed action is used to define a range of reasonable alternatives (purpose of and need for action is defined in Sections 1.2 and 1.3). The BLM is making an allocation decision here and adopting a list of stipulations, BMPs, and compliance procedures to be incorporated in the land use plans. The PEIS analyzes in detail the Proposed Action, a No Action alternative, and the Leasing Near Transmission lines alternative. The Final PEIS incorporates input from public comments on the Proposed Action. Another alternative considered but eliminated from detailed study included no leasing or development of geothermal resources on public or NFS lands (Section 2.4.1). As explained in Section 2.4.1, this alternative, which would have been the most protective (from a ground disturbance standpoint), was eliminated because it would violate the multiple use provisions of FLPMA and is inconsistent with the President's National Energy Policy, the Energy Policy Act of 2005, and Executive Order 13212 and would not have fulfilled the purpose and need for the proposed action.

The alternatives analyzed represent a range of acreages as potentially available for leasing. See CEQ's *Forty Most Asked Questions Concerning the CEQ's NEPA Regulations*, Question 1b ("When there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in the EIS.") In particular, the Leasing Near Transmission Lines alternative was developed based on public scoping comments to represent a limited development alternative. Instead of inventing a variety of alternatives that would lie between the alternatives presented, the BLM and FS elected to include protective measures (i.e., stipulations, BMPs, and compliance procedures) in each of the action alternatives. Further, those planning areas whose plans include more protective measures may elect to keep those measures in place, instead of the stipulations, BMPs, and compliance procedures presented in the Final PEIS.

O-55-19

The commentor's concerns about Alternative B are noted.

O-55-20

The commentor's preference for Alternative C and concerns about Alternative C are noted.

O-55-21

As stated in the responses above, prior to inclusion of a lease in a competitive bidding process, the BLM or FS would review the lease area for sensitive resources and would provide the necessary stipulations to protect these resources. This review would include consultation with appropriate Native American Tribal Governments, as necessary.

STATE OF ALASKA

SARAH PALIN, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

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September 19, 2008

Jack Peterson
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Re: Comments on BLM's Geothermal PEIS

Thank you for the opportunity to review and comment on BLM's Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (PEIS).

Governor Sarah Palin has expressed a strong commitment to exploring and developing alternative forms of energy in the State of Alaska, including geothermal power. She supports BLM's efforts to make geothermal sites on federally owned land available for geothermal development in a timely and efficient manner.

A-56-1

We support the recommended alternative B described in the PEIS as it pertains to Alaska, which facilitates making the maximum land available for leasing outside of the areas that are closed to geothermal leasing by laws, regulations or Executive Orders. We anticipate cooperating with your agency to identify specific sites with geothermal potential in Alaska and encouraging their development.

In addition, we support alternative B for pending lease application sites AK 084543, 084544 and 084545, located on Bell Island in the Tongass National Forest, with appropriate stipulations and protections. A-56-2

We appreciate BLM's movement toward addressing the backlog of pending geothermal applications and the initiation of a PEIS that will facilitate prompt adjudication of future applications on federal land. A-56-3

The state has consistently held the position that all ANCSA (d)(1) withdrawals should be revoked because the purposes for which they were withdrawn have long been met. State participation in the BLM land use planning process for BLM lands within the geothermal planning area in Alaska will continue to push for the revocation of the withdrawals and opening to mineral entry, including geothermal exploration and development. A-56-4

Sincerely,

Kevin Banks
Acting Director

Post-it® Fax Note 7671	Date 9/19/08 # of pages ▶ 2
To Jack Peterson	From Kathy Means
Co./Dept. EMPSi	Co. AK-DNR-Oil & Gas
Phone #	Phone # 907-269-8757
Fax # 1-866-625-0707	Fax # 907-269-8943

A-56-1

The commentor's support for Alternative B is recognized.

A-56-2

The commentor's support for the pending lease applications on Bell Island is noted.

A-56-3

The commentor's support for the PEIS is noted.

A-56-4

The comment is noted. Under the PEIS, lands withdrawn under Section 17(d)1 are identified as closed to geothermal leasing under non-discretionary closure.

NPS Letterhead

September 19, 2008

L2360

To: Director, Bureau of Land Management
Attn: Jack G. Peterson

From: /s/Acting Director Dan Wenk

Subject: Comments on Draft Programmatic Environmental Impact Statement for Geothermal Leasing in Eleven Western United States and Alaska

The National Park Service (NPS) has reviewed the subject document and offers the following general and detailed comments for your consideration. Please note that our detailed comments are set forth in Attachment 1.

The Draft Programmatic Environmental Impact Statement (PEIS) for Geothermal Leasing in the Eleven Western United States and Alaska was prepared in keeping with the requirements of the Energy Policy Act of 2005, which calls for increasing the availability of geothermal energy sources through a competitive lease sale process. To meet these requirements, the Bureau of Land Management (BLM) and U.S. Forest Service (USFS) will be amending numerous land use planning documents to allow for increased geothermal leasing.

Under the Geothermal Steam Act Amendments of 1988 (30 U.S.C. §1026), Congress identifies sixteen units of the National Park System that contain significant thermal features (see Attachment 2). In order to protect these features, Congress directs that the Secretary of the Interior must "determine based on scientific evidence if exploration, development or utilization of the lands subject to the lease application is reasonably likely to result in a significant adverse effect on a significant thermal feature within a unit of the National Park System." If it will, the Secretary "shall not issue such lease." [30 U.S.C. §1026(c)]. In addition, the 1988 Amendments direct that stipulations be included in leases and drilling permits to protect the noted park units in the event that development is only "reasonable likely to adversely affect" the designated significant thermal features [30 U.S.C. §1026(d)]. A-57-1

While the Draft PEIS properly does not analyze leasing in any unit of the National Park System, the Final PEIS needs to analyze the potential impacts of leasing outside twelve park units that contain designated significant thermal features in the study area of the Draft PEIS. Because the Draft PEIS does not address this statutory requirement, it identifies areas as open to leasing with stipulations when many of these areas should be identified as closed to leasing. The Draft PEIS also does not adequately address the need for stipulations in leases and permits to protect the A-57-2 twelve parks from adverse affects that are reasonably likely to occur. We ask that these two oversights be corrected before issuing the Final PEIS. The discussion in Attachment 1 under Crater Lake National Park illustrates the significant thermal features at risk, the state of the science, and why leasing adjacent to the park conflicts with the 1988 Amendments.

In addition to the special protection afforded certain park units under the 1988 Amendments, it is important to note that impacts to other park resources and values in all units of the National Park System located in the study area should be evaluated in the Final PEIS. The mission of the NPS is to protect units of the National Park System and to provide for their enjoyment in a manner that will leave them unimpaired for future generations. Because activities associated with geothermal development have the potential to adversely impact such areas, the BLM must take into consideration such impacts in light of the Secretary of the Interior's duties under the NPS Organic Act before issuing leases and approving site-specific projects. Among other things, the Organic Act directs that "[t]he authorization of activities shall be construed and the protection, management and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress." (16 U.S.C. §1a-1)

The NPS also urges the BLM and USFS to include in the Final PEIS an evaluation of potential impacts to a variety of other special status areas for which the NPS has some programmatic responsibilities. Such areas include properties on the National Register of Historic Places, National Historic Landmarks, National Natural Landmarks, National Trails, National Wild and Scenic Rivers, and lands acquired under the Land and Water Conservation Fund Program and Federal Lands to Parks Program. A-57-3

To ensure that the congressionally designated significant geothermal features in park units are protected, and opportunities to mitigate impacts to thermal features in other park units and are factored into leasing decisions, we would like to arrange a meeting of experts from our bureaus along with experts at USGS. The meeting would be a means for identifying needed research, monitoring techniques and protection measures. We also think it would be advantageous for our two bureaus, along with USGS, to enter into a Memorandum of Agreement on how we will engage each other in carrying out the provisions of the 1988 Amendments. Kerry Moss of the NPS Geologic Resources Division will be contacting Bureau staff shortly. He can be reached at 303-969-2634 or by e-mail at kerry_moss@nps.gov. A-57-4

Attachments

ATTACHMENT 1

NPS Comments on Draft Programmatic Environmental Impact Statement for Geothermal Leasing in Eleven Western United States and Alaska

I. Overall Comments

NPS Units With Designated Significant Thermal Features

The Final DEIS needs to contain a table and a map that depict the location of designated significant thermal features in park units under the 1988 Amendments. As a sample, the table below lists six units of the National Park System in Alaska and their designated significant geothermal features. Most of these are volcanoes and associated features, which are being monitored by the USGS. At present, many of the potential geothermal lease areas indicated in the Draft PEIS overlap park units with designated significant thermal features which could lead prospective lessee to explore near lands administered by the NPS that should be off limits from exploration and leasing by statute. A-57-5

GEOTHERMAL FEATURES IN UNITS OF THE NATIONAL PARK SYSTEM IN ALASKA

PARK	**DGGS Site #**	**GEOTHERMAL FEATURE TYPE**	**LOCATION**
ANIA	AA-34	Warm Mineral Springs, 23ºC	West of Surprise Lake in Aniakchak Caldera, 56º55’43”N by 158º06’00”W. Aniakchak Crater erupted in 1930s.
BELA	NC-3	Serpentine Hot Springs, 75ºC	Hot Springs Creek, 65º51’25”N by 164º42’33”W
GAAR	NC-15	Warm Springs,	Reed River warm springs (122ºF, 57ºC) @ 65º51’25”N by 164º42’33”W, Alatna River area warm springs @ 67º16”00N by 155º06’20”W, Lower Kugrak River warm springs @ 69º19”48”N by 144º02”38”W. (**Note:** these coordinates may not be correct.)
KATM	SC-3	Volcano, fumaroles @ 94 ºC	Mt. Martin @ 58 º10’N by 155 º21’W
	SC-4	Volcano, fumaroles	Mt. Mageik @ 58º 11’45” N by 155º 15’ 10”W
	SC-5	Volcano, fumaroles	Mt. Griggs @ 58º 21’15”N by 155º 05’ 30”W
	SC-6	Volcano, fumaroles	Mt. Katmai @ 58º 15’44”N by 154º 58’ 31”W
	SC-7	Volcano, fumaroles @ 29 ºC	Trident Volcano @ 58º 14’ N by 155º 05’ W
	SC-8	Volcano, fumaroles @ 89 ºC	Snowy Mtn @ 58º 27’24”N by 154º 20’ 56”W
	SC-9	Volcano, fumaroles	Kukak Volcano @ 58º 20’09”N by 154º 40’ 12”W
		Volcano, fumaroles	Four-peaked Mtn, recently reactivated
	SC-10	Volcano, fumaroles @ 93ºC	Mt. Douglas @ 58º 51’31”N by 153º 32’ 34”W
LACL	SC-12	Volcanoes	Mt. Iliamna, with steaming fumaroles, @

			.60º01’57”N by 53º05’24”W.
	SC-13		Mt. Redoubt, erupted in 1989/90 @ 60º29’15”N by 152º44’30”W.
WRST	SC-18	Volcano	Mt Wrangell, 86ºC fumaroles @ North Crater @ 61º59’34”N by 144º01’16”W.
	SC-19	Copper Glacier Warm Springs	20ºC @ 62º05’22”N by 143º48’22”W
	SC-17	Upper Klawasi mud volcanoes,	17 ºC on flanks of Mt. Drum @ 62º 04’ 52”N by 145º 00’ 17”W. (**Note** these features are entirely within Ahtna Native Regional Corporation lands with private lands between these features and the power grid near Glennallen, AK. NPS does not have jurisdiction over these lands and features.)
		Lower Klawasi mud volcanoes	20 ºC @ 62º 03’ 27”N by 145º 13’ 20”W

Data from oversized Map “Geothermal Resources of Alaska, 1983” by the Division of Geological and Geophysical Surveys, Alaska Department of Natural Resources, @ http://www.dggs.dnr.state.ak.us/webpubs/dggs/mp/oversized/mp008_sh001.PDF

Regarding the evaluation of subsistence uses for the Alaska leases, we note that the Draft PEIS at 1.13.16 identifies the requirement; however, evaluations for these leases are not included or otherwise referenced in the Draft PEIS. The usual practice in Alaska is to attach the ANILCA Section 810(a) subsistence evaluation as an Appendix. We recommend that the Final PEIS do this as well. A-57-6

Chapter 1

As previously mentioned, the Geothermal Steam Act at 30 U.S.C. §1026(c)(1) prohibits leasing of lands where the Secretary has determined that development is “reasonably likely to result in a significant adverse effect” on a statutorily designated significant thermal feature within 16 units of the National Park System. Twelve of the 16 units exist in the study area of the Draft PEIS. The Draft PEIS properly identifies this as one of the statutory prohibitions in Chapter 1.5.2, but there is no further description of how and when a determination will be made, what areas it may apply to, or how the NPS will be engaged in such determinations. This Congressional requirement establishes additional restrictions that need to be incorporated in the Final PEIS. There are many areas of BLM and USFS lands surrounding designated significant thermal features in park units where development may result in a significant adverse effect even with mitigation. These areas, by statute, must not be leased. In 1998, BLM revised its federal geothermal leasing regulations at 43 CFR Part 3200 to incorporate the statutory direction contained in the 1988 Amendments. A-57-7

Unfortunately, in most cases, insufficient studies have been conducted to date to aid in making the determination called for under the 1988 Amendments. In the face of this lack of data, it is important that the BLM exercise caution and err on the side of protecting the statutorily designated thermal features in the noted park units. A case in point is the inconclusive findings of a 1991 USGS study in which USGS evaluated the potential for geothermal development in the Corwin Springs, Montana area north of Yellowstone National Park impacting Mammoth Hot Springs located five to ten miles inside the park boundary (1991, Sorey, U.S. Geological Survey A-57-8

WRIR 91-4052). While this report concludes that larger scale developments could impact the Mammoth Hot Springs, it cites a lack of sufficient data with which to draw conclusions with more certainty. Given that all of Yellowstone National Park is designated as a significant thermal feature, this study points to the need for extreme caution in issuing leases outside this park. As a result, the Final PEIS needs to address this uncertainty at Yellowstone National Park and the other 11 park units.

For the Yellowstone Controlled Groundwater Area designation (1994, Water Rights Compact State of Montana and National Park Service, MCA 85-20-401), national, state and local geothermal and hydrogeological experts conducted a regional assessment. The experts were directed to delineate the area where there was any potential for water well development to affect the geothermal system within the boundary of the park. While this study is instructive, it is inconclusive with regard to the impacts that could emanate into Yellowstone National Park from geothermal development outside the park. It is important to note that the water well study did not consider release of pressure or cooling of rock via dry thermal system development, concerns that would be of issue in geothermal development. A-57-9

<u>Chapter 2</u>

The proposed action, as stated in Chapter 2.2, includes the identification of areas that are open to leasing with possible moderate to major constraints and areas that are closed to leasing. In Chapter 2.2.1., the Draft PEIS further describes non-discretionary closed areas to include lands within congressionally designated areas such as park units and wilderness areas. In Chapter 2.2.1., closed lands also include areas that could be closed based on BLM and USFS administrative discretion such as ACECs, NLCS, etc. Given the explicit language in the 1988 Amendments and BLM regulations, the Final PEIS needs to account for the non-discretionary closures required to protect the designated significant thermal features in park units. This area could be sizeable. As noted in our cover memorandum, the NPS will be following up with BLM and USGS experts to ensure that the special protection afforded park units under the 1988 Amendments are properly carried out. A-57-10

<u>Chapter 4</u>

It is important to recognize that significant thermal features are only the uppermost portions of one or more geothermal flow systems driven by heat sources at depth. A geothermal flow system includes hydrologic recharge, transmission, heating, and discharge components. To adequately assess impacts to significant thermal features, all potential changes to this entire geothermal flow system must be considered as well as the degree to which that feature relies on said system. The NPS has some experience with this issue. For example, the NPS and the State of Montana jointly pursued scientific evidence to address the potential for impacts to significant thermal features at Yellowstone National Park from groundwater development which, like geothermal development, includes drilling and fluid withdrawal. The result of that effort was a report by an independent working group of geophysicists, geologists, and hydrogeologists (Working Group) experienced in studying geothermal systems. The Working Group examined literature and data on development and associated observed changes for geothermal systems world-wide (1993, Recommended Boundary for the Controlled Groundwater Area in Montana A-57-11 near Yellowstone National Park, Custer, Michels, Sill, Sonderegger, Weight, Woesnsner). The Working Group reported that direct impacts were observed commonly more than a mile away and in some instances up to 22 miles away from development sites. It concluded that the full scope of impacts would logically be over a much greater area than the one to 22 mile range observed. While the extent of impacts reported is stated in general terms and based on very limited data, the report indicates that significant thermal features are susceptible impacts from development at great distances.

If the geothermal flow system is altered, some attributes will likely not be restorable. For example, if the pressure in the system is lowered, air or fluid passageways will collapse and flow will be closed off. Once these passageways collapse, it is likely that restoring pressure will not reopen the passageways.

The Draft PEIS states that no impacts on Congressional designations are anticipated from geothermal exploration and development at 4.2.7. The stated basis for this is that the congressionally designated areas will not be leased so there will be no exploration and development activities within the designated areas. This conclusion is not supported by scientific study or in keeping with the statutory direction contained in the 1988 Amendments. Furthermore, as noted above, exploration and development activities on land adjacent to or even miles away from the park units with Congressional designated thermal features could cause significant impacts to those features. This oversight needs to be corrected in the Final DEIS.

Crater Lake National Park

Crater Lake, our nation's deepest and clearest body of water, is vulnerable to impacts from geothermal development. The 1988 Amendments designate Crater Lake National Park as a unit of the National Park System that possesses significant thermal features. On the floor of Crater Lake, hydrothermal vents pump chemically rich water into the lake ecosystem. Not only are these geothermal features special natural resources in their own right, but research indicates that the features contribute significantly to the chemical balance and function of the Lake's complex ecosystem.

Subterranean and subaqueous geothermal resources by their nature are relatively little understood in terms of their extent, function and connectivity. Confounding this inherent uncertainty, the geothermal resources at Crater Lake are found at extreme depths of nearly 2000 feet below the lake surface. Consequently, research directed at understanding their extent and function and monitoring their condition is extremely difficult and costly. A-57-12

Based on the Draft PEIS maps of the potential areas for lease, U.S. Forest Service lands immediately adjacent to Crater Lake National Park appear would be open to lease even though scientific research does not support such a conclusion. Given the known significance of hydrothermal contributions to the integrity of the Crater Lake ecosystem as well as the unknown connectivity of these systems to areas beyond the park's boundary, the Final PEIS needs to ensure that the statutory duty to protect the vulnerable resources of Crater Lake is carried out. If scientific research does not indicate that stipulations will conclusively protect the surface and subterranean or sub aqueous geothermal features at Crater Lake National Park, then the area around the park may not be leased for geothermal development. This decision rule also applies with regard to the other park units with designated significant thermal features under the 1988 Amendments. New research and techniques may lead to a different conclusion in the future.

National Historic Trails and National Scenic Trails

We are pleased overall with the consideration given in the Draft PEIS to National Historic Trails and National Scenic Trails on public lands managed by the BLM and the USFS. The proposed closure of public lands to geothermal leasing within a one-mile radius from the centerline of trails recognizes the incompatibility of energy extraction with the recreational and educational use of trails. As the Draft PEIS appropriately notes, however, resources important to a National Historic or Scenic Trail often extend past a one-mile radius of the trail. We support the BLM and USFS proposal in the Draft PEIS to require further protection of the National Trails with sensitive viewsheds through lease stipulations. We also ask that protection also be afforded to the other special status areas for which the NPS has some programmatic responsibilities. Such areas include properties on the National Register of Historic Places, National Historic Landmarks, National Natural Landmarks, National Trails, National Wild and Scenic Rivers, and lands acquired under the Land and Water Conservation Fund Program and Federal Lands to Parks Program. A-57-13

Since site-specific details are not provided in the Draft PEIS, it is not clear to the NPS which segments of the Lewis and Clark National Historic Trail (Lewis and Clark Trail) are within the planning area and which segments are removed from potential leasing. It appears that the length of the Lewis and Clark Trail within the project and planning areas may not be accurate in the Draft PEIS. Due to the small scale of the maps that are provided in the Draft PEIS, we cannot fairly assess the accuracy of the Lewis and Clark Trail's location and length in the planning area. Better maps with more detailed geographical information would be helpful. NPS staff is available to help with this task. A-57-14

Impacts of transmission lines on the viewshed and other resources associated within the National Trails are not adequately discussed in the Draft PEIS. We found only one direct reference to this aspect of geothermal development in the Draft PEIS on page 4-127 which states, "Long-term impacts on national scenic and historic trails would result from construction of [electrical transmission lines] within the route or historic landscape of the affected trail." The Best Management Practices (BMPs) in Appendix D appear to apply only to the geothermal sites, and not to any related transmission lines. We recommend that the Final PEIS include an analysis of the potential effects of transmission lines associated with geothermal leasing as well as identification and discussion of BMPs for transmission lines. A-57-15

The Draft PEIS acknowledges that a wide range of impacts may occur to natural resources, many of which will be localized to the development site. Stipulations and BMPs are proposed to reduce the possible introduction of invasive species, protect critical habitat for threatened and endangered species, and protect wetland and aquatic resources. While thoughtful consideration of a wide range of concerns associated with extractive use of resources on public lands was presented in the Draft PEIS, we note that site-specific environmental analysis is required under the National Environmental Policy Act. Therefore, we ask that the NPS be specifically engaged in reviewing site-specific leasing areas before the BLM issue leases. A-57-16

II. Page-Specific Comments

Page 2-6, Section 2.2.1 – This section states that "[t]he BLM and FS have determined that certain lands within the planning area are excluded from geothermal leasing on the basis of existing laws, regulations (see 43 CFR §3201.11), and Executive Orders. These non-discretionary closures include the following lands:" This list should include the phrase "all units of the National Park System." A-57-17

Page 2-12, Figure 2-6 – In the Final PEIS, this map figure and other map figures elsewhere in the document need to clearly indicate the location of National Park System units and other federal areas closed to geothermal leasing within the geothermal potential areas, including areas around park units with designated significant thermal features. This would help prospective lessees to readily identify areas available for exploration and potential development. A-57-18

Page 2-47, Sec 2.5.1 – This paragraph states that "…production of geothermal fluids could be expected to vary widely from one to six million gallons per well, per day. Assuming five million gallons per day per well as an average production figure, a lease with two producing wells would produce 10 million gallons of fluid per day... In flash steam facilities about 15-20 percent of the fluid would be lost due to flashing to steam and evaporation through cooling towers and ponds." Assuming continuous pumping, five million gallons per day for each well equals about 3470 gallons per minute. A loss rate of 20 percent through flashing, evaporation, etc. will result in a depletion to the groundwater aquifer of about three acre-feet per day per well. The Final PEIS needs to indicated that an analysis is needed as to the implications that of a loss of three acre-feet per day will have on hydrologic resources on-site and on adjacent areas and whether water rights may be affected. A-57-19

Page 3-3, Section 3.2.1, 2nd to last sentence – Insert "USNPS" before USFWS. A-57-20

Page 4-4, Section 4.2.2, 2nd Bullet – We recommend inserting "(e.g., areas that could adversely affect designated significant thermal features in units of the National Park System.)" A-57-21

Page 4-5, Section 4.2.3 – The Draft PEIS states that "[a]ccording to the RFD scenario, it is estimated that 110 power plants could be constructed by 2015, and another 132 power plants could be constructed by 2025." This schedule would require the construction of more than one power plant per month. This scenario does not sound realistic and should be confirmed or revised in the Final PEIS. A-57-22

Page 4-18, Section 4.3.1 – The NPS believes similar comments could be made about protecting volcanic fumaroles and warm/hot springs in Alaska National Park System units as were made about the Yellowstone region. The Final PEIS needs to reflect a decision rule that areas around park units listed at 30 U.S.C. §1026(a) will not be available for lease until the proper studies have been conducted and needed mitigation identified to ensure the protection of the significant thermal features in those parks as required by law. A-57-23

Page 4-19, Section 4.3.3. Paragraph 1 – This paragraph and perhaps other sections in the Draft EIS refer to protecting geological features in national park and national monument areas. This A-57-24 language should be revised to replace “national park” with units of the National Park System. This change needs to be made throughout the Final PEIS. In addition, the Final PEIS needs to indicate that under the 1988 Amendments geothermal leases may only be issued adjacent to park units with designated significant thermal features if the Secretary of the Interior can determine based on scientific evidence that such development would not cause significant impacts to those features.

Page 5-18 (Sec 5.4) – This section states that “[t]he magnitude of actions on public and NFS [national forest service] lands considered in this analysis is great, information about how many future projects may actually be undertaken is lacking, and information about the likely locations of future development is unknown. As such, the cumulative effects discussed in this section are general in nature.” The NPS understands that this is a programmatic EIS; however, if large numbers of projects are contemplated using the Final PEIS, then some effort needs to be made to determine the cumulative effect of that large number of projects. This information is important in light of language included in the 1988 Amendments that requires the protection of designated significant thermal resources in parks units from federal geothermal leasing and site-specific development. A-57-25

A-57-1

The BLM and FS are committed to working with the NPS to avoid adverse impacts to thermal features within NPS units. The language in Section 1.5.4 *Environmental Review Requirements Prior to Leasing* has been revised to clarify further that the BLM is prohibited from geothermal leasing on NPS lands as well as on lands where the Secretary has determined that geothermal operations are reasonably likely to result in a "significant adverse effect on a significant thermal feature" in a unit of the NPS. In addition, a list of the 12 units of the NPS with significant thermal features that occur in the study areas is now included.

Prior to inclusion of any specific parcels in a lease sale, the BLM and FS would coordinate with the NPS to determine if there would be any impacts to thermal or hydrological features within NPS units in proximity to a proposed lease. Language has been added to Section 2.2.2 *Procedures Prior to Leasing* to reiterate this point.

In addition, should development be determined to be reasonably likely to have an "adverse effect" on a significant thermal feature, the BLM would include appropriate lease stipulations to protect the park unit.

If it is determined in advance of leasing that exploration, development, or utilization of the lease parcel would "reasonably likely result in a significant adverse effect on a significant thermal feature of a National Park System unit," then the lease would not be issued (30 USC Section 1026[c]). While preexisting leases and permits are beyond the scope of this PEIS, the statute also provides that if it is determined that use of an existing lease or permit would be "reasonably likely to adversely affect" any significant thermal feature within a National Park System unit, then stipulations are included on leases and permits to protect the thermal features (30 USC Section 1026 [c][d]).

A-57-2

As stated in the above responses, language has been added to the Final PEIS to specify that the BLM is prohibited from geothermal leasing on NPS lands as well as on lands where the Secretary has determined that geothermal operations are reasonably likely to result in a "significant adverse effect on a significant thermal feature" in a unit of the NPS.

A-57-3

As noted in Chapter 2, the Proposed Action affords protection to sensitive areas. For example, designated wild rivers are closed to leasing, while designated scenic and recreational rivers, and river segments determined to be potentially eligible for Wild and Scenic River status, would have a NSO stipulation. Likewise, National Register of Historic Places, National Landmarks, and National Register Districts would have an NSO stipulation (see Section 2.2.2 of the PEIS).

A-57-4

The BLM welcomes collaborative discussions.

A-57-5

The NPS lands have been added to the appropriate figures and noted as being closed to geothermal leasing. The listing of the NPS units with significant thermal features has been added to Chapter 1.

A-57-6

In Chapter 2, *Procedures Prior to Leasing*, the PEIS notes the following: "During the processing of any lease nomination or application in Alaska, the authorized officer of the BLM or FS would conduct a site-specific analysis of the effects of the lease on subsistence uses and needs in accordance with Section 810(a) of the ANILCA." At the programmatic level, it is uncertain what areas in Alaska would receive lease applications or nomination, so conducting a subsistence analysis in the PEIS would be too general for the intent of 810(a).

A-57-7

Language has been added to the document to further clarify that the PEIS is in accordance with the statutory direction in the 1988 amendments.

Please see response to comment A-57-1.

A-57-8

Please see response to comment A-51-1.

As stated above, additional language has been added to the PEIS to clarify that the BLM will avoid adverse impacts to thermal features within NPS units.

A-57-9

Given that impacts on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for NPS lands.

A-57-10

Additional text has been added in Chapter 1 explaining the requirements of the Geothermal Steam Act Amendments. In Chapter 2 under *Procedures for Leasing*, additional text has been added clarifying that the BLM and FS will coordinate with the NPS and conduct the necessary review to make a determination of potential impacts to any significant thermal features in a NPS unit.

A-57-11

As stated in the above responses, language has been added to the PEIS to clarify that if it is determined in advance of leasing that exploration, development, or utilization of the lease parcel would "reasonably likely result in a significant adverse effect on a significant thermal feature of a National Park System unit," then the lease would not be issued (30 USC Section 1026[c]). In addition, if it is determined that use of an existing lease or permit would be "reasonably likely to adversely affect" any significant thermal feature within a National Park System unit, then stipulations are included on leases and permits to protect the thermal features (30 USC Section 1026 [c][d]).

A-57-12

Please see the above response.

A-57-13

As noted in Chapter 2, the Proposed Action affords protection to sensitive areas. For example, designated wild rivers are closed to leasing, while designated scenic and recreational rivers, and river segments determined to be potentially eligible for Wild and Scenic River status, would have a NSO stipulation. Likewise, National Register of Historic Places, National Landmarks, and National Register Districts would have an NSO stipulation (see Section 2.2.2 of the PEIS).

A-57-14

While attempts were made to accurately portray trail locations and alternate routes, the broad-scale figures provided in the PEIS are for illustrative purposes and should not be used to assess any site-specific actions or protections. The NPS should coordinate with those FS and BLM jurisdictions managing trail resources that would benefit from more detailed mapping and could contribute to assessments of trail locations and condition.

A-57-15

BMPs that discuss the impacts on trails have been checked and revised for consistency and to explicitly address the visual impacts of transmission lines.

A-57-16

Prior to inclusion of any specific parcels in a lease sale, the BLM and FS would review the lands for sensitive resources and would provide for the necessary stipulations to protect these resources. In addition, the authorized officer would coordinate with the National Park Service to determine if there would be any impacts to thermal or hydrological features within NPS units in proximity to a proposed lease. Language has been added to Section 2.2.2 *Procedures Prior to Leasing* to reiterate this point.

Furthermore, all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis.

A-57-17

Suggested text has been added to document.

A-57-18

Figures in Chapter 2 have been revised to clearly indicate that NPS lands are closed to leasing.

A-57-19

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1 *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. A statement to this effect has been added to the *Procedures Prior to Leasing* section. Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process.

As discussed in Section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see Section 1.5.1).

A-57-20

Language in the document has been revised, as requested.

A-57-21

Chapter 4-2 has separate analysis for land use, recreation and special designation areas. The following bullet in section 4.2.6 covers all special designation areas:

"result in proposed land uses that are incompatible with existing or adjacent special designation areas"

A-57-22

While perhaps optimistic, the projection is based on a collaborative effort, including the findings of a Western Governor's task force consisting of industry, academic experts, and governmental agencies.

A-57-23

Additional language has been added to the PEIS to clearly identify the protective measures for thermal features on NPS lands. See response to comment A-57-1.

A-57-24

The suggested change has been made.

The suggested NPS language from the 1988 amendment has been added to Chapters 1 and 2 in the Final PEIS.

A-57-25

Additional discussion has been added to the cumulative impact analysis. As noted in Chapter 5, past, present, and reasonably foreseeable actions, including commercial uses of public and federal lands, are documented and analyzed.

THE WILDERNESS SOCIETY

September 19, 2008

Delivered via electronic mail (geothermal_EIS@blm.gov) and U.S. mail (with attachments)

Geothermal Programmatic EIS
c/o EMPSi
82 Howard Street, Suite 110
San Francisco, CA 94105

Re: Comments on the Draft Programmatic Environmental Impact Statement for Geothermal Energy Leasing

To Whom It May Concern:

Please accept and fully consider these scoping comments on behalf of The Wilderness Society and the other organizations identified below. The Wilderness Society's more than 300,000 members and supporters nationwide care deeply about the management of our public lands. Founded in 1935, our mission is to protect wilderness and inspire Americans to care for our wild places. We appreciate the opportunity to submit these comments to the Bureau of Land Management and Forest Service on the Programmatic Environmental Impact Statement (PEIS) for Geothermal Energy. We are submitting these comments today via electronic mail and also forwarding a copy with attachments to you separately.

We support development of clean, renewable energy resources because doing so promotes non-polluting, sustainable energy production that will benefit Americans and our public lands in the long term and encourages a move from a fossil fuels-based economy to a renewables-based economy. While we recognize geothermal energy can contribute to a clean energy economy and reduction of greenhouse gas emissions, like all energy production on public lands, geothermal resources must be developed responsibly and in a sustainable manner. This is of special importance in the western states which comprise the planning area, where water is a finite resource and becoming evermore so due to global warming. We must take precautions so that developing geothermal energy does not exacerbate the very problem that it has the potential to mitigate. If properly sited, geothermal energy can make a valuable contribution to our energy supply.

Geothermal energy development is an essential component of a renewable energy portfolio. As the PEIS states, there are potentially 12,000 MW of this resource in the planning area that are viable for commercial development by 2025. In Nevada alone, there are present-day requests of nearly 1,500 MW of geothermal energy seeking grid interconnection. Consequently, geothermal will play in increasingly important role in meeting both immediate and future western energy needs. As a renewable energy resource, geothermal energy stands alone as a “baseload” resource and has a very high (80% plus) “capacity factor” – meaning that commercial geothermal facilities produce power that can be consistently relied upon. Megawatt for megawatt, therefore, geothermal has the immediate capacity to replace energy coming from coal-fired power plants. Geothermal can also facilitate development of wind and solar resources, serving as a needed back-up or operating reserve to cover contingencies (i.e., when the wind is not blowing or the sun is not shining) and combining with these resources to use more transmission line capacity (wind and solar generally use only 50% or less of total transfer capacity), which ultimately lowers transmission costs for renewable energy.

In the spirit of assisting the agencies with responsible development of this important resource, we are raising two overarching concerns that are of particular relevance in this programmatic study, for which we also proposed detailed solutions. First and foremost, programmatic environmental studies serve the best opportunity to address suitability issues – i.e., given lands and hydrology impacts associated with known geothermal technologies and the many uncertainties with unknown and emerging technologies, not all western public lands are appropriate for this type of energy development. Valuable public lands, including roadless areas and proposed wilderness, must be closed to geothermal leasing and development. Second, a programmatic EIS is the perfect opportunity to develop a thoughtful and consistent approach to leasing and permitting. The Draft PEIS would open 117 million acres of public lands to competitive leasing all at once; this is not an acceptable approach. This vast amount of acreage suggests that a rigorous suitability analysis has not been performed in the current study. Rather, the agencies should develop a uniform process for prioritizing lease applications and site-specific permits for lands considered suitable for this type of energy production.

By preventing unnecessary impacts and facilitating development in the *right* places and in the *best* ways, such an approach should actually *speed* responsible development by avoiding unnecessary conflicts. Further, such an approach would ensure that geothermal development on public lands will truly achieve the goals set for using renewable energy to transition away from fossil fuels and combat the negative impacts of climate change.

These and other concerns are detailed in the comments below.

I. Large-scale Geothermal Energy Leasing Requires Development of a Thoughtfully Designed Approach

A. The risks and unknowns specific to geothermal energy development require caution before rushing into a large-scale program

O-58-1

According to the Energy Information Association, there are currently roughly 2,400 megawatts (MW) of installed geothermal electricity generation in the western United States, less than 1% of total U.S. generation capacity. The Reasonably Foreseeable Development Scenario (RFD) for the Draft PEIS forecasts that within the planning area, 12,100 MW of geothermal potential are considered viable for commercial electrical generation in 242 power plants by 2025; the RFD further estimates direct use applications of 4,200 thermal MW by 2025. Such massive development of geothermal resources will no doubt have significant impacts to the public lands and their many resources. We believe development predicted on this scale warrants careful studies of the impacts to public lands, water and other affected natural resources prior to issuing leases.

While significant development of flash steam power plants has allowed analysis of impacts from this indirect use of geothermal resources, most of the geothermal power plants planned for construction in the U.S. are binary-cycle. Though impacts from binary-cycle plants do not appear to be radically different from flash steam plants, additional technologies are being developed that will require much greater analysis before their impacts can be understood. In particular, "co-produced geothermal fluids," also known as "produced water cut", and "enhanced geothermal systems" are emerging technologies whose impacts are relatively unknown. Development of these resources should not be done without close examination of potential risks and impacts, and if development does occur it should be done slowly, in a phased manner, to ensure ongoing study can identify and fix problems and issues which arise.

For new technologies such as enhanced geothermal systems, a cautious approach emphasizing monitoring and strategic development is critical. Though the Draft PEIS states that "It is anticipated that there may be applications for research and development drilling on public and NFS lands in the future. While it is a viable and proven technology, it is unlikely that it will be applied at a large scale in the western US within the next 20 years." Draft PEIS 1-9. The technological options have not been thoroughly tested in the US and requires further investigation to ensure that unacceptable impacts are avoided.

While Chapter 4 of the Draft PEIS examines the general types of impacts expected from geothermal development, the inability to predict future development scenarios, including types of development, timing and location will require additional site-specific analysis for individual leases and project applications.

<u>Recommendations</u>: Due to the projected scale of geothermal development and relative lack of knowledge of the impacts of such development, the agencies should approach geothermal development on public lands in a measured manner, using strategic development and monitoring, to ensure all impacts are minimized and mitigated and unacceptable impacts are avoided altogether. By "strategic" we mean that the locations with the highest potential resources coupled with the fewest environmental impacts are given priority, so that we encourage production while avoiding the most sensitive lands. In the case of new and developing technologies, research and development should be undertaken with caution and large-scale deployment of new technologies should only be done after sufficient analysis has been completed. Site-specific analysis of leases and project applications will also be necessary to address the particular impacts of future leases and projects. Overall, in addressing potential impacts to natural resources, the agencies should apply the "mitigation hierarchy" recommended by the Council on Environmental Quality of (1) avoid; (2) minimize; (3) reclaim/restore; (4) restore.

B. Geothermal development is not always renewable: water use of certain geothermal development systems demands in-depth analysis. O-58-2

> *Renewable energy resources are naturally replenishable, but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Some (such as geothermal and biomass) may be stock-limited in that stocks are depleted by use, but on a time scale of decades, or perhaps centuries, they can probably be replenished. Renewable energy resources include: biomass, hydro, geothermal, solar and wind.* (Source: http://www.websters-online-dictionary.org/RE/RENEWABLE_RESOURCES.html)

Because of water use, certain types of geothermal development are not "renewable" in the way that other renewable energy sources are. The Draft PEIS acknowledges that for flash steam facilities, "about 15-20 percent of the fluid would be lost due to flashing to steam and evaporation through cooling towers and ponds." Draft PEIS, p. 2-47. The Draft PEIS further addresses these impacts in Chapter 4, stating that potential impacts on water resources could occur if reasonably foreseeable actions were to result in "Substantially depleted groundwater supplies or interfered substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level;" or "Resulted in changing conditions so that the geothermal resource itself was degraded." Draft PEIS, p. 4-40. During drilling operations,

> **Extracting geothermal fluids could result in drawdowns in connected shallower groundwater aquifers, with the resulting potential to affect streams or springs that are connected to the water table aquifer**. The potential for these types of adverse impacts is reduced through extensive aquifer testing, which is the basis for designing the geothermal plant and for locating, designing, and operating the extraction and injection wells. Combined with the requirement to comply with state and federal regulations that protect water quality and with limitations imposed by water rights issued by the state engineer, the impacts on water quality and the potential for depleting water resources is expected to be minimized. **There is a medium risk for moderate to high impacts on groundwater supplies from the use of groundwater for geothermal activities**. Draft PEIS, p. 4-43 (emphasis added).

During utilization,

> Geothermal resource utilization could affect groundwater resources because of consumption of water by evaporation and the need to reinject water to replenish the geothermal reservoir. The magnitude of the effects would vary depending on groundwater conditions and availability within the basin and on the type of geothermal plant. Availability of water resources could be a limiting factor, affecting the expansion of geothermal resource development in a given area. Draft PEIS, p. 4-44.

The Draft PEIS further states that, "withdrawing shallow groundwater or surface water for cooling purposes could affect nearby springs." Draft PEIS, p.4-45.

Clearly, flash cycle plants have significant potential for depleting the water which is a critical component of the geothermal resource, limiting the "renewable" nature of this development. Further, all geothermal development has the potential for impacts to surface and groundwater quality and quantity, and analysis and mitigation must focus on limiting these impacts.

Recommendation: Because geothermal development can result in depletion of geothermal resources and water, if development conflicts occur between geothermal and wind or solar facilities, the impacts to water should be an important consideration in determining the best use of an area, as well as surface disturbance, so that renewable energy development with the lease impacts to resources that are present is given priority. The BLM and Forest Service should also prioritize binary cycle geothermal development over flash steam development to reduce the risk of depleting geothermal resources. The PEIS should specifically require additional site-specific analysis of potential impacts to geothermal and water resources of individual lease and project proposals.

C. Geothermal leasing and development should not be implemented in the same way as oil and gas leasing and development

O-58-3

The Draft PEIS repeatedly mentions the perceived similarities between oil and gas drilling and geothermal development and the intent of the agencies to rely on their experience with oil and gas development for fashioning their approach to managing geothermal energy development. The Draft PEIS states:

> BLM and FS have had a great deal more experience managing lands for development of oil and gas resources, and many more management plans address these resources. Development of oil and gas resources result in many of the same kinds of impacts as development of geothermal resources (e.g., surface disturbance resulting from the footprints of facilities, wells, pads and pipelines, as described in Section 2.5, Reasonably Foreseeable Development Scenario); therefore, BLM and FS have determined that it is appropriate to take an approach to development of geothermal resources similar to that taken to development of oil and gas resources. Areas that require protection from the effects of development of fluid resources are more likely to require protection from the similar effects of development of geothermal resources. Draft PEIS, p. 2-6.

In fact, for Areas of Critical Environmental Concern (ACECs), the agencies simply defer to the management approach for oil and gas development (Draft PEIS, p. 2-7), even though specific resources protected in individual ACECs vary widely and, as a result, the impacts of geothermal development on those resources will also vary. Analysis and management decisions specific to geothermal development are necessary.

Although similarities exist in the development and impacts of developing geothermal energy and oil and gas, there are also fundamental differences and opportunities. As discussed above and throughout these comments, the technologies used and still in development for geothermal energy often require significant amounts of water and can have different effects than oil and gas drilling. Also, while development of these energy sources can cause significant damage to other resources, such as wilderness qualities, wildlife, water, vegetation, and recreation opportunities, the agencies have already made major commitments to oil and gas leasing, and seen the devastating results to the public lands. The BLM and Forest Service should take the opportunity offered by this programmatic document to avoid the mistakes of the oil and gas program. Significant problems have beset the oil and gas program, including: inappropriate prioritization of leasing and drilling over all other resources and values; lack of adequate impacts analysis; failure to use the best available scientific research to inform management; insufficient monitoring and mitigation of impacts; inadequate leasing stipulations and Best Management Practices (BMPs) to protect other resources; abuse of exceptions and waivers from stipulations and BMPs; failure to employ true phased development; and inadequate bonding and reclamation. The failure to carefully plan, consider impacts and avoid damage to other resources and users of the public lands has resulted in serious conflict and devastating impacts to the public lands, as well as negative impacts to our economy and public health.

Geothermal development offers the opportunity to increase our national energy supplies while limiting greenhouse gas emissions and subsequent impacts from climate change. However, if the agencies do not learn from and avoid a repeat of the mistakes of the oil and gas program, any potential benefits could be outweighed by the recurrence of the problems listed above. BLM should instead adopt a measured approach that maximizes the benefits of geothermal development while limiting impacts to other resources and values. This PEIS provides an important opportunity to design a thoughtful approach to geothermal leasing and development.

<u>Recommendation</u>: BLM should adopt a measured approach to geothermal development, taking into consideration the unique aspects of geothermal development and avoiding the problems of the oil and gas program in order to maximize the benefits of geothermal development while limiting impacts to other resources and values.

D. Analysis and management of geothermal development should be conducted to achieve a net decrease in greenhouse gas emissions and related impacts that contribute to climate change. O-58-4

The development of renewable energy sources, including geothermal, offers the opportunity to limit damaging impacts from climate change by displacing electricity production from fossil fuels and thus reducing greenhouse gas emissions. As stated in the Draft PEIS:

> "A study comparing greenhouse gas emissions from electrical generation using fossil fuels and geothermal fluids found that geothermal produces an order of magnitude less in carbon dioxide, hydrogen sulfide, methane, and ammonia (Bloomfield *et al.* 2003)." Draft PEIS, p. 1-20.

> "Direct use of geothermal resources, such as using geothermal to heat buildings, has the potential to displace 18 million barrels of oil per year (WGA 2006). Increased geothermal energy utilization could help the US reduce greenhouse gas emissions and meet policy goals (Bloomfield *et al.* 2003)." Draft PEIS, p. 1-20.

We support the BLM's recognition of the importance of analyzing the effects of its action on climate change. Global climate change is now acknowledged to be a major consideration for effects of major federal actions. The Supreme Court has concluded that "[t]he harms associated with climate change are serious and well recognized." *Massachusetts v. E.P.A.*, 127 S.Ct. 1438, 1455 (2007). Further, the Supreme Court has held that while agency action may not completely reverse the effects of climate change, it does not relieve the agencies of the responsibility to take action to reduce it. Id. at 1458. In fact, an order issued by the Secretary of the Interior requires that:

> Each bureau and office of the Department will consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for scientific research and investigations, when developing multi-year management plans, and/or when making major decisions regarding the potential utilization of resources under the Department's purview.

U.S. Dept. of the Int., Sec. Order No. 3226 (Jan. 19, 2001), Section 3.

While there are many anticipated benefits to geothermal energy production over fossil fuels, in order to maximize these benefits, the PEIS must also address the potential for geothermal energy development to have adverse impacts on climate change or to increase negative impacts to resources that are affected by climate change. For example, many western landscapes are already becoming increasingly fragile due to global climate change and development of geothermal energy could inflict further damage on undeveloped lands. These landscapes may very well have important value as carbon "sinks," which could be lost if they are developed.[1] Further, undeveloped land has value as potential habitat as wildlife migrates to respond to climate changes. Damage to these lands for geothermal energy production, although more limited than other forms of energy development, could thus contribute to the negative impacts of climate change. Moreover, when analyzing individual projects, the net benefit for reducing the impacts of climate change may be affected by such factors as the location of the project in relation to workforce, due to the combustion engines used in construction and operation by personnel.

Though the Draft PEIS does address impacts to air quality and climate from geothermal development, it does so only in the context of comparisons between geothermal development and fossil fuels development. The PEIS should further analyze negative impacts to climate change from geothermal development on lands that are undeveloped and have values as carbon "sinks" and/or potential habitat. The PEIS should also seek to avoid or mitigate negative impacts on climate change from geothermal development by designating only appropriate lands for geothermal energy development and incorporating lease stipulations and BMPs to protect these lands.

Recommendations: The agencies should manage geothermal development on the public lands in a manner that will result in a net benefit for reducing the impacts of climate change and maximize these benefits. The PEIS should analyze climate impacts of geothermal development in the context of both the negative impacts to carbon-sinks and wildlife habitat and migration corridors, as well as the positive impacts in displacing fossil fuels electricity production.

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[1] *See, e.g., Have Desert Researchers Discovered a Hidden Loop in the Carbon Cycle?,* Science, Vol. 320, pp. 1094-140 (June 13, 2008) (attached).

Further, the PEIS should require similar analyses of proposed leasing and projects at a site-specific level, taking into account need for water, use of geothermal resources, and impacts from traffic to and from the site. Fully considering the net benefits from geothermal development will enable the agencies to best manage development of energy on the public lands and national forests to maximize the potential to reduce contributions to global warming.

II. **<u>The Proposed Action Is Not Sufficient to Protect the Resources which the Agencies Are Charged with Managing.</u>**

O-58-5

A. The agencies must consider a more protective range of alternatives.

NEPA mandates consideration of a full range of alternatives. The range of alternatives is "the heart of the environmental impact statement." 40 C.F.R. § 1502.14. NEPA requires BLM to "rigorously explore and objectively evaluate" a range of alternatives to proposed federal actions. *See* 40 C.F.R. §§ 1502.14(a), 1508.25(c).

> NEPA's requirement that alternatives be studied, developed, and described both guides the substance of environmental decision-making and provides evidence that the mandated decision-making process has actually taken place. Informed and meaningful consideration of alternatives -- including the no action alternative -- is thus an integral part of the statutory scheme.

Bob Marshall Alliance v. Hodel, 852 F.2d 1223, 1228 (9th Cir. 1988), cert. denied, 489 U.S. 1066 (1989) (citations and emphasis omitted).

"An agency must look at every reasonable alternative, with the range dictated by the nature and scope of the proposed action." *Nw. Envtl. Defense Center v. Bonneville Power Admin*., 117 F.3d 1520, 1538 (9th Cir. 1997). An agency violates NEPA by failing to "rigorously explore and objectively evaluate all reasonable alternatives" to the proposed action. *City of Tenakee Springs v. Clough*, 915 F.2d 1308, 1310 (9th Cir. 1990) (quoting 40 C.F.R. § 1502.14). This evaluation extends to considering more environmentally protective alternatives and mitigation measures. *See, e.g., Kootenai Tribe of Idaho v. Veneman*, 313 F.3d 1094,1122–23 (9th Cir. 2002) (and cases cited therein).

NEPA requires that an actual "range" of alternatives is considered, such that the Act will "preclude agencies from defining the objectives of their actions in terms so unreasonably narrow that they can be accomplished by only one alternative (i.e. the applicant's proposed project)." *Col. Envtl. Coal. v. Dombeck*, 185 F.3d 1162, 1174 (10th Cir. 1999), citing Simmons v. U.S. Corps of Engineers, 120 F.3d 664, 669 (7th Cir. 1997). This requirement prevents the environmental impact statement (EIS) from becoming "a foreordained formality." *City of New York v. Dep't of Transp.*, 715 F.2d 732, 743 (2nd Cir. 1983). *See also Davis v. Mineta*, 302 F.3d 1104 (10th Cir. 2002).

For this PEIS, the broad scope of the proposed action requires a broad range of alternatives. However, the Draft PEIS currently considers only two actual alternatives: the proposed alternative, Alternative B, for leasing on a broad scale and another, Alternative C, for more limited leasing based on existing transmission lines. The Draft PEIS itself states that Alternative A is not an alternative but rather a baseline against which to compare the two action alternatives. Draft PEIS, p. 2-30. This range is insufficient.

Recommendations: The PEIS should incorporate aspects of both alternatives into a broader range and expand the conservation emphasis in the range of alternatives; many additional conservation measures that are within the range between "no leasing" (Alternative A) and making the majority of lands available for leasing (Alternative B) are discussed below and should be included for consideration and in the selected alternative. For example, the agencies could prioritize projects in proximity to existing transmission lines without necessarily precluding projects that are outside of energy corridors. Also, instead of simply evaluating lease applications as received, the agencies could give priority to projects that are in non-controversial locations, have already completed a robust environmental analysis and mitigation plan, and/or sited near existing or planned corridors. The agencies could also phase leasing based on the most well-documented geothermal resources and limit the amount of leasing based on protecting wildlife habitat and other uses. Buffers around existing geothermal resources on lands that are protected from leasing should also be incorporated. A research and development component should also be considered, such that a portion of lands could be leased for experimental technologies, but only on a limited basis in the planning area.

B. The proposed action, Alternative B should not be adopted, because it formally makes the majority lands available for leasing and development without sufficient analysis or protections. O-58-6

Alternative B would make 117 million acres of BLM land and 75 million acres of Forest Service land open to geothermal leasing for direct and indirect use, a total of 192 million acres comprising approximately 77% of the planning area. Draft PEIS, p. 2-7. The Draft PEIS refers to the agencies' discretion in deciding whether to issue leases, but Alternative B does not provide a reasoned approach for exercising this discretion to ensure the best use of our public lands. The decision would be made without sufficient protection for other natural values, such as wilderness characteristics and other recreational or scientific use of geothermal resources. Further, Alternative B would only provide a limited buffer around the geothermal resources in Yellowstone National Park, based on areas that are already protected by a non-discretionary closure (as opposed to the 15 miles in Alternative C). Draft PEIS, p. ES-6. Alternative B also does not encompass practical considerations, such as the availability of transmission, existing or planned, for development.

The Draft PEIS analogizes to the structure of oil and gas leasing. *See, e.g.*, Draft PEIS, pp. 2-6 – 2-7. In the context of oil and gas leasing, issuance of a lease is considered an irretrievable and irreversible commitment of federal resources and, unless issued with a "no surface occupancy" stipulation, cannot be presumed to allow the agencies to retain control to prohibit damage to the environment. *See, e.g., Bob Marshall Alliance v. Hodel*, 852 F.2d 1223, 1227 (9th Cir. 1988); *Pennaco Energy v. U.S. Dept. of Interior*, 377 F.3d 1147, 1160 (10th Cir. 2004). Accordingly, it is important that allocations of land as open to leasing be based on thorough environmental review, in addition to providing for sufficient site-specific analysis to occur prior to leasing. Because the Draft PEIS specifically states that projects can be tiered to the PEIS and not all development will warrant additional environmental analysis, the PEIS must critically analyze the lands that it designates as open to leasing, which requires inventorying the area for wilderness and roadless characteristics and protecting those places with valuable and vulnerable resources. Alternative B does not include sufficient commitments to inventory or to apply protective measures.

Recommendation: The PEIS should not adopt Alternative B.

C. Additional elements required for an approach to be adopted in the PEIS.

O-58-7

Alternative C includes significant improvements from Alternative B. This alternative would still make approximately 92 million acres of land available for leasing for commercial transmission. Draft PEIS, p. ES-6. However, there would be a protective 15-mile buffer around the boundary of Yellowstone National Park and leasing would be confined to a 20-mile corridor (10 miles from centerline) from existing transmission lines and those under development, with protective management prescriptions. *Id*. Nonetheless, Alternative C fails to protect additional valuable places and resources that are at risk of damage or destruction if leased for geothermal development.

In order to protect these values, the PEIS must:

1. Expand categories of lands that are closed to leasing.

We agree with the agencies' assessment of categories of certain lands as closed to geothermal leasing, including Wilderness Areas, Wilderness Study Areas, National Conservation Areas, Wild and Scenic Rivers, National Recreation Areas, and other special management areas. However, there are other important areas that must be excluded from geothermal leasing and development.

a) Forest Service Inventoried Roadless Areas

O-58-8

The Roadless Area Conservation Rule mandates no new road construction or reconstruction in inventoried roadless areas. *See*, 66 Fed. Reg. 3243, 3270 (January 12, 2001). Further, the Draft PEIS acknowledges that the need for road construction and maintenance for exploration, drilling and utilization phases of geothermal energy development. *See, generally*, Draft PEIS, pp. 2-40 - 2-46. Accordingly, since these lands cannot be developed in accordance with the Roadless Rule, they should not be made available for leasing.

b) Lands with wilderness characteristics

O-58-9

The Draft PEIS states:

> BLM has the authority to address lands with wilderness characteristics and describe protective management prescriptions in RMPs. In keeping with the public involvement process that is part of all land use planning efforts, the BLM

will consider public input regarding lands to be managed to maintain wilderness characteristics.

Draft PEIS, 1-25. We appreciate the BLM's acknowledgment of its authority and commitment to public participation in managing lands to protect wilderness characteristics. Since the PEIS will amend as many as 122 land use plans and many RMPs will not be revised for years after the PEIS is finalized, the inventory and protective management of lands with wilderness characteristics should occur as part of this planning process.

Pursuant to FLPMA, "The Secretary shall prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values (including, but not limited to, outdoor recreation and scenic values), giving priority to areas of critical environmental concern. This inventory shall be kept current so as to reflect changes in conditions and to identify new and emerging resource and other values." 43 U.S.C. §1711(a). Wilderness character is a resource for which BLM must keep a current inventory. As the U.S. Court of Appeals for the Ninth Circuit recently held: "wilderness characteristics are among the 'resource and other values' of the public lands to be inventoried under § 1711. BLM's land use plans, which provide for the management of these resources and values, are, again, to 'rely, to the extent it is available, on the inventory of the public lands, their resources, and other values.' 43 U.S.C. § 1712(c)(4)." *Oregon Natural Desert Ass'n v. Bureau of Land Management*, 531 F.3d 1114, 1119 (9th Cir. 2008). Therefore, BLM is required to consider "whether, and to what extent, wilderness values are now present in the planning area outside of existing WSAs and, if so, how the Plan should treat land with such values." *Id*. at 1143.

BLM has defined "wilderness characteristics" to include naturalness and providing opportunities for solitude or primitive recreation. *See* Instruction Memoranda 2003-274, 2003-275, Change 1. These values are to be *identified and protected* in the land use planning process. *See* BLM Land Use Planning Handbook (H-1601-1, 2005); *Oregon Natural Desert Ass'n v. Bureau of Land Management*, *supra*. Further, BLM's national guidance provides for management that emphasizes "the protection of *some or all* of the wilderness characteristics as a priority" over other multiple uses. (emphasis added). This guidance does not limit its application to lands suitable for designation of Wilderness Study Areas; for instance, the guidance does not include a requirement for the lands at issue to generally comprise 5,000-acre parcels or a requirement that the lands have *all* of the potential wilderness characteristics in order to merit protection.

During the scoping process, we provided GIS data regarding lands with wilderness characteristics, which not only constitutes significant new information but also facilitates the O-58-10
agency's review and consideration of protection. In *Oregon Natural Desert Association v. Rasmussen*, CV 05-1616-AS, Findings and Recommendations (D. Or. April 20, 2006); Order (D.Or. Dec. 12, 2006), the court found that BLM's failure to re-inventory lands for wilderness values and to consider the potential impact of decisions regarding management of a grazing allotment violated its obligations under NEPA and FLPMA, then enjoined any implementation of the decision until the agency re-inventoried the lands at issue and prepared an environmental document taking into account the impacts of its decisions on wilderness values. In *Oregon Natural Desert Association v. Rasumussen,* the district court found that BLM had violated NEPA

by failing to consider significant new information on wilderness values and potential impacts on wilderness values, and had also failed to meet its obligations under FLPMA by failing to engage in a continuing inventory of wilderness values. It concluded:

> The court finds BLM did not meet its obligation under NEPA simply by reviewing and critiquing [a local environmental group's] work product. *It was obligated under NEPA to consider whether there were changes in or additions to the wilderness values* within the East-West Gulch, *and whether the proposed action in that area might negatively impact those wilderness values,* if they exist. The court finds BLM did not meet that obligation by relying on the one-time inventory review conducted in 1992. *Such reliance is not consistent with its statutory obligation to engage in a continuing inventory so as to be current on changing conditions and wilderness values*. 43 U.S.C. § 1711(a).
>
> BLM's issuance of the East-West Gulch Projects [environmental analysis] and the accompanying Finding of No Substantial Impact (FONSI) in the absence of current information on wilderness values was arbitrary and capricious, and, therefore, was in violation of NEPA and the [Administrative Procedure Act].

Id. (emphasis added).

The Geothermal PEIS presents an opportunity for the BLM to consider information that has previously been submitted regarding lands with wilderness characteristics in the lands at issue in the PEIS and to inventory these lands, which contain numerous areas proposed for wilderness designation in citizen's wilderness inventories and/or found to have wilderness characteristics. Prior to identifying lands open to geothermal leasing and development, we recommend that the agencies assess information received regarding wilderness characteristics, including inventorying lands identified, and exclude lands with wilderness characteristics, citizen-proposed wilderness, and wilderness inventory units from the lands available for consideration of siting geothermal energy projects.

c) Important habitat and migration corridors

O-58-11

The WGA - consistent with state wildlife action plans - has recently produced the Wildlife Corridors Initiative Report (available at http://www.westgov.org/wga/publicat/wildlife08.pdf), which identifies important wildlife corridors and habitats in the western states and makes recommendations for best protecting these crucial areas. The agencies should consult this report for information on the areas identified and/or confer with the WGA Western Wildlife Habitat Council before completing the PEIS, in order to incorporate this data into decisions regarding which lands will be available for leasing. The agencies should also ensure that additional analysis is conducted, in the PEIS and/or prior to leasing and development, to accurately determine the present of important habitat, including vegetation and migration corridors, and to take appropriate measures to avoid or otherwise mitigate potential damage, as discussed in further detail in the following section of these comments.

d) Places that would be excluded from development under bills pending in Congress O-58-12

All areas that would be closed to geothermal development under bills currently pending in Congress should be excluded from leasing in the PEIS. This should include lands that are included in pending legislation for designation in one of the categories listed as closed to leasing in the Draft PEIS or would otherwise include provisions that prohibit geothermal energy development

e) Appendix with other specific places of concern O-58-13

Appendix A details specific places that are inappropriate for geothermal energy development and/or require special analysis of potential damage to natural and cultural resources prior to leasing and development, including areas around national parks, citizens' inventories or other valuable resources. These areas should be closed to geothermal leasing in the PEIS or upon confirmation of potential damage to the identified values and resources.

2. Designate buffers to protect geothermal resources already prioritized for recreational/scenic values O-58-14

a) Research shows that drilling for geothermal energy in proximity to other known geothermal features can disturb and damage these features.

The National Park Service's web page on Yellowstone's geothermal resources states, "In Iceland and New Zealand, geothermal drill holes and wells 2.5 - 6.2 miles distant have reduced geyser activity and hot spring discharge." (http://www.nps.gov/yell/naturescience/geothermalresources.htm) This confirms the necessity of creating buffer zones around geothermal resources with surface features that are part of protected areas, such as national parks, or have been identified for the recreational and scenic values. Disturbances to these features would have major economic and environmental impacts on our national parks and other areas with geothermal resources. Tourism would decrease as a result of loss of thermal features, and endemic species that depend on the geothermal resources of the area would likely suffer.

The New Zealand Geothermal Association provides evidence of damage caused to thermal features as a result of geothermal development that is not well-planned. Some environmental effects that have been documented in New Zealand include loss of active geysers, unsustainable draw down, and subsidence. According to the association, "Of more than 200 geysers active in the central North Island in the 1950s, only about 40 remain." (http://www.nzgeothermal.org.nz/environmental/surface_effects.asp) These potential impacts are unique to geothermal resources, and therefore must be analyzed thoroughly.

b) Additional protections around Yellowstone National Park.

O-58-15

The PEIS must include a buffer around Yellowstone National Park in order to protect the thermal features found there. According to the National Park Service, 75% of the world's geysers are located in Yellowstone. The NPS warns that "research is needed to determine the extent to which YNP's geothermal systems connect with areas of lease application west and north of the boundary." (http://www.nps.gov/yell/naturescience/geothermalresources.htm) Clearly, the necessary scientific research substantiating the effects that geothermal development could have on the park's features is not yet adequate. While Alternative C would provide a 15 mile buffer and close the Island Park Geothermal Area to leasing, further analysis and protections are needed.

(1) Background

The geothermal features in Yellowstone National Park were largely responsible for its designation as this country's first national park in 1872. These features are a global treasure. Nowhere else in the world can you find the array or number of geysers, hot springs, mud pots, and fumaroles found in Yellowstone. More than 75% of the world's geysers, including the world's largest are in Yellowstone's seven major basins.

As stated above, in almost every other geyser area in the world, including those in New Zealand, Iceland, China and the United States, development has seriously affected or permanently destroyed the thermal features of those areas. The park's thermal features lie in the only essentially undisturbed geyser basin left worldwide. Ten miles north of Yellowstone, research has demonstrated that the LaDuke Hot Springs are connected to geothermal features within Yellowstone.

(2) Montana & U.S. Water Compact, Yellowstone Controlled Groundwater Area

O-58-16

As a national park, the lands within Yellowstone's boundary are protected by statute from geothermal leasing. Other existing statutes are in existence to protect Yellowstone's geothermal features such as the Island Park Known Geothermal Resource Area and wilderness designations and given necessary deference within the Draft PEIS. However, a significant agreement ratified in 1993 by the State of Montana and the U.S. Government has not been acknowledged or considered within the Draft PEIS. That agreement is the Water Rights Compact between the State of Montana and United States of America, National Park Service (http://data.opi.state.mt.us/bills/mca/85/20/85-20-401.htm).

The State of Montana and the National Park Service entered into a Water Rights Compact on May 12, 1993 that committed the two entities to protecting the geothermal integrity of Yellowstone National Park. This agreement designated and provided protections for the Yellowstone Controlled Groundwater Area in Montana. The statement of intent for the Yellowstone Controlled Groundwater Area is as follows:

> Yellowstone National Park was reserved for the express purpose of "preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition." (17 Stat. 32.) The parties agree

> that Congress reserved water necessary to preserve the hydrothermal features within the reserved land of YNP. These reserved water rights have priorities as of the date on which the land was reserved.
>
> The parties understand that knowledge of the interrelationship of hydrothermal features within YNP, the hydrothermal system that supports those features, and groundwater in surrounding areas of Montana will benefit from increased study. The parties agree that the hydrothermal features of YNP are a unique and irreplaceable resource and represent one of the few undisturbed hydrothermal systems in the United States.
>
> This Compact does not recognize a reserved water right to groundwater outside the boundaries of the reserved land of YNP. However, the parties agree that restrictions shall be placed on the development of groundwater adjacent to YNP to the extent necessary to prevent adverse effect on the reserved water right to groundwater within YNP. *The parties agree that the goal of establishment and administration of the Yellowstone Controlled Groundwater Area shall be to allow no impact to the hydrothermal system within the reserved land of YNP.*
>
> Water Rights Compact between the State of Montana and United States of America, National Park Service, Article IV "Yellowstone Controlled Groundwater Area", Section A (emphasis added)

Article IV went on to indicate that research was limited at the time of signing, and more was necessary to fully understand the interconnectedness of Yellowstone National Park and adjacent lands. A provisional Yellowstone Controlled Groundwater Area was established in 1993, but a commissioned Technical Oversight Committee established a scientifically-based boundary for the Area which is provided in the enclosed map. in Article IV went on to indicate that research was limited at the time of signing, and more was necessary to fully understand the interconnectedness of Yellowstone National Park and adjacent lands. A provisional Yellowstone Controlled Groundwater Area was established in 1993, but a commissioned Technical Oversight Committee established a scientifically-based boundary for the Area inwhich is provided in the enclosed map.

Given the State of Montana's and the U.S. Government's commitment to protecting the integrity of Yellowstone's geothermal resources through the designation of the Yellowstone Controlled Groundwater Area through the Water Rights Compact, the Yellowstone Controlled Groundwater Area must be withdrawn from any consideration for geothermal leasing under this programmatic EIS.

Recommendation: Geothermal leasing is prohibited within the Yellowstone Controlled Groundwater Area established through the 1993 Water Rights Compact between the State of Montana and United States of America, National Park Service.

(3) Areas not covered by the Island Park Known Geothermal Area and the Yellowstone Controlled Groundwater Area 0-58-17

Outside the Island Park Known Geothermal Resource Area and the Yellowstone Controlled Groundwater Area, existing research on areas adjacent to Yellowstone is for the most part lacking or inadequate. Moreover, it is likely that other important aquifers with hydrologic links to Yellowstone National Park exist but have yet to be designated as Known Geothermal Resource Areas.

Alternative C in the Draft PEIS recognizes the importance of Yellowstone's geothermal resources by prohibiting geothermal leasing within fifteen miles adjacent to the Park in addition to the protections provided by statute to the Island Park Known Geothermal Resource Area. As discussed above, a prohibition of geothermal leasing adjacent to Yellowstone will provide inadequate protection unless it includes the entire Yellowstone Controlled Groundwater Area in the State of Montana.

It must be recognized in the Final PEIS that in some instances fifteen miles may not provide adequate protection of Yellowstone's geothermal resources. For any geothermal leasing proposals outside the Island Park and Yellowstone controlled areas and up to fifty miles from the park boundary, the Park Service should be given the opportunity to consult as to whether or not the proposed activity might interfere with the natural function of any geothermal feature or hydraulically linked aquifer in Yellowstone Park. When current science and technology cannot provide absolute assurance regarding the effect of a proposed action on geothermal resources in Yellowstone Park, then that activity should be prohibited on federal land and private lands with federal mineral rights.

Recommendation: Use of geothermal resources as an energy source should not be pursued in areas where a hydrologic link with Yellowstone National Park geothermal features is possible. A permanent ban should be placed on all geothermal development on federal lands within a 15-mile radius of Yellowstone Park. The protected area should be expanded to fully incorporate the Island Park Geothermal Area (a minimum of 32 miles outside Yellowstone Park) and, in Montana, the Yellowstone Controlled Groundwater Area. In addition, the National Park Service should be provided a formal consultation role in any proposal beyond the protected buffer, up to fifty miles from the park boundary.

c) Identify other areas where buffers are necessary due to protected geothermal resources (including other national parks or national monuments that exist due to presence of geothermal resources O-58-18

The agencies must work with the National Park Service (NPS) and other agencies and organizations to determine where geothermal features exist that could potentially be impacted by development. Although national parks and monuments are not open to leasing in the PEIS, buffer zones around these sites must also be identified and closed to leasing where necessary to protect the resources.

The Draft PEIS makes no reference to the Geothermal Steam Act Amendments of 1988, which require the Secretary of the Interior to maintain a list of NPS units with significant thermal features, monitor the features (with priority to those in proximity to current, proposed or potential geothermal development), deny lease applications that would result in a significant adverse effect to the thermal features and ensure that all leases and permits include stipulations to protect the significant thermal features. 30 U.S.C. § 1026. As discussed above, geothermal development can affect geothermal features at a distance of miles. Geothermal leases that have the potential to impact a significant thermal feature must either be denied or granted with compulsory stipulations to protect the resource. The 1988 amendments *require* that impacts to thermal features within the National Park System are considered in geothermal leasing and development. The testimony submitted by the National Parks Conservation Association (NPCA) in connection with the 1988 amendments highlights the potential risk to geothermal features that propelled this legislation. *See,* Statement of Destry Jarvis, Vice President for Conservation Policy, NPCA - attached to these comments. NPCA's testimony also provides important information on other NPS lands that could be negatively impacted by geothermal energy development, listing lands with volcanic and thermal activity or features and those that, at the time of the testimony, were already identified as having high potential for development. *Id*. These lands, due to their features, remain at risk and due special consideration; they are also set out in Appendix A to these comments.

Recommendation: The Final PEIS must incorporate the list of significant thermal features within the NPS and ensure that the formal consultation with the NPS occurs for any leasing and/or development activities with the potential to impact these features.

3. Identify and prioritize for leasing places that would be more appropriate for geothermal

In addition to avoiding ecologically-sensitive lands, the PEIS can identify areas that are more likely to be suitable for development and non-controversial; and leasing could be prioritized in these areas. Factors that should be considered are set out below.

a) Impaired or degraded lands

O-58-19

The PEIS should require that lands that are already impaired be considered first for proposed geothermal development. Abandoned mines, developed oil and gas fields, and other brownfields, which are not being restored to ecological function, provide opportunities for geothermal energy development without loss of other uses and values. Such sites are often close to existing infrastructure, which is another important consideration, both in conjunction with degraded sites and as a separate factor.

b) Proximity to existing infrastructure

O-58-20

Proximity to existing infrastructure will minimize new road construction or major roadway improvements (such as paving and widening), avoiding another set of impacts on the public lands. Further, proximity to the load that will be served by the project will limit the amount of new transmission needed and reduce related income.

c) Co-siting with solar energy projects

O-58-21

Federal land agencies are currently in the process of completing a PEIS for solar energy development as well. Both solar and geothermal energy are long-term, industrial uses of public lands. While we support the development of renewable, clean energy sources, we encourage the agencies to mitigate the impacts of all energy development to the extent possible. One mitigation measure that could prove greatly beneficial is the possibility of co-siting geothermal and solar energy projects, thereby reducing environmental impacts. The agencies should explore this possibility in the PEIS, and create terms to encourage this type of development.

d) Siting to maximize use of transmission for renewable energy

O-58-22

The federal agencies are involved in designation of transmission corridors on public lands and national forests, including the West-wide Energy Corridor PEIS. Individual states are engaged in designation of zones to prioritize development and transmission of renewable energy, such as California's Renewable Energy Transmission Initiative and Nevada's Renewable Energy Zones. The Western Governors Association (WGA) is undertaking an initiative to designate Renewable Energy Zones. Prioritizing lands for lease and development that are within these zones or in proximity to other approved renewable energy development projects will maximize access to transmission. This approach should also be incorporated into the PEIS.

e) Possibility of land exchange

O-58-23

The agencies should consider land exchange as a mitigation measure for geothermal development due to the industrial and long-term use of public lands.

4. Conduct strategic leasing or use conditional development stipulations

O-58-24

Because the current BLM geothermal program is very small in scale when compared to the reasonably foreseeable development scenario laid out in the Draft PEIS, the agencies should conduct strategic leasing to prioritize areas that are not controversial and have proven technology, to limit leasing on unknown technologies until they are proven successful both in the utilization phase and in the reclamation phase.

We also reiterate our scoping comment that the PEIS should analyze the use of conditional-development lease stipulations. As it is often difficult at the time of leasing to have the best data on site-specific impacts for future geothermal full-field development within an area, a leasing stipulation that conditions the right of development on the results of future and more-detailed studies provides an opportunity to clarify that development may ultimately be limited. This type of stipulation could also be used to support a research and development program, as discussed below.

5. Restrict development initially to traditional geothermal resources and/or established technology; commit to an R&D leasing program to develop additional technologies

O-58-25

a) Only technologies analyzed in this PEIS can be approved by tiering to the PEIS and important to use R&D leasing

It is essential that the PEIS clearly states that only geothermal technologies described and analyzed for impacts in the PEIS can be tiered to this document. These are specifically dry steam, flash steam, and binary-cycle power plants.

b) The agencies should support a program for developing new technologies, using R&D leasing O-58-26

While we support research and development (R&D) of new geothermal technologies, especially those that reduce impacts on public lands by utilizing heat differential technology and thus do not require use of limited water sources, R&D activities require new NEPA analysis. Applications for R&D, including "enhanced geothermal systems," cannot be tiered to this PEIS because their impacts are not analyzed in the document. However, the PEIS could describe and commit the agencies to develop and support a R&D leasing program for new technologies, which could be facilitated through the use of conditional development leases.

Recommendation: The management alternative to be selected for the PEIS should include the protective and proactive measures described above.

III. The PEIS Does Not Adequately Assess Environmental Consequences to Key Resources.

NEPA requires that the scope of environmental analysis be commensurate with the proposed action. *Kern v. United States Bureau of Land Management,* 284 F.3d 1062, 1072 (9th Cir. 2002). In light of the multistate range of lands and millions of acres that would be affected by the decisions in the PEIS, a more thorough analysis of potential impacts to other resources and values is necessary, as detailed below.

A. The agencies are required to assess the planning projects of other federal agencies and local governments in order to provide adequate cumulative impact analysis.

O-58-27

NEPA requires the agencies to consider the cumulative impacts of and related to the PEIS. NEPA regulations define "cumulative impact" as:

> the impact on the environment which results from the *incremental impact of the action when added to other past, present, and reasonably foreseeable future actions* regardless of what agency (Federal or non-Federal) or person undertakes such other actions. *Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*.

40 C.F.R. § 1508.7 (emphasis added).

To satisfy NEPA's hard look requirement, the cumulative impacts assessment must do two things. First, BLM must catalogue the past, present, and reasonably foreseeable projects in the area that might impact the environment. *Muckleshoot Indian Tribe v. U.S. Forest Service,* 177 F.3d 800, 809–10 (9th Cir. 1999). Second, BLM must analyze these impacts in light of the proposed action. *Id.* If BLM determines that certain actions are not relevant to the cumulative impacts analysis, it must "demonstrat[e] the scientific basis for this assertion." *Sierra Club v. Bosworth,* 199 F.Supp.2d 971, 983 (N.D. Ca. 2002). A failure to include a cumulative impact analysis of actions within a larger region will render NEPA analysis insufficient. *See, e.g., Kern* *v. U.S. Bureau of Land Management*, 284 F.3d 1062, 1078 (9th Cir. 2002) (analysis of root fungus on cedar timber sales was necessary for an entire area).

This definition clearly encompasses the other large-scale energy development being planned for the same lands under analysis in this PEIS, which will inevitably compound the effects of leasing and development of geothermal energy on the natural resources of our public lands, such as wildlife habitat, wilderness character and roadlessness, water, scenic beauty, and cultural resources.

Further, NEPA, as explained by the Council on Environmental Quality, also directs agencies to consider potential conflicts with the objectives of other plans, policies or controls, which requires an assessment of possibilities for resolving conflicts and a thorough consideration of how not resolving the conflict could "impair the effectiveness of land use control mechanisms for the area." 40 C.F.R. § 1502.16(c); *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, 23a. Similarly, FLPMA requires that the BLM's guidance and management policies shall "be consistent with officially approved and adopted resource related policies and programs of other Federal agencies, State and local governments and Indian tribes." 43 U.S.C. § 1712(c)(9); 43 C.F.R. § 1610.3-2.

There are currently several major planning processes underway in the Western United States that we want to highlight for the BLM to address in the Geothermal PEIS because of the potential overlap in goals. California's Renewable Energy Transmission Initiative (RETI), the Western Governors Association's Western Renewable Energy Zones (WREZ), and the West-wide Energy Corridors PEIS are all transmission initiatives in the project area. The states of Colorado, New Mexico, and Nevada also have initiatives to identify locations and provide incentives for renewable energy development and transmission.

The West-wide Energy Corridor PEIS is of particular relevance to the Geothermal PEIS. These two processes should be viewed as an opportunity for synergy and as an opportunity to bring more renewable energy into the American electricity grid while minimizing environmental degradation. If both energy corridors and geothermal energy development projects are properly sited and renewable technologies such as solar, wind, and geothermal energy are given preference in new transmission rights-of-way within the corridors, these efforts together can help America reduce its reliance on the fossil fuels responsible for global climate change. Currently, the West-wide Energy Corridor PEIS is the subject of significant controversy, due to the failure to assess the need for corridors to support renewable energy, as well as the failure to avoid ecologically important areas. Although the Draft PEIS makes note of this initiative, it fails to provide analysis of the cumulative impacts that will result from both of these programs being established in the same project area.

In addition, BLM is preparing a solar energy program and oil shale/tar sands program and has recently completed a wind energy program. All of these planning processes impact lands in the western states and will utilize transmission corridors, and in combination have the potential to disturb a majority of public and Forest Service lands in the West.

Chapter 5 of the Draft PEIS states that geothermal development would have a minor cumulative impact on resources such as vegetation and soil due to its comparatively small footprint: “The contribution to cumulative impacts of geothermal projects on public and FS lands would be small or negligible unless a significant permanent, uncompensated loss of the current productive use of a site occurred, or if future uses were precluded” Draft PEIS at 5-18. However, in context of a small area cleared for geothermal, and other areas all over the West cleared for solar, wind, oil shale, and transmission for all of these energy sources, the cumulative impacts can actually be expected to be quite large, with geothermal development making a significant contribution. In addition, because transmission will be necessary for indirect use geothermal projects, it is imperative that the agencies analyze transmission initiatives in the project area and provide cumulative impact analysis. Disregard of these processes may lead to duplicative corridors and unnecessary lands, wildlife and natural resource impacts.

Before preparing the Final PEIS, the agencies must go back and analyze not just the small impacts from geothermal plants, but the *cumulative* impacts of geothermal plants and transmission in context with solar plants, wind turbines, oil shale and tar sands mines, and the many other planning processes in the project area.

Recommendation: Because leasing of land for geothermal development is a commitment of the resource for future exploration and development, the agencies must conduct cumulative impact analysis of reasonably foreseeable future actions in context of other energy development and transmission projects in the western states.

B. Socioeconomic analysis.

There are several areas where the Draft PEIS for Geothermal Leasing in the Western US (Draft PEIS) falls short in the analysis of the potential socioeconomic impacts associated with leasing public lands for the development of geothermal energy. These are described briefly below and discussed in greater detail in the sections which follow.

1) The socioeconomic analysis in the Draft PEIS is superficial and is based heavily on documents that were produced by the geothermal energy industry itself.

2) The analysis of the socioeconomic impacts is one-sided, focusing only on the potential benefits of geothermal energy development without assessing the potential costs of such development on public lands.

    a. The Draft PEIS fails to address the potential impacts to rural economies from potential impacts to public lands. Many economies benefit from undeveloped public lands and this potential impact should be analyzed in the Final EIS.

    b. The Draft PEIS does not account for the non-market values, including the impacts on local quality of life, which are associated with the undeveloped public lands that may be impacted by geothermal energy development.

These specific concerns are discussed in detail in the sections below.

1. **The socioeconomic analysis in the Draft PEIS is superficial and is based heavily on documents that were produced by the geothermal energy industry itself.** O-58-28

The Draft PEIS presents only the most general estimates of the potential jobs and royalties (and these are based only on industry references), without any in-depth analysis or even a qualitative discussion of the overall potential socioeconomic impacts associated with large scale developments on public lands in rural areas.

The socioeconomic analysis in the Draft PEIS refers frequently to several documents which were produced by or for geothermal industry advocacy groups. One of these documents is a two-page promotional document touting only the potential beneficial economic impacts of the industry. They are clearly self-serving for this specific industry and while potentially a valuable source of information, they should not be the only source of information about the socioeconomic impacts of large-scale geothermal energy development on public lands.

In preparing the Final EIS the BLM and FS should do a review of the economic literature on modern rural economies and include analysis of a broader range of impacts. The agencies should also include input and research from a more broad range or sources, rather then relying solely on industry analyses.

2. **The analysis of the socioeconomic impacts is one-sided, focusing only on the potential benefits of geothermal energy development without assessing the potential costs of such development on public lands.** O-58-29

While it is certainly possible that the benefits to local communities from geothermal energy development may be substantial, it is also quite likely that such development will have certain costs as well. The Draft PEIS does not analyze the potential costs associated with leasing millions of acres of BLM and FS lands for geothermal energy. The Draft PEIS merely assumes that mitigation, stipulations and BMPs will result in minimal impacts.

Western communities often face the need to balance extractive development and other industrial uses of the region's abundant public lands with the economic and aesthetic benefits that are derived from these lands in their undeveloped state. The economy of the western United States has long been viewed as one dependent upon the extraction of natural resources. However, recent research has shown that this assumption is no longer valid. Commercial geothermal development would be yet another such industrial use, with many of the attendant pitfalls and issues. Yet the Geothermal DPIES does not assess the impacts associated with continued reliance on extraction industries in the context of the changing economy of the region.

a) **The Draft PEIS fails to address the potential impacts to rural economies which benefit from undeveloped public lands – lands which will be impacted by the development of geothermal energy projects and related transmission corridors.** O-58-30

The omission of the potential costs to the western economies affected is reflected in the list (on page 4-139 of the Draft PEIS) detailing the conditions under which potential impacts on socioeconomics and environmental justice could occur. This list focuses very narrowly on commodity impacts, jobs and income in the geothermal industry, and revenues from royalties and taxes that might accrue. The list mentions the potential for increases in population and the potential for these increases to strain local resources; however, the analysis does not treat this potential impact with any depth. Missing from the list are the potential impacts on businesses and individuals who may rely on the presence of protected public lands to attract employees, to attract customers or for their own quality of life.

In the last 30 years, the West has evolved beyond being a region whose economy was largely focused on extractive industries, into a more diverse economy (Bennett and McBeth, 1998; Johnson, 2001). As the economies of rural communities in the West evolve, the impact of public land management on these economies also evolves, and the management of our public lands must as well. Sociological and economic research conducted over the last two-plus decades indicates that the environmental amenities provided by public lands are an important economic driver in the rural West. For several examples see: Rudzitis and Johansen, 1989; Johnson and Rasker, 1993, 1995; Rasker 1994; Power, 1995, 1996; Duffy-Deno, 1998; Rudzitis, 1999; Rasker,et al. 2004; Holmes and Hecox, 2004; Whitelaw, et al. 2003.

These indicators include the growing importance of non-labor income from investments and retirement, increasing employment in high technology, knowledge-based, and service industries, the important role that recreation and tourism plays in providing jobs and income, and the rise of small businesses and other entrepreneurial endeavors. The Draft PEIS fails to analyze or account for negative impacts on these segments of the economy. Large scale geothermal energy development is likely to have negative impacts such as habitat fragmentations, loss of quality of life, loss of quality recreation, and reduced quality of hunting and fishing. These impacts can, in turn, have detrimental consequences for non-traditional sectors of the economy which have come into prominence in the West. These non-traditional sectors have been shown to rely upon protected, undeveloped public lands. Such lands enhance the attractiveness of rural western communities for businesses, workers and retirees who are not tied to specific locations for income or employment. These sectors have for decades been the largest portion of almost every county in the U.S.

The recreation opportunities alone provided by wilderness quality and other undeveloped public lands yield direct economic benefits to local communities. The Draft PEIS socio-economic analysis does not include an analysis of the income and jobs associated with recreation, hunting and fishing from each alternative. In our scooping comments, we included a document entitled "Socio-Economic Framework for Public Land Management Planning: Indicators for the West's Economy," which details our expectations for the baseline analysis of the region's economy as well as the analysis of the potential impacts of this program. We request that you re-review the document and that your analysis for the Final EIS follow the approach set out in this document.

b) The Draft PEIS does not account for the non-market values, including the impacts on local quality of life, which are associated with the undeveloped public lands that may be impacted by geothermal energy development. O-58-31

Public lands provide numerous values, some of which are realized when natural resources are extracted, and others which require that the natural ecosystems remain intact. The benefits of these various values often flow to different groups or individuals. Some of the benefits from public lands are more likely to flow to individuals or companies (market benefits), and others are available for the entire population (non-market benefits).

Any time that unique or irreplaceable resources or values are at risk, there is a strong component of non-market value which must be assessed. One of the primary purposes of the public lands system is the provision of public goods such as the protection of unique landscapes, ecological diversity, wildlife habitat, wilderness, and cultural and archeological resources. Large-scale geothermal energy development may put these resources at risk.

To facilitate informed decisions about publicly owned wildlands, economic analysis must take into consideration both market and nonmarket benefits and costs (Loomis 1993). It is important that the FS and BLM examine both market and non-market benefits and costs of large-scale geothermal energy development. Non-market benefits must be measured and compared with the market benefits that accrue to companies and individuals when undeveloped public lands are developed.

In analyzing the socioeconomic impacts of geothermal energy leasing and development, the agencies must complete a full accounting of the costs and benefits associated with this development including non-market costs and benefits. The agencies' accounting should recognize the multiple use aspects and the full extent and value of existing wilderness character and wildlands as a resource within and near new geothermal energy development, which include formally designated Wilderness and Wilderness Study Areas, as well as other areas with wilderness and special characteristics identified by citizens and proposed for protective management. The multiple benefits that derive from protecting wilderness quality and other undeveloped lands include positive economic impacts to local communities. In developing the Final EIS, the agencies should analyze the benefits of protecting all existing wilderness character and wildlands against impairment from large-scale geothermal energy development, and should also consider how managing these lands will affect wildlands and wildlife in other locations and in turn the economies in local communities.

Recommendations: In preparing the Final EIS for geothermal leasing, the BLM and FS must:

- consider the increasing importance of industries and economic sectors that rely on public lands for environmental amenities;
- examine the potential impacts that large-scale geothermal development on public lands may have on key indicators which characterize the modern western economy; and

- estimate the potential non-market benefits and costs associated with large-scale geothermal energy.

C. Visual resources

O-58-32

NEPA requires the agencies to "assure for all Americans . . . aesthetically . . . pleasing surroundings." 42 U.S.C. § 4331(b)(2). FLPMA specifically directs the BLM to prepare and maintain inventories of the visual values of all public lands, 43 U.S.C. § 1711(a), and manage public lands "in a manner that will protect the quality of . . . scenic . . . values," §1701(a)(8). BLM has interpreted these mandates as a "stewardship responsibility" to "protect visual values on public lands" by managing all BLM-administered lands "in a manner which will protect the quality of the scenic (visual) values." BLM Manual 8400 – Visual Resource Management .02, .06(A). BLM utilizes visual resource inventories during its land use planning process to establish management objectives, organized into four classes. These objectives are as binding as any other resource objectives contained in the RMP. *See Southern Utah Wilderness Alliance*, 144 IBLA 70, 84 (1998).

These statutory and regulatory responsibilities are especially important because of the scenic values associated with use and enjoyment of the public lands and national forests, and also with the use and enjoyment of geothermal areas, specifically. The agencies should ensure that natural settings are protected – these settings are often vital to local and regional economies and for cultural resources. Viewsheds and scenic values should be considered as a factor for establishing buffers of protection from surface disturbance.

D. Wildlife habitat and fragmentation analysis

O-58-33

1) Endemic species

There are numerous species that rely on the geothermal characteristics of their habitat for survival. The PEIS should clearly identify these species, their range, and appropriate protections.

2) Habitat fragmentation analysis

O-58-34

Significant portions of the land that will be considered for geothermal energy development in the PEIS contain core habitat areas and migration linkages between those core areas, all of which need to be preserved in order for the regional ecosystems to continue to function. Fragmentation of wildlife habitat affects the ecological composition, structure, and functions of a landscape. Habitat fragmentation has been defined as the "creation of a complex mosaic of spatial and successional habitats from formerly contiguous habitat" (Lehmkuhl and Ruggiero 1991). **Although fragmentation can be difficult to measure, there are a variety of metrics that can be used to assess the degree of existing habitat fragmentation and the condition of the landscape, then applied to available data regarding distribution of wildlife and habitat, and ultimately used to make decisions regarding appropriate locations for geothermal energy projects. We recommend that the agencies complete such an analysis as part of the PEIS.**

Existing road density can be calculated by measuring the length of linear features in a given sub-area at regular intervals and then reported as miles of route per square mile (mi/mi^2). The degree of habitat fragmentation, the distribution of unroaded areas, or core areas, can also be measured and calculated based on the amount of land beyond a given distance or effect zone, from transportation routes (Forman, 1999). Wildlife species respond to disturbances related to this type of network at varying distances, so determining the size distribution of core areas for a range of effect zones (i.e., of 100ft, 250ft, 500ft and 1320ft) from all routes is also important. Wildlife literature will yield information on the effect zones for different species. For instance, an ongoing study by Sawyer et al. (2005, 2004, 2001) of GPS collared deer on the Pinedale Anticline observed that deer utilized habitat progressively further from roads and well pads over three years of increasing gas development and showed no evidence of acclimating to energy-related infrastructure. Birds are also impacted by roads and management practices associated with energy development, due to fragmentation, changes in vegetation and noise (Mabey and Paul, 2007; Robel, et al., 2004).

In addition to geothermal projects themselves, habitat fragmentation can be caused by transmission corridors, which will be necessary to transmit geothermal energy to electricity grids. Wildlife habitat fragmentation caused by transmission lines, pipelines, and roads generally fall into three broad categories:

1. Construction impacts (access, right-of-way clearing, construction of towers, stringing of cables);
2. Line maintenance impacts (inspection and repair); and
3. Impacts related to the physical presence and operation of the transmission line.

As such, wildlife habitat must be examined on an individual project and site-specific basis. The only way to accomplish this requirement is to ensure that each individual geothermal project is spatially evaluated for direct, indirect and cumulative impacts.

Specific activities that negatively impact wildlife and cause destruction of core habitat or habitat fragmentation include the construction of facilities, disturbance of soil by the use of heavy machinery, site clearing and grading, noisy machinery during construction and maintenance, removal of vegetation, use of herbicides, well drilling, and accidental release of hazardous materials.

The effects of these activities on wildlife can be severe and include removal of habitat, fragmentation of habitat, and the creation of edge effect vegetation and habitat (changes in composition, structure, microclimate, etc. of area adjacent to facility and transmission corridor). Species shown to avoid edges include red-backed vole, snowshoe hair, pine marten and red squirrels. In addition, it is logical to suspect that construction of facilities and transmission in previously undisturbed areas will lead to a direct loss of life to wildlife during construction, operation and service of transmission lines.

We have included The Wilderness Society’s most recent Science and Policy Brief, “Habitat Fragmentation from Roads: Travel Planning Methods to Safeguard BLM Lands”. This report provides a summary of available scholarly and government reports and studies on the impact of habitat fragmentation on wildlife, provides methods for calculating habitat fragmentation, and provides recommendations on how to integrate fragmentation analysis into management. BLM should use the information provided in this brief (as well as related information from State Wildlife Action Plans, Audubon Important Bird Areas, and the Wildlands Network) to identify core areas, measure habitat fragmentation, conduct a thorough fragmentation analysis, and inform decisions regarding designation of lands as available for geothermal energy in the PEIS, as well as incorporating these requirements into the PEIS to guide analysis of specific projects.

E. Wilderness and/or roadless characteristics

O-58-35

As mentioned above, because the PEIS will be used to amend land use plans and tiered to in analyzing specific projects, the agencies must inventory the project area for lands with wilderness and/or roadless characteristics and exclude these areas from leasing and development, in order to prevent destruction of these values.

F. Cultural resources

O-58-36

Native and prehistoric cultures also prize geothermal resources, such that there is a significant overlap between geothermal resources and sacred sites. The National Historic Preservation Act affords heightened protection to these resources, establishing a cooperative federal-state program for the protection of historic and cultural resources. In particular, the review process set out in Section 106 (16 U.S.C. § 470f) obligates the agencies to consider the effects of management actions on historic and cultural resources listed or eligible for inclusion under NHPA. Further, Section 110 of the NHPA requires the BLM to assume responsibility for the preservation of historic properties it owns or controls (16 U.S.C. § 470h-2(a)(1)), and to manage and maintain those resources in a way that gives "special consideration" to preserving their historic, archaeological, and cultural values. Section 110 also requires the BLM to ensure that all historic properties within the National Monument are identified, evaluated, and nominated to the National Register of Historic Places. *Id*. § 470h-2(a)(2)(A).

The agencies must place special importance on consultation with Tribes and the PEIS should comment to a specific plan for ensuring identification, evaluation, nomination and protection of cultural resources prior to issuing leases. Further, places where Tribes have already raised concerns and those where there is known to be a significant concentration or high potential for such a concentration of cultural resources should be excluded or avoided from those lands prioritized for leasing and development.

G. GIS Data

O-58-37

As stated in our scoping comments, geographic information systems (GIS) data is critical for ensuring that existing resources can be mapped and considered in this PEIS and subsequent decisions. The agencies should not only obtain and analyze this data, they should also make it available to the public for use in understanding and commenting on impacts, as was done with the West-wide Energy Corridors Draft PEIS.

1) Lands with wilderness characteristics and proposed wilderness: GIS layers needed to complete the PEIS. 0-58-38

Prior to identifying areas appropriate for geothermal energy development as part of the PEIS, it is imperative that the agencies gather the necessary information to ensure that wilderness quality lands are not disturbed. The agencies have before them a unique opportunity to act as stewards of the public domain on a west-wide scale. By collecting and using appropriate GIS data layers before considering appropriate places for geothermal leasing and development, the agencies can ensure that they avoid disturbing our nation's wild places. **We recommend that the agencies collect and use the following GIS data layers to map areas that are unacceptable for siting geothermal projects and in siting projects to avoid impacting the identified areas:**

State	Contact Information
Alaska	**Address:** The Wilderness Society, Alaska 705 Christensen Drive Anchorage, AK 99501 **Phone:** (907) 272-9453 **Email:** ak_office@tws.org **Website:** www.wilderness.org
Arizona	**Address:** Arizona Wilderness Coalition PO Box 529 Alpine, AZ 85920 **Phone:** (928) 339-4426 **Email:** azwild@azwild.org **Website:** www.azwild.org
California	**Address:** California Wilderness Coalition 1212 Broadway, Suite 1700 Oakland, CA 94612 **Phone:** (510) 451-1450 **Email:** info@calwild.org **Website:** www.calwild.org
Colorado	**Address:** Colorado Environmental Coalition 1536 Wynkoop Street #5C Denver, CO 80202 **Phone:** (303) 534-7066 **Email:** info@cecenviro.org **Website:** www.ourcolorado.org
Idaho	**Address:** The Wilderness Society, Idaho 950 W. Bannock Street Suite 605 Boise, ID 83702 **Phone:** (208) 343-8153 **Email:** brad_brooks@tws.org **Website:** www.wilderness.org
Montana	**Address:** Montana Wilderness Association PO Box 635 Helena, MT 59624 **Phone:** (406) 443-7350 **Email:** mwa@wildmontana.org

	Website: www.wildmontana.org	
Nevada	**Address:** Nevada Wilderness Project 8550 White Fir Street Reno, NV 89523 **Website:** http://www.wildnevada.org	**Phone:** (202) 266-0465 **Email:**
New Mexico	**Address:** New Mexico Wilderness Alliance 202 Central SE Suite 101 Albuquerque, NM 87102 **Website:** www.nmwild.org	**Phone:** (505) 843-8696 **Email:** Emailnmwa@nmwild.org
Oregon	**Address:** Oregon Wild 5825 North Greeley Portland, OR 97217-4145 **Website:** www.oregonwild.org	**Phone:** (503) 283-6343 **Email:** info@oregonwild.org
Utah	**Address:** The Wild Utah Project 68 South Main Street, Suite 400 Salt Lake City, UT 84101 **Website:** http://www.wildutahproject.org	**Phone:** (801) 328-3550 **Email:** wup@xmission.com
Washington	**Address:** The Wilderness Society, Seattle 720 3rd Avenue, Suite 1800 Seattle, WA 98104 **Website:** www.wilderness.org	**Phone:** (206) 624-6430 **Email:** bob_freimark@tws.org
Wyoming	**Address:** Biodiversity Conservation Alliance P.O. Box 1512 Laramie, WY 82073 **Website:** www.biodiversityassociates.org	**Phone:** (307) 742-7978 **Email:** erik@voiceforthewild.org

Attached with the hard copy of these comments is a CD of GIS data for all available citizen-proposed wilderness areas for Colorado, Idaho, New Mexico, Utah, and Wyoming, current as of September 2008. The offices above can always be contacted for the most current versions of these data; GIS data for Citizen Proposed Wilderness Areas for Alaska, Arizona, California, Montana, Nevada, Oregon, and Washington can be obtained by contacting the offices above.

Many lands with wilderness characteristics have been inventoried and mapped by BLM field offices as part of RMP revisions. BLM should use this data to identify exclusion areas for geothermal leasing. Further, in identifying additional lands with wilderness characteristics, BLM should use GIS mapping to identify exclusion areas, and the agency should make these data layers available to the public as part of their PEIS.

2) Other GIS layers needed to complete the PEIS

As stated above, because the siting of geothermal projects will have significant and long lasting impacts on public lands, it is critical that the agency gather, analyze, and make available to the public any GIS layers which describe sensitive or protected areas. In addition to the lands with wilderness characteristics, citizen proposed wilderness, and wilderness inventories discussed above, we recommend that the agencies **collect and use the following GIS data layers to map areas that are unacceptable for siting geothermal projects and in siting projects to avoid impacting the identified areas:** 0-58-39

1. Designated Wilderness Areas;
2. Wilderness Study Areas;
3. National Monuments;
4. National Conservation Areas;
5. Other lands within BLM's NLCS;
6. National Historic and National Scenic Trails;
7. National Wild, Scenic, and Recreational Rivers, study rivers and segments, and eligible rivers and segments;
8. ACECs, including Outstanding Natural Areas and Research Natural Areas;
9. Forest Service Research Natural Areas;
10. Threatened, endangered and sensitive species habitat (available from USFWS[2], state wildlife agencies and, for BLM lands, from NatureServe[3]; critical cores and linkages for wildlife habitat (available from USFWS and state wildlife agencies, including in State Wildlife Action Plans, as well as the Wildlands Project and its affiliated regional organizations[4]) important bird areas (available from BLM and the National Audubon Society[5]);
11. Riparian areas (available from SWReGAP[6], except for California, which is available from the UCSB Biogeography Lab[7]); and
12. Yellowstone Controlled Groundwater Area (available from Montana's Department of Natural Resources and Conservation, 406-586-5243),

Recommendations: The agencies should complete the additional collection of data and analysis of impacts outlined above, then revise the PEIS to incorporate the results into the selected alternative.

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[2] http://www.fws.gov/southwest/es/newmexico/ES_home.cfm
[3] NatureServe was contracted to identify and map locations of threatened and endangered species habitat that exist only on BLM lands – making these areas even more critical to the survival of the species. This data can be found at www.natureserve.org

[4] http://www.twp.org/cms/page1158.cfm
[5] http://www.audubon.org/bird/IBA/
[6] http://ftp.nr.usu.edu/swgap/
[7] http://www.biogeog.ucsb.edu/projects/gap/gap_home.html

IV. Additional Analysis Is Required Prior to Leasing and Development.

The agencies have stated that this PEIS will be used to "develop a comprehensive list of stipulations, best management practices, and procedures to serve as consistent guidance for future geothermal leasing and development on public and NFS lands" and to "amend the BLM Resource Management Plans (RMPs) to adopt the resource allocations and procedures." 73 Fed.Reg. 33803. These uses require that the PEIS include sufficient environmental analysis to justify decisions and also commit the agencies to further analysis prior to approval of leasing.

A. Tiering to the PEIS must be limited and unequivocal commitments to site-specific NEPA analysis included in the PEIS and land use plan amendments.

O-58-40

The PEIS will identify lands that are available for leasing. In order to support amendment of BLM land use plans and for the Forest Service and the BLM to tier to the PEIS in connection with subsequent decision-making processes, the analysis conducted under NEPA must be sufficiently robust to support the determination that specific lands are suitable for development. NEPA requires the agencies to take a "hard look" at the potential environmental consequences of this proposed action, so that they must assess impacts and effects that include: "ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative." 40 C.F.R. § 1508.8. In the context of a programmatic EIS, "the overview or area-wide EIS would serve as a valuable and necessary analysis of the affected environment and the potential cumulative impacts of the reasonably foreseeable actions under that program or within that geographical area." Council on Environmental Quality, *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, Question 24b, available at http://ceq.hss.doe.gov/nepa/regs/40/40p3.htm. For future projects, the agencies can tier to the environmental analysis in the PEIS, but this incorporation "would be followed by site-specific or project-specific EISs," which "would make each EIS of greater use and meaning to the public as the plan or program develops." *Id.*, Question 24c.

In addition, NEPA requires the consideration of a reasonable range of alternatives as part of evaluation of a proposed action. NEPA requires the agencies to "rigorously explore and objectively evaluate" a range of alternatives to proposed federal actions. *See* 40 C.F.R. §§ 1502.14(a), 1508.25(c). "An agency must look at every reasonable alternative, with the range dictated by the nature and scope of the proposed action." *Nw. Envtl. Defense Center v. Bonneville Power Admin.*, 117 F.3d 1520, 1538 (9th Cir. 1997). An agency violates NEPA by failing to "rigorously explore and objectively evaluate all reasonable alternatives" to the proposed action. *City of Tenakee Springs v. Clough*, 915 F.2d 1308, 1310 (9th Cir. 1990) (quoting 40 C.F.R. § 1502.14). This evaluation extends to considering more environmentally protective alternatives and mitigation measures. *See, e.g., Kootenai Tribe of Idaho v. Veneman*, 313 F.3d 1094,1122–23 (9th Cir. 2002) (and cases cited therein). In the context of analyzing specific leases, the range of alternatives should also include an alternative not to lease at all.

The PEIS acknowledges the need for additional environmental analysis, although it defers the level of review for individual permits to be determined at the BLM field office or FS unit and provides for that analysis to be either an EIS or a "tiered environmental assessment (EA)," depending on the extent to which "this PEIS anticipates issues and concerns associated with individual projects, including potential cumulative impacts." Draft PEIS, p. 2-22. This statement properly acknowledges the need for site-specific analysis, but is too general.

Recommendation: Based on the general level of analysis included in the Draft PEIS, the PEIS and the subsequent amendments to BLM land use plans should specifically and unequivocally require site-specific environmental review prior to approval of projects, including opportunities for public comment and addressing direct, indirect and cumulative impacts. Both of these documents should state that an EIS will be presumed to be required unless the Forest Service or BLM determines that all site-specific concerns have been addressed in this PEIS and the cumulative impact analysis has not substantively changed. There should also be a specific commitment to considering a range of alternatives, including an alternative not to issue a lease for geothermal development.

B. Additional limitations on tiering.

The Draft PEIS acknowledges that the RFD, which forms the basis for the cumulative impact analysis, is limited, stating: 0-58-41

> The RFD was based on a review of recent government and industry reports providing assessments of geothermal potential across the western US (Western Governors' Association 2006; DOE and BLM 2003; NREL 2006; BLM 2007a; Geothermal Energy Association 2007a) and the typical impacts associated with geothermal development (GeothermEx 2007). Few quantitative evaluations have been conducted at this scale, and those that exist are considered largely speculative due to the wide array of variables around future geothermal development. These variables include the speculative estimation of unexplored geothermal resources, the development of geothermal technologies that may allow for extraction of resources currently unusable, the unknown nature of future energy markets, and the unknown future of regulatory and political climates.

Draft PEIS, p. 2-33. Accordingly, where technologies not specifically addressed in the PEIS are proposed, their environmental consequences have not been thoroughly discussed, requiring a new assessment. Similarly, where leases are proposed in areas that were not identified in the PEIS, new analysis is required. Further, if new technologies, geographic areas or economic, regulatory or other conditions change, the cumulative impact analysis in the PEIS will no longer by accurate.

Recommendations: The PEIS should clearly state the limitations of the issues analyzed, the limitations on tiering to the PEIS for environmental analysis, and the need to update the cumulative impacts analysis if relevant factors change.

C. Best management practices must be mandated for incorporation in all permits and should not be subject to waiver, exception or modification. 0-58-42

The Draft PEIS sets out important protective terms and conditions that should be incorporated into permits. *See*, Draft PEIS, pp. 2-16 – 2-17. However, different portions of the Draft PEIS refer to these terms and conditions as those that "will" or "may" apply, giving the impression that some of these terms are required to be incorporated into permits and others may not be, even when they are applicable to a proposed location. Further, since the BLM routinely permits waiver, exception and modification of stipulations and conditions in the context of oil and gas development, there is not guarantee that these measures will be applied.

Best management practices are an important vehicle for mitigating impacts of geothermal development. However, without a definitive commitment to their use, these practices cannot be relied upon to reduce environmental consequences. *See, e.g.*, Council on Environmental Quality, *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, Question 19, *Davis v. Mineta*, 302 F.3d 1104, 1125 (10th Cir. 2002).

Recommendation: The PEIS must clearly state that all best management practices, stipulations and conditions are required to be incorporated into permits where the resources that they are designed to protect are present. Further, these provisions should not be subject to waiver, exception or modification unless very narrow, specific qualifications are met and should not be available at all in the context of no surface occupancy stipulations.

D. Compliance with Section 106 of the NHPA and Section 7 of the ESA.

O-58-43

The Draft PEIS states that consultation under Section 106 of the National Historic Preservation Act and Section 7 of the Endangered Species Act will occur prior to leasing and additional consultation will occur as needed for specific projects. Draft PEIS, p. 2-21.

Recommendation: The PEIS should maintain a specific commitment to engaging in consultation prior to leasing and as needed throughout evaluation of a project.

V. The Pending Applications Should Be Assessed in Accordance with the Recommendations Set Out for New Leasing.

O-58-44

A. Pending lease applications should be subject to the screens listed in Section II prior to approval

The 19 pending lease applications should be subject to the screens listed in Section II. Any pending lease applications which conflict with the screens in Section II should either be required to alter their boundaries to avoid citizen-proposed wilderness, inventoried roadless areas, lands with wilderness characteristics and other lands with special values, or the leases should be denied.

The following lease applications encompass lands that are in Forest Service Inventoried Roadless Areas: CACA 043745, 043744, 042989 - Modoc National Forest; NVN 074289 - Humboldt-Toiyabe National Forest/Battle Mountain District; OROR 017049, 017327 - Mt. Hood National Forest; OROR 054587 - Willamette National Forest; WAOR 056025, 056058, 052069 - Mt. Baker National Forest.

The following lease applications encompass lands that are in citizen-proposed wilderness areas: CACA 043745, 043744, 042989 – Modoc National Forest/BLM Surprise Field Office; OROR 017149, 017503 – Mt. Hood National Forest/BLM Prineville Field Office.

Specific comments on individual lease applications are set out in Appendix B to these comments, attached and incorporated by reference.

Recommendation: If pending applications conflict with the screens in Section II, the agencies should either alter the lease boundaries to avoid the conflict or deny the application.

B. Because the pending lease applications anticipate the use of binary cycle systems, the agencies should prioritize leases in areas that are not controversial and have well-documented resources, and consider use of conditional development leases until the technology is proven to be successful 0-58-45

As discussed in previous sections of the comments, because the binary cycle technology proposed for development in the pending lease applications has not been thoroughly tested, the proposed development requires a careful, measured approach to minimize potential impacts.

Recommendation: The agencies should consider prioritizing approval of applications and use of conditional development leases until technology is proven to be successful.

We look forward to continuing to participate in this process. Please feel free to contact us if you have any questions or need additional information. We would also welcome the opportunity to meet with you to present and discuss these comments in person.

Sincerely,

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AND ON BEHALF OF:

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Bark

Appendix B: Comments on Specific Pending Lease Applications

El Centro Field Office (Draft PEIS, Chapter 12) O-58-46

Recommendation: Subject to the screens listed in Section II and all of the other recommendations included in these comments, this lease should be approved. This will protect the other resources of this area while still allowing development of the geothermal resource and the benefits to climate change from renewable energy development.

Modoc National Forest/Surprise Field Office (Draft PEIS, Chapter 13)

The pending lease applications have significant conflicts, overlapping nearly entirely with FS Inventoried Roadless Areas (IRAs) and Citizen Wilderness Inventory Areas (CWIAs). The pending lease applications overlap with the Powley and Soldier IRAs and the Powley Creek and Cedar Mountain CWIAs. However, the DPEIS states that development would result in two binary power plants outside of these conflict areas – one on the private lands of pending lease site CACA 043745 and one in the northwestern portion of pending lease application site CACA 043745 (DPEIS 13-8). O-58-47

The PEIS also acknowledges that there are known cultural resources in the area of the leases (and even within one of the leases), which would be "considered significant cultural resources to the local Native Americans and tribes." (PEIS, p. 13-39)

The PEIS further states that areas of potential affect such as access roads, power plants, well pads, etc., would be analyzed at the project specific level and require inventories, evaluations, and appropriate treatments as outlined in the BMPs. As detailed in Appendix D of the PEIS, this would include:

- Unexpected discovery of cultural resources stops development work and requires notice of the responsible BLM officer for evaluation and development of appropriate mitigation measures;
- Section 106 of the National Historic Preservation Act compliance before any specific permitting under the leases; and Development of a Cultural Resources Management Plan if cultural resources are identified at the site, or if areas with high potential to contain cultural materials have been identified.

Under these BMPs, BLM would also conduct Section 106 consultation with the SHPO, Native American tribes with historic ties to the area, and local historic preservation groups. Project specific impacts after leasing would be reduced by implementing these BMPs.

Recommendation: The boundaries of these pending lease applications should be redrawn to exclude the IRAs and CWIAs, or the applications should be denied. Due to the presence of significant cultural resources in the area and even within one lease boundary, it is critical that the agencies follow the BMPs set out in the PEIS to protect these resources. If the lease boundaries are redrawn to exclude IRAs and CWIAs, and subject to the screens listed in Section II and all of the other recommendations included in these comments, this lease should be approved. This will protect the other resources of this area while still allowing development of the geothermal resource and the benefits to climate change from renewable energy development.

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O-58-1

DOE and others are actively funding research to better understand the viability of recovering the heat from hot fluids from oil and gas wells (e.g., Rocky Mountain Oilfield Testing Center near Casper, Wyoming and research symposia and research at Southern Methodist University). It has been a very slow process, taking almost five years for both to get off the ground. In addition, with the publication of The Future of Geothermal Energy: Impact of Enhanced Geothermal System (EGS) in the United States by MIT in 2006, followed two years later by both the Department of Energy's recent RFP regarding further R&D on EGS, and Google Foundation's 2008 announcement of its funding of further EGS research and development, EGS development studies are ongoing. While neither BLM nor FS are research agencies, they pay very close attention to these studies.

Site-specific analysis of leases and project applications will also be necessary to address the particular impacts of future leases and projects from various technologies.

The PEIS also provides for mitigation and monitoring of leases, stipulations, and permit conditions, as discussed on page 2-20 of the Draft PEIS.

O-58-2

Please see response to comments I-2-4 and I-2-6 for a discussion of flash steam technology.

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1 *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

O-58-3

As noted in the comment and in the PEIS, there are similarities in the leasing process and how geothermal resources are explored, drilled, and developed. The BLM and FS have appropriately applied many of the lessons of oil and gas to the development of the proposed action, including proactive stipulations.

O-58-4

The PEIS has been modified to include additional climate change discussion for affected resources. Please see the water, soil, vegetation, fish and wildlife, and other resource sections in the Final PEIS.

O-58-5

In accordance with 40 CFR Section 1502.13, the purpose of and need for the proposed action is used to define a range of reasonable alternatives (purpose of and need for action is defined in Sections 1.2 and 1.3). The BLM is making an allocation decision here and adopting a list of stipulations, BMPs, and compliance procedures to be incorporated in the land use plans. The PEIS analyzes in detail the Proposed Action, a No Action alternative, and a Leasing Near Transmission lines alternative. The Final PEIS incorporates input from public comments on the Proposed Action. Another alternative considered but eliminated from detailed study included no leasing or development of geothermal resources on public or NFS lands (Section 2.4.1). As explained in Section 2.4.1, this alternative, which would have been the most protective (from a ground disturbance standpoint), was eliminated because it would violate the multiple use provisions of FLPMA and is inconsistent with the President's National Energy Policy, the Energy Policy Act of 2005, and Executive Order 13212 and would not have fulfilled the purpose and need for the proposed action.

The alternatives analyzed represent a range of acreages as potentially available for leasing. See CEQ's *Forty Most Asked Questions Concerning the CEQ's NEPA Regulations*, Question 1b ("When there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in the EIS.") In particular, the Leasing Near Transmission Lines alternative was developed based on public scoping comments to represent a limited development alternative. Instead of inventing a variety of alternatives that would lie between the alternatives presented, the BLM and FS elected to include protective measures (i.e., stipulations, BMPs, and compliance procedures) in each of the action alternatives. Further, those planning areas whose plans include more protective measures may elect to keep those measures in place, instead of the stipulations, BMPs, and compliance procedures presented in the Final PEIS.

O-58-6

The commentor's concerns with Alternative B are noted.

See the above responses in this letter for details on level of analysis and protections provided in the PEIS.

O-58-7

The commentor's concerns with Alternative C are noted.

O-58-8

The existing case law regarding the roadless rule is inconsistent. On August 12, 2008, the Wyoming District Court found the 2001 Roadless Rule violated NEPA and the Wilderness Act (*State of Wyoming v. US Department of Agriculture,* 07-CV-17-B, Wyoming District Court, Cheyenne, Wyoming [2008]). The District Court ordered the 2001 Roadless rule "set aside" and "permanently enjoined." This order is subsequent to a 2006 California District Court ruling that set aside the 2005 State Petitions Rule and reinstated the 2001 Roadless Rule. See *California ex re. Lockyer v. US Department of Agriculture*, 459 F.Supp.2d 874 (N.D. Cal 2006). The United States Justice Department, on behalf of the Department of Agriculture, has filed motions with both the Wyoming and California courts seeking adjustments of those courts' conflicting judicial orders. Neither the Wyoming nor California District Court rulings bar the Department of Agriculture from promulgating other roadless area regulations. To address this inconsistency, the PEIS includes the following Department of Agriculture Roadless Area Stipulation, "If future legislation or regulation change the roadless area designation, the restriction would be revised along with any appropriate environmental review." An appropriate NEPA review would be required prior to any changes to the Roadless Area Stipulation.

O-58-9

Decisions regarding the management of areas with wilderness characteristics are made at the field office level as part of the local land use planning process and not in this PEIS. This allows wilderness characteristics to be evaluated at a finer scale than afforded at a programmatic level. The management and level of protection of the wilderness characteristics on non-WSA lands is discretionary and not bound by requirements of the Wilderness Act of 1964 or the WSA Interim Management Policy (IMP, H-8550-1; BLM 1995); thus, these areas have no official status that removes them from consideration for leasing. Nonetheless, the BLM must consider in its NEPA analyses possible impacts on wilderness characteristics, if present, and may manage the lands to protect and/or preserve some or all of those characteristics through the local land use planning process.

As noted in Chapter 2 of the Draft PEIS, before making any leasing decisions, the BLM will assess whether the existing NEPA is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis. For example, additional NEPA analysis may be required in light of new information, or from a potential change in management approach regarding resources identified for special management (e.g., travel management planning or areas under consideration by BLM for management for wilderness characteristics).

O-58-10

Decisions regarding the management of areas with wilderness characteristics are made at the field office level as part of the local land use planning process and not in this PEIS. This allows wilderness characteristics to be evaluated at a finer scale then can be afforded at a programmatic level. The management and level of protection of the wilderness characteristics on non-WSA lands is discretionary and not bound by requirements of the Wilderness Act of 1964 or the WSA Interim Management Policy (IMP, H-8550-1; BLM 1995); thus, these areas have no official status that removes them from consideration for leasing. Nonetheless, the BLM may manage the lands to protect and/or preserve some or all of those characteristics through the local land use planning process.

O-58-11

Thank you for your comment. The PEIS does provide BMPs and stipulations that protect important migration corridors. Language has been revised in Section 2.2.2 *Procedures Prior to Leasing* to state:

- The authorized officer of the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states manage and typically have regulatory authority for water quality, water rights, and wildlife; and

- The authorized officer of the BLM or FS would review the lands for any other sensitive resources (e.g., paleontological, BLM sensitive status species, and FS species of local concern) and provide for the necessary stipulations to protect these resources and ensure compliance with the land use plan. Assessment of the resource would include consulting with agency experts, coordinating with other appropriate agencies, and site surveys, if warranted.

Prior to any geothermal development, site-specific NEPA would be conducted and migration corridors and important wildlife habitats would be identified. Appropriate measures, including but not limited to those provided in the list of BMPs, would be applied to protect these areas.

O-58-12

The BLM and operators would work with agencies and local stakeholders to identify areas requiring protection and mitigate impacts to special designation areas. See Section 4.2.8 for discussion of areas closed to leasing by Congressional designation.

O-58-13

The purpose of Appendix A is to provide a factual overview of the current status of geothermal resources and the permitting requirements in each state. It is educational, not a proposal. Chapter 2 of the PEIS details the lands proposed for closure and the proposed stipulations for lands with sensitive resources.

O-58-14

Given that impact on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for Yellowstone under the proposed action. See response to comment O-58-18 for a discussion of protection of NPS lands.

O-58-15

Given that impacts on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for Yellowstone under the proposed action. See response to comment O-58-18 for a discussion of protection of NPS lands.

O-58-16

Given that impacts on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for Yellowstone under the proposed action. See response to comment O-58-18 for a discussion of protection of NPS lands.

O-58-17

Given that impacts on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for Yellowstone under the proposed action. See response to comment O-58-18 for a discussion of protection of NPS lands.

O-58-18

The BLM and FS are committed to working with the NPS to avoid adverse impacts to thermal features within NPS units. The language in Section 1.5.4 *Environmental Review Requirements Prior to Leasing* has been revised to clarify further that the BLM is prohibited from geothermal leasing on NPS lands as well as on lands where the Secretary has determined that geothermal operations are reasonably likely to result in a "significant adverse effect on a significant thermal feature" in a unit of the NPS. In addition, a list of the 12 units of the NPS with significant thermal features that occur in the study areas is now included.

Prior to inclusion of any specific parcels in a lease sale, the BLM and FS would coordinate with the National Park Service to determine if there would be any impacts to thermal or hydrological features within NPS units in proximity to a proposed lease. Language has been added to Section 2.2.2 *Procedures Prior to Leasing* to reiterate this point.

In addition, should development be determined to be reasonably likely to have an “adverse effect” on a significant thermal feature, the BLM would include appropriate lease stipulations to protect the park unit.

If it is determined in advance of leasing that exploration, development, or utilization of the lease parcel would “reasonably likely result in a significant adverse effect on a significant thermal feature of a National Park System unit,” then the lease would not be issued (30 USC Section 1026[c]). While preexisting leases and permits are beyond the scope of this PEIS, the statute also provides that, if it is determined that use of an existing lease or permit would be “reasonably likely to adversely affect” any significant thermal feature within a National Park System unit, then stipulations are included on leases and permits to protect the thermal features (30 USC Section 1026 [d]).

O-58-19

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to address sensitive issues and conditions.

O-58-20

Please see response to comment O-58-19, above.

O-58-21

Please see response to comment O-58-19 above.

O-58-22

Please see response to comment O-58-19 above.

O-58-23

Please see response to comment O-58-19 above.

O-58-24

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential and does discuss some of the available technologies, but it is not intended to provide full analysis of all phases of development. All development and utilization, including impacts of the specific technology used at plants, would be subject to further site-specific permitting and environmental analysis.

O-58-25

As stated in the above response, issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential and does discuss some of the available technologies, but it is not intended to provide full analysis of all phases of development. All development and utilization, including impacts of the specific technology used at plants, would be subject to further site-specific permitting and environmental analysis.

O-58-26

Please see the above response.

O-58-27

Additional discussion has been added to the cumulative impact analysis, including discussion on various ongoing transmission line projects and reasonably foreseeable transmission efforts. As noted in Chapter 5, past, present, and reasonably foreseeable actions, including commercial uses of public and federal lands, are documented and analyzed.

O-58-28

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-58-29

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-58-30

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-58-31

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-58-32

The comment is noted. No surface use stipulations for important viewsheds and BMPs for the protection of visual resources (see Appendix B) would be applied, as appropriate to land use plan revisions.

O-58-33

The BLM is proposing to include a Sensitive Species Stipulation for leases in areas that have agency-designated sensitive species. The stipulation could be a NSO, CSU, or TL in order to meet resource objectives (Page 2-19 of the Draft PEIS). This approach provides the flexibility to respond to the dynamic national and regional planning and protection efforts for these species. During the permitting process for any subsequent drilling or development applications, the BLM would conduct the appropriate analysis on siting locations, as noted in the comment.

To provide further protection for threatened, endangered, and sensitive species, the BLM will impose an Endangered Species Act stipulation (see Section 2.2.2) on all geothermal leases.

O-58-34

Thank you for your comment. Unfortunately, this level of data analysis is beyond the scope of the PEIS. The analysis in Chapter 4 is commensurate with the scope of the proposed action for the PEIS.

O-58-35

Decisions regarding the management of areas with wilderness characteristics are made at the field office level as part of the local land use planning process and not in this PEIS. This allows wilderness characteristics to be evaluated at a finer scale than afforded at a programmatic level. The management and level of protection of the wilderness characteristics on non-WSA lands is discretionary and not bound by requirements of the Wilderness Act of 1964 or the WSA Interim Management Policy (IMP, H-8550-1; BLM 1995); thus, these areas have no official status that removes them from consideration for leasing. Nonetheless, the BLM must consider in its NEPA analyses possible impacts on wilderness characteristics, if present, and may manage the lands to protect and/or preserve some or all of those characteristics through the local land use planning process.

As noted in Chapter 2 of the Draft PEIS, before making any leasing decisions, the BLM will assess whether the existing NEPA documentation is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis. For example, additional NEPA analysis may be required in light of new information, or from a potential change in management approach regarding resources identified for special management (e.g., travel management planning or areas under consideration by BLM for management for wilderness characteristics).

Please see the response to comment O-58-8 regarding roadless area regulations.

O-58-36

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and potential geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

The programmatic EIS does not change existing closures, avoidance or protective measures developed for cultural resources, or tribal concerns. It does not constrain local FS or BLM offices from determining new restrictions or closures in land use plans or through special designations. It does describe a process to ensure that these concerns are addressed through tribal consultation at each phase of leasing and development.

O-58-37

The PEIS was based on the best available GIS data available and appropriate for the analysis, including from data sets used in the West-wide Energy Corridors Draft PEIS. The scope of the GIS data is discussed in Section 1.9.3 *Scope of GIS Data and Graphics of the Draft PEIS*.

While the BLM used the GIS data for programmatic level analysis, it is not necessarily appropriate for site-specific analysis. Maps from the Final PEIS will be provided on the public project website.

O-58-38

Available GIS data for the criteria listed in the Proposed Action (Section 2.1.1 *Identify Lands for Leasing*) were used for analysis, data calculations, and graphics.

O-58-39

Figures and acre calculations were developed using GIS for the criteria outlined in the Proposed Action (Section 2.1.1 *Identify Lands for Leasing*). As noted in this section, it included many of the layers listed in the comment. Other layers, including habitat data, watersheds, and soils, were used in preparing the affected environment sections and for the impact analysis.

O-58-40

Prior to making leasing decisions, BLM will assess whether the existing NEPA documentation is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis. As stated in the above responses, all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

O-58-41

Because it is difficult or even impossible to foresee all future permutations of possible geothermal development, the BLM could not create an exhaustive list of the limitations on the future use of this PEIS. Rather, as stated in the Draft PEIS, prior to making leasing decisions the BLM would asses whether the existing NEPA documentation is adequate (through completion of a DNA) or whether there is new information or new circumstances that warrant further analysis (see Section 2.2.2 *Procedures Prior to Leasing*).

O-58-42

It is important to clarify that stipulations are applied to leases, while BMPs are optional actions that can be applied to subsequent development permits based on local site conditions. As noted in Chapter 2 of the Draft PEIS, the stipulations provided in the PEIS would serve as the minimal level of protection and would be adopted into local land use plans upon signing of the ROD. If existing land use plans offer more protective measures or have resource-specific commitments, those more protective measures would apply instead. Section 2.2.2, subsection *Lease Exceptions, Waivers, and Modifications* discusses the limited circumstances under which lease stipulations can be excepted, waived, or modified.

O-58-43

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and potential geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

O-58-44

The comment for suggested revision of lease boundaries has been noted.

The authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

Please see response to comment O-58-8 above for discussion of roadless area regulations.

O-58-45

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1 *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

O-58-46

The conditional support for issuance of the El Centro leases has been noted.

O-58-47

The comment for suggested revision of lease boundaries has been noted and will be considered by the FS and BLM prior to leasing decisions.

UINTAH COUNTY

STATE OF UTAH

Our past is the nation's future

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David J. Haslem
Darlene R. Burns
ASSESSOR - Rolene Rasmussen
ATTORNEY - JoAnn B. Stringham
CLERK-AUDITOR - Michael W. Wilkins
RECORDER - Randy J. Simmons
TREASURER - Wendy Long
SHERIFF - Jeff Merrell
SURVEYOR - John Slaugh

September 19, 2008

Geothermal Programmatic EIS
c/o EMOSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

RE: Draft Programmatic EIS for leasing of Geothermal Resources in 11 Western States and Alaska

Dear Sirs:

Thank you for the opportunity to comment on the Draft Programmatic EIS (DPEIS) for Leasing of Geothermal Resources.

Our comments are below:

The DPEIS addresses incorporation of the findings into existing Resource Management Plans (RMP's) and lists the plans that will be amended when the EIS (Environmental Impact Statement) is implemented. The DPEIS does not state clearly how it will be incorporated with respect to RMP's that are in draft stages. A-59-1

A number of the RMP's listed to be revised are likely to be in the final stages of approval or approved prior to the implementation of the EIS.

It is possible that the Diamond Mountain Plan and Book Cliffs Plan will be replaced by the Vernal Office Resource Management Plan by the time the decision is released.

Uintah County is concerned that geothermal leasing decisions may be diluted or rejected in the RMP revision process that incorporates them into the RMP because of proposed or existing resource allocations.

Language should be developed to guide such incorporation. In particular, decisions in the RMP's, such as ACEC's (Areas of Critical Environment Concern) and non-WSA (Wilderness Study Areas) lands with wilderness characteristics or unavailable for leasing, which would prevent geothermal leasing, should be re-analyzed unless the impacts to geothermal resources were analyzed and disclosed in the RMP/EIS

Thank you for your attention to these comments.

Sincerely,

UINTAH COUNTY COMMISSION

Michael J McKee   Darlene R. Burns

Michael J. McKee, Chairman   David J. Haslem   Darlene R. Burns

A-59-1

The geothermal RMP amendments would amend the Book Cliffs and Diamond Mountain plans. Once the ROD is signed for the Vernal RMP revision, it will become the guiding management document. The potential for geothermal development in Vernal is limited enough so that future site-specific analysis is anticipated to be sufficient to support the development.

IDAHO WILDLIFE FEDERATION
Affiliated with the National Wildlife Federation

Geothermal Programmatic EIS
C/O EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

September 19, 2008

RE: Draft Programmatic Environmental Impact Statement
For Geothermal Leasing in the Western United States

The Idaho Wildlife Federation has reviewed the Bureau of Land Management, and U.S. Forest Service, *Draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States, including Alaska*. This draft PEIS has set forth three alternatives with respect to future action taken regarding the development of BLM and U.S. Forest Service lands to geothermal leasing. Upon review of the draft PEIS, the Idaho Wildlife Federation is going on record in support of Alternative A, which is the No Action Alternative. O-60-1

Sincerely,

Rob Fraser
Director – Idaho Wildlife Federation

PO Box 6426, Boise, ID 83707 Phone: 208-342-7055 Fax: 208-342-2366
idahowildlife@gmail.com www.idahowildlife.org

O-60-1

The commentor’s support for Alternative A is noted.

Pit River Tribe Environmental Department
37118 Main Street • Burney, CA 96013
phone 530.335.5062 • fax 530.335.5069 • email shastamedicine@snowcrest.net

September 18, 2008

via electronic mail (geothermal_EIS@blm.gov)

Geothermal Programmatic EIS
c/o EMPSi
82 Howard Street, Suite 110
San Francisco, California 94105

Re: Comments on the Draft Programmatic Environmental Impact Statement for Geothermal Energy Leasing

Dear Sir or Madam:

The Pit River Tribe Environmental Department submits the following comments containing grave concerns about the Draft Programmatic Environmental Impact Statement for Geothermal Energy Leasing (PEIS), affecting sacred lands that are vital to the Tribe's spiritual, cultural, and physical wellbeing.

The Pit River Tribe is a federally recognized sovereign Indian Tribe consisting of eleven autonomous bands. Members of the Pit River Tribe have used, and continue to use, Mount Shasta, the Medicine Lake and the Highlands, and the Warner Mountains for religious and cultural purposes. These areas, and possibly others within the PEIS boundaries, are vital to the spiritual and cultural continuity of the Pit River Nation.

The Tribe's federally approved Tribal Constitution grants the Tribe the authority to "exercise its jurisdiction to the fullest extent permitted by Federal Law, including but not limited to, lands, waters, properties, air space, fish and wildlife and other resources" on its ancestral lands.[1]

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[1] PIT RIVER TRIBE CONSTITUTION.

Request to submit additional comments

The Tribe requests an extension of the comment deadline pending complete consultations regarding the PEIS. While initial consultations were recently held, the Tribe does not consider that it has been given a full picture of the implications of the PEIS for its interests. The Tribe may wish to add concerns other than those stated in this letter, based on information newly made available to the Tribe at a recent quarterly meeting with the Modoc National Forest and during further consultations. A-61-1

Areas of critical spiritual, cultural and physical importance to the Pit River Tribe

We are aware that three areas, included in Table 2-7 [page 2-35 of the PEIS] and in the Lease Applications, are of vital significance to the Tribe. These areas are the Medicine Lake Highlands in the Modoc and Klamath National Forests, Mount Shasta in the Shasta-Trinity National Forests, and areas in the Warner Mountains within the Modoc National Forest. A-61-2

Table 2-7 [PEIS at 2-35] shows that the Medicine Lake/Glass Mountain area has a projected capacity of 480 megawatts, and that Mount Shasta could produce up to 240 megawatts. These figures are totally unsubstantiated by any exploration projects, which were either a total failure or, at best, marginal. We believe these highly exaggerated figures to be a fabrication of geothermal companies (Calpine and Vulcan) who are seeking to mislead the agencies in order to prioritize these areas for geothermal leasing.

The projected 480 megawatts adds up to ten power plants in the Medicine Lake Highlands, for a total of at least 60-80 square miles. This would essentially mean full industrialization of the Highlands, which is wholly unacceptable to the Tribe.

For Mount Shasta, the projected 240 megawatts would mean 5 power plants, which is equally inconceivable from a Tribal point of view.

Medicine Lake Highlands

A-61-3

The Medicine Lake volcanic caldera and surrounding forested Highlands form a unique, visually stunning landscape that has been revered by the region's Indian Tribes and used in Native American cultural and religious ceremonies "since time immemorial," or for at least 10,000 years by the archaeologist's count. The Tribe has long used, and continues to use the Medicine Lake Highlands for religious and cultural purposes, including vision quests, religious prayers and teaching, traditional shaman/doctoring practices, life cycle ceremonies, the collection of traditional foods, medicines and materials, quiet contemplation, and spiritual renewal.[2] The Medicine Lake Caldera and Highlands have been designated as eligible for listing on the National Register of Historic Places based on the area's value to the Pit River, Modoc and other Tribes near and far. The Traditional Cultural District comprises an area of 113 square miles, encompassing the area above the 6,000 foot elevation.

Pit River people continue to depend upon the physical, environmental and visual integrity of these lands and their quietude, for carrying out these traditional practices. "This area is of utmost importance to the cultural survival of the Pit River Tribe, because it is still being utilized and still has spiritual integrity …. Whatever happens to the Medicine Lake Highlands affects our spiritual and physical existence."[3]

The Highland's enduring role in Pit River religious life is rooted in its sacred geography:

> Among all the places lying within the traditional territory of the Pit River people, few are of such *enduring cultural significance* as the Highlands . . . [it] is referred to as 'where all the water comes from,' . . . it is viewed as an integral part of Mount Shasta, called Yet, or 'sacred mountain[,]' . . . one of the primary peaks from which the world was said to have been created in Pit River oral tradition.[4]

Heritage use of the Medicine Lake Highlands continues to this day. In a decision resulting in the invalidation of Calpine's geothermal leases at Fourmile Hill within the Highlands, the Ninth Circuit Court of Appeals summed up the Pit River Tribe's continuing relationship with the Highlands:

> Medicine Lake and the highlands surrounding it are of great spiritual significance to the Pit River Tribe and to the other Native American tribes in the region . . . the highlands are within the Pit River Tribe's ancestral homelands . . . Tribe members [] consider the region sacred and continue to use numerous important spiritual and cultural sites within the Highlands.[5]

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[2] *See generally,* FOURMILE HILL GEOTHERMAL DEVELOPMENT PROJECT, VOLUME I: FINAL EIS/EIR, 3-69 – 3-71 (Sept. 1998) [hereinafter FINAL EIS/EIR] (noting that the Pit River people "were intimately and spiritually involved in their physical environment, and the landscape of their territory played an intricate role in their history, mythology, cultural patterns, and social system to the present")).
[3] Theodore Ruben Martinez & Floyd J. Buckskin, *Individual Declarations Regarding the Medicine Lake Highlands and Impacts of Proposed Geothermal Developments* at 1 (Feb. 2, 1999) [hereinafter *Martinez and Buckskin Declarations*].
[4] HISTORIC PROPERTIES MANAGEMENT PLAN FOR THE MEDICINE LAKE HIGHLANDS, at 20 (emphasis added).
[5] *Pit River Tribe v. U.S. Forest Serv.*, 469 F.3d 768, 772 (9th Cir. 2006).

In summary, the Highlands' religious and cultural significance derives from and depends fundamentally upon the physical, environmental, and visual integrity of the landscape as a whole, and upon its quietude.[6] This is acknowledged by the Modoc Forest Plan, which states that:

> The certainty and uncertainty of maintaining the group's way of life and their traditional uses of the land is *directly related to the amount of environmental disturbance* caused by Forest activities: the greater the disturbance, the more likely an area of religious or cultural significance will be changed.[7]

The need for protective action in the Medicine Lake Highlands is, therefore, readily apparent.

Mount Shasta

We have gone into detail to describe the importance of the Medicine Lake Highlands, and Mount Shasta is no less significant. Indeed, the two landscapes are linked in the Tribe's creation stories, as well as in its spiritual and cultural practices. Mount Shasta is a pinnacle of sacredness to all five Tribes of the region, as shown by an extensive ethnographic study done in conjunction with a ski resort proposal, which was denied in 1998 after a ten-year administrative and legal challenge. C-61-4

The Forest Service has decided not to consent to geothermal leasing on Mount Shasta, after consultations with the Pit River Tribe and other affected Tribes. The Forest Supervisor determined that leasing would be inconsistent with the Forest Plan because of "the risk of adverse impacts to cultural and historic values" on Mount Shasta, an "iconic landmark known world-wide for its beauty and spiritual significance." The Forest Plan directed in 1995 that Mount Shasta would be managed for "cultural and historic values, recreation and visual quality." The decision concluded that "geothermal development…would in fact be a significant degradation of a pace held sacred by many Native American peoples."

The Forest Service report emphasized that "the entire Mountain, from the peak to the surrounding flatlands, is of significance…. Repeated communications over the years document the interconnected nature of features on Mount Shasta. Tribal consultations clearly demonstrate that Mount Shasta, in its entirety, continues to be held as a sacred entity …. As was found with the geothermal developments at Medicine Lake, I believe there is no way to proceed with

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6 *See, e.g.*, FINAL EIS/EIR at 3 – 73-76.

7 USDA FOREST SERVICE, MODOC NATIONAL FOREST, LAND AND RESOURCES MANAGEMENT PLAN, 3-4 (1991) (emphasis added) [hereinafter MODOC FOREST PLAN].

geothermal development on Mount Shasta in a manner that does not damage fundamental cultural values."

The Regional Forester agreed with the Shasta-Trinity Supervisor, citing authorities under Sacred Sites Executive Order 13007 that directs agencies to "avoid adversely affecting the physical integrity" of Indian Sacred Sites.

Warner Mountains

C-61-5

The Tribe was recently made aware of the inclusion of an area of the Warner Mountains for leasing through the PEIS. This area is significant to several Tribal bands and to the Tribe as a whole. Before such an area can be considered for leasing, ethnographic and archaeological studies must be done. No irretrievable commitments can take place unless full evaluations under Section 106 of the National Historic Preservation Act are carried out.

Other areas

C-61-6

Other areas of significance may exist about which the Tribe was not consulted. The Tribe requests such consultations before any area within its Traditional Ancestral Lands is included in the PEIS or any other proposal.

Industrial geothermal development is incompatible with sacred areas

C-61-7

Based on our experience in the Medicine Lake Highlands, we know geothermal development to consist of a sprawling industrial production complex dominated by towering emission plumes, continuous industrial noise and lighting, and hundreds of miles of electrical lines, piping, fencing, and roads.

Ground disturbance and landscape fragmentation is vastly understated in the PEIS [at 2-12]. The project proposals with which we are familiar would cover areas of 6 to 8 square miles *each*, with the impacts described above.

Excavation of potential wells often require a process known as Enhanced Geothermal Systems (EGS), which entails injecting large quantities of toxic acids into the ground in order to produce a pooling of the geothermal resource.

From a Tribal cultural preservation standpoint, geothermal development is one of the most harmful forms of development.[8] Geothermal plant operations are noisy and well-lit, attributes that are "fundamentally incompatible with the solace and isolation required for the vision quest.[9]

Concerns about hydrology and water quality

One of the Tribe's most valuable and important Tribal resources is water, and Medicine Lake and its surrounding springs are "a vital traditional resource for the health and well-being of the people."[10] The waters of the Medicine Lake Highlands are a key component of religious and ceremonial life for the Pit River Tribe. "Water quality is of critical concern because it impacts so many areas of life. To the Pit River Tribe, water fulfills an essential role beyond daily use." [11] The Tribe developed formal Water Quality Standards to be used as guidance supplements to the Historic Properties Management Plan for the Medicine Lake Highlands. A-61-8

The waters of the Medicine Lake Highlands also play an important role as a regional reservoir of fresh water "through recharge of snowmelt on the slopes of the Medicine Lake Volcano. [12] Due to the porous geologic environment of the Highlands, which includes a network of underground ice caves "and other cavities that are open to winter cold air," a water reservoir is collected by means of underground ice, which "may contain as much as 30 to 40 years of accumulated snowmelt in a shallow surface 'aquifer.'" [13] This reservoir steadily feeds the Fall River Springs, the Pit River, and ultimately the Sacramento River, and "supports an important sustainable fish and wildlife resource." [14]

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8 *Deur Ethnographic Study* at 94 ("The sights and sounds of geothermal plant operations . . . were fundamentally incompatible with the solace and isolation required for the vision quest. The impacts of geothermal development are therefore said to be greater than other types of development that already exist in the Highlands, and even limited geothermal development has the potential to adversely affect the broadly distributed ceremonial sites of the Highlands").

9 *Ibid.*

10 PIT RIVER TRIBE, *Tribal Water Quality Standards* at 6 [hereinafter *Water Standards*], which were incorporated into the Historic Properties Management Plan for the Medicine Lake Highlands. The Water Quality Standards were prepared with the assistance of Dr. Robert Curry, Ph.D., P.G. of Watershed Systems.

11 *Theodoratus Ethnographic Report* at 30.

12 *Water Standards* at 6.

13 *Id.*

14 *Id.*

The Tribal Standards seek "to protect and maintain the existing physical, biological, and chemical integrity" of local waters through an "anti-degradation policy" expressly akin to that which underlies the Clean Water Act.[15] The Tribal Standards provide "action limits" for evaluating water quality on the basis of a) general water quality indicators, including, *inter alia,* temperature, dissolved oxygen, pH, and turbidity, and b) chemical constituents including, *inter alia,* nitrates, sulfites, and heavy metals.[16]

Geothermal excavation and development may result in the seepage of sulfur and other pollutants into lakes, springs, and fresh water reservoirs in the Highlands. In addition to impacting the continuation of tribal rituals using Medicine Lake, Pit River Tribal members reasonably believe these areas of seepage "could ruin habitat [,] affect groundwater and kill plant life."[17]

Geothermal energy production would also likely result in over-consumption of Highland waters; this effect threatens tribal rituals and the surrounding ecosystem. A goal of the Tribe is to insure that precipitation in the Highlands continues to recharge groundwater, and to feed lakes, rivers, and springs such that there are "no changes in static groundwater levels or volumes of flow in aquifer units."[18] Changes in water flow of this sort would harm the soil moisture levels necessary to support traditional vegetation and animals, and would "occur to the detriment of traditional uses."[19] A-61-9

Air quality

A-61-10

The value of a "pure, untainted airshed" is stated by the Tribe to be a basic "[t]ribal cultural value." [20] Effective air quality management directives should include "measurable criteria, quantifiable thresholds, and clear implementation and monitoring procedures" for both a) ambient air quality and b) emissions.[21]

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[15] *Water Standards* at 1; Clean Water Act of 1977, 33 U.S.C. §1313 (d)(4)(B) ("… any water quality standard … or any other permitting standard may be revised only if such revision is *subject to and consistent with the antidegradation policy established under this section.*").
[16] *Water Standards* at 4.
[17] *Theodoratus Ethnographic Report* at 30.
[18] *Water Standards* at 8
[19] *Id.* Of particular concern to tribal members is reduced water flow from Schonchin Spring and Paynes Spring.
[20] PIT RIVER TRIBE, *Tribal Air Quality Standards for the Medicine Lake Highlands,* 1 [hereinafter *Air Standards*]. *See* Appendix C.
[21] *Id.* at 3 (stating that the Cultural Plan noticeably lacks these essential elements).

To these ends, the Tribe recommends: 1) applying federal Class I Airshed criteria to the Medicine Lake Highlands as a whole, 2) pursuing EPA Class I Airshed designation and expanding the Lava Beds Class I Airshed into the Highlands, 3) avoiding siting industrial activities within the Traditional Cultural District or Buffer Area, and 4) rerouting industrial traffic outside of the Traditional Cultural District.[22]

The visual environment

Many Pit River rituals, such as vision quests, depend upon a viewshed undisrupted by "intrusive objects" foreign to the natural environment, in order for the practioner to attain goals such as power achievement. [23] C-61-11

A successful vision quest is "dependent on an individual's ability to 'see the land the way the Creator created it.' The 'natural' landscape must therefore be experienced without noticeable evidence of human encroachment or modification."[24] Particularly in ceremonial areas, "there should be no visible scars."[25]

The ability to maintain an unimpeded view of certain landscape features, including Mount Shasta, Tule Lake, Lassen Peak, and the major butte "alignments," is of particular concern for certain rituals.[26] These landscape features "must be in clear view if tribal members are going to engage, or draw from the power of those distant places, or if the powers and moral lessons associated with those places are going to be accessible."[27]

Noise

C-61-12

Noise pollution is also deeply problematic for the Tribe. The continuation of cultural practices such as prayer, healing, and vision quests "depend[s] upon preserving natural quiet in [the Medicine Lake Highlands] area that is being threatened with increased recreational use and industrial projects."[28]

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[22] *Id.* at 4.
[23] *Id.* at 34.
[24] *Deur Ethnograhic Study* at 87.
[25] *Id.*
[26] *Id.* at 89.
[27] *Id.*
[28] PIT RIVER TRIBE, *Tribal Auditory Standards for the Medicine Lake Highland*s, 1 (Aug. 3, 2007) [hereinafter *Auditory Standards*]. *See* Appendix D.

Of particular concern to the Tribe is the finding that "noise-producing projects would be more intrusive than previously suspected," due to significant inaccuracies in noise measurements disclosed in geothermal development environmental documents.[29] These documents show noise levels in the Highlands that are far higher—by at least ten decibels—than is actually the case, erroneously minimizing the auditory impacts of geothermal operations.[30] Furthermore, noise simulation testing conducted by the Tribes has demonstrated that "existing noise standards provide inadequate protection for cultural practices even if agencies were to enforce those standards."[31]

Therefore, the Tribal Standards recommend quieter noise limits than existing agency standards provide, specifically limiting "non-natural noise" to "at most 5 dBA L_{eq} above baseline levels in the Highlands with an upper limit of 40 dBA L_{eq}."[32]

Conclusion

In summary, the Pit River Tribe requests additional consultations regarding the PEIS and its effects on lands within the Tribe's Ancestral Territory. Based on these consultations, the Tribe may wish to submit additional comments. A-61-13

At the very least, the Medicine Lake Highlands, Mount Shasta, and the Warner Mountains must be pronounced off-limits to geothermal leasing. Any leasing within these areas would be highly controversial, as Medicine Lake has already been (resulting in a 10-year legal battle). Such leasing would have unacceptable adverse effects on Tribal spiritual and cultural values and would threaten the very continuity of traditional Tribal identity. A-61-14

[29] *Id.*
[30] *Id.*
[31] *Id.*
[32] *Id.*

For other areas, the PEIS should, where appropriate, facilitate geothermal leases on a *provisional* level, until full site-specific studies (cultural, hydrologic, air, noise, wildlife and botanical, etc.) are accomplished, so as not to commit resources irretrievably before the full NEPA and NHPA processes are completed. This would avoid a situation that occurred in connection with the Telephone Flat project in the Medicine Lake Highlands. The Forest Service and BLM originally denied this project based on the new information it had obtained about the extent and significance of Tribal cultural resources and adverse impacts on these values. However, Calpine Corporation threatened a $100 million takings claim because of the rights it had been given in the leases. The original decision to deny the project was subsequently reversed, and the situation is currently in the courts. A-61-15

In other words, the agencies should reserve a way out of the lease in the event that significant resources and/or adverse effects are discovered. The environmental analysis in the PEIS is far too brief and general to take the place of full NEPA/NHPA processes, and only after these are completed on a site-specific basis would decision makers have the sound understanding to make valid decisions.

Further, the PEIS should expand the criteria for places that are off-limits to geothermal leasing. These exclusions should include Indian Sacred Sites, lands with significant water resources, and other controversial areas. A-61-16

And finally, the scope of the PEIS is far too broad in opening 192 million acres to geothermal leasing, which represents 77% of the Forest Service and BLM lands in the 12 states it covers. It is a mistake to prioritize geothermal development at the expense of other values, and it would be wiser to consider a phased approach, starting on a smaller scale with lands that are not controversial. A-61-17

Thank you for your consideration of these comments, and for your response in addressing these concerns.

Very truly yours,

Michelle Berditschevsky
Environmental Coordinator

cc: Pit River Tribal Council
Klamath Tribes
Deborah Sivas, Esq., Stanford Environmental Law Clinic
Native Coalition for Medicine Lake Highlands Defense
Mount Shasta Bioregional Ecology Center
Save Medicine Lake Coalition

A-61-1

The government will continue to consult with the Pit River Tribe and will address any comments.

A-61-2

The RFD scenario was developed based on the Western Governors Association 2006 report and BLM data. The potential development scenario is based on the current best available information and may change if new information becomes available. Development at any site will require additional NEPA evaluation to address site-specific resource values and analyze potential impacts.

A-61-3

As described in Section 2.2.2 *Procedures Prior to Leasing*, prior to inclusion of a lease in a competitive bidding process, the BLM or FS would review the lease area for sensitive resources and would provide the necessary stipulations to protect these resources. This review would include consultation with appropriate Native American Tribal Governments as necessary.

A-61-4

The Forest Service is engaged in consultation with the Pit River Tribe, and these points will be addressed in consultation prior to a decision being made.

A-61-5

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and potential geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

A-61-6

As stated above, the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers prior to leasing.

A-61-7

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

A-61-8

Appendix D provides BMPs to address methods to minimize groundwater contamination. Federal, state, and local regulations ensure that operators will conduct drilling in a prudent manner. Potential for contamination based on local soil types and groundwater conditions would be assessed prior to issuance of permits for development.

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments prior to leasing. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases.

A-61-9

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Consultation with local tribal agencies is also required prior to leasing. Site-specific impacts on water resources, including groundwater and water importation, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement, as appropriate. The BLM and FS would work with interested and affected parties to identify and resolve resource conflicts. Appropriate site-specific mitigation would be developed as necessary.

A-61-10

The Tribe's cultural value for pure, untainted airshed has been added to the Tribal Interests affected environment section. As noted in the impact analysis, any subsequent development could have this type of impact. The FS has ongoing consultation with the tribe to discuss this and all tribal concerns.

A-61-11

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments. Through consultation, the agencies would identify tribal interests, such as the specific visual resource concerns discussed in this comment.

A-61-12

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments. Through consultation, the agencies would identify tribal interests, such as the tribal noise standards discussed in this comment.

A-61-13

The government will continue to consult with the Pit River Tribe and address any comments.

A-61-14

As described in Section 2.2.2 *Procedures Prior to Leasing*, prior to inclusion of a lease in a competitive bidding process, the BLM or FS would review the lease area for sensitive resources and would provide the necessary stipulations to protect these resources. This review would include consultation with appropriate Native American Tribal Governments, as necessary.

A-61-15

As noted in Chapter 2, Procedures Prior to Leasing, the BLM or FS would consult with the appropriate Native American Tribes and SHPO in accordance with Section 106 of the National Historical Preservation Act prior to issuing any leases in order to address cultural concerns. Since the case study cited in the comment, the BLM has adopted two new stipulations that are applied to all leases notifying lease holders that the BLM may not approve ground-disturbing activities that may affect resources protected by cultural resource laws, statutes, or orders. These stipulations are included in the Proposed Action in Chapter 2.

A-61-16

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

A-61-17

By opening lands to geothermal leasing, the BLM and FS are not giving geothermal development a higher priority than other land values. The authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

geothermal_eis

From:	Mary_Christensen@blm.gov [Mary_Christensen@blm.gov]	**Sent:**	Fri 9/19/2008 8:59 PM
To:	geothermal_eis		
Cc:			
Subject:	Mail forwarded from geothermal_eis@blm.gov		
Attachments:			

This message has been automatically forwarded from geothermal_eis@blm.gov.

Carolyn Jones Weinberger <carolynweinberger@comcast.net>

09/19/2008 09:53 PM

To: Geothermal PEIS <geothermal_EIS@BLM.gov>

cc

bcc

Subject: PEIS Comments

To BLM
Re: Comments on proposed geothermal PEIS

The proposed PEIS is a disaster for the American Public. It vitiates the protections of NEPA & CEQA by granting a blanket ok for geothermal leasing projects without considering site specific detriments. Nowhere are the REAL impacts of geothermal development considered under the PEIS!! Issuance of leases before REAL impacts are considered is a giveaway of lands with recreational, cultural, scenic, wildlife habitat value without even evaluating these factors let alone the impacts on air, and water quality, ESPECIALLY SINCE ONCE THE LEASE IS ISSUED IT CANNOT BE CHALLENGED. At least that is the position of the government and companies granted leases under similar conditions a decade or more ago. C-62-1

Geothermal is not per se "green' energy. Rather it is like extracting oil in its impact on the environment. Huge power plant/ cooling tower complex, many clear cut well pads, decades of 24 hour lighting and noisy diesel-powered drill rigs as well as pipelines, and transmission corridors are among the well documented impacts on water, air and other landscape-fragmenting, habitat destroying consequences. C-62-2

The PEIS doesn't disclose the immense problems encountered through a similar leasing process in areas such as the Medicine Lake Highland, Newberry Crater and Cosco Hot Springs. It fails to adequately analyze 19 lease applications pending prior to 2005. To meet NEPA requirements the PEIS must contain language that allows a project to be denied based on site specific conditions disclosed through the NEPA and CEQA processes. Also, the criteria for closing land to geothermal development are too restrictive. They must include headwater sources, sensitive Native American cultural areas, scenic lands used primarily for recreation and lands containing fragile environment resources and wildlife habitat. In particular re California-the Medicine Lake Highlands and Mount Shasta must be excluded from geothermal leasing. C-62-3

It's high time the BLM acted in the interests of all the people who value and want our public lands protected rather than the despoiling corporate interests!!

Sincerely,

Carolyn Weinberger
2844 Garber Street
Berkeley CA 94705

C-62-1

The Proposed Action and alternatives do not specifically propose development of a resource. Therefore, the analysis relies on predictions of future development in the RFD scenario. Appropriate lease stipulations would be applied to protect resources, and site-specific analysis would be conducted prior to development and utilization.

C-62-2

The comment is noted.

C-62-3

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

geothermal_eis

From:	Mary_Christensen@blm.gov [Mary_Christensen@blm.gov]	**Sent:**	Fri 9/19/2008 12:31 PM
To:	geothermal_eis		
Cc:			
Subject:	Mail forwarded from geothermal_eis@blm.gov		
Attachments:			

This message has been automatically forwarded from geothermal_eis@blm.gov.

"Diane Shockey" <shockeyd@comcast.net>
09/19/2008 01:29 PM

To <geothermal_EIS@BLM.gov>
cc
bcc
Subject Comments-Geothermal PEIS

I am a Medicine Lake homeowner in the Medicine Lake Highlands. I grew up in the area and spend as much time there as can be allowed during the summer.

I ask the BLM and the Forest Service to take no action on geothermal leasing decisions until individual Environmental Impact Statements are completed for each of the

public land areas that are under review.

The Medicine Lake Highlands and Mount Shasta should be completely excluded. I have seen the environmental damage the previous company, Calpines, has done to

the areas surrounding Medicine Lake. It is shamefully clear that adequate assessments, planning, and oversite were NOT done by any of the government

agencies charged with the public trust.

I am skeptical that anything has changed and could well become worse unless appropriate impact studies are done before any leasing consideration begins.

I-63-1

Please consider my remarks and make a decision based on what is good for the public land involved.

From: Diane Shockey
517 Sandy Creek Road
Loganville, GA 30052

I-63-1

As described in Section 2.2.2 *Procedures Prior to Leasing*, prior to inclusion of a lease in a competitive bidding process, the BLM or FS would review the lease area for sensitive resources and would provide the necessary stipulations to protect these resources.

The authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

It is also important to note that lands allocated as open to geothermal leasing are subject to existing laws, regulations, and formal orders, which could prohibit some lands from leasing.

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602-771-8500 Ph.
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JANET NAPOLITANO
Governor

HERBERT R. GUENTHER
Director

September 15, 2008

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c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105

Re: "Draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States"

Dear Sir/Madam:

The Arizona Department of Water Resources (Department) has reviewed the "Draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States" dated May 2008 and we submit the following comments.

Under Arizona law:

> "The director [Department of Water Resources] has general control and supervision of surface water, its appropriation and distribution, and of groundwater to the extent provided by this title, except distribution of water reserved to special officers appointed by courts under existing judgments or decrees."
>
> Arizona Revised Statutes 45-103

The Department of Water Resources is thus the appropriate state authority for the Bureau of Land Management, Forest Service, other agencies and applicants to work with regarding water resources associated with geothermal energy development. In additional to roles associated with well permits and water rights identified on page A-8 of the draft PEIS, the Department is involved with administration of Active Management Areas and Safety of Dams rules at the state level. The State's Active Management Areas were established to provide long-term management and conservation of their limited groundwater supplies. In order to accomplish this the Active Management Area staffs administer state laws, explore ways of augmenting water supplies to meet future needs, and routinely work to develop public policy in order to promote efficient use and an equitable allocation of available water supplies. Maps and descriptions of Active Management Areas can be found at http://www.azwater.gov/dwr. A-64-1

Thank you for the opportunity to review this draft document. If you have any questions, please contact Mr. Bill Werner at 602-771-8412.

Sincerely,

Herbert R. Guenther

Herbert R. Guenther

A-64-1

Thank you for your comment. The BLM and FS recognize the Arizona Department of Water Resources as the state authority for applicants on water resources associated with geothermal development in Arizona.

PROGRAMMATIC EIS ON LEASING

•The PEIS violates the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) by proposing a process to issue leases *granting exclusive rights to explore, produce and sell* geothermal energy *without requiring a site-specific analysis* of impacts on public lands ***before** the leases are*
I-65-1 *granted.* There are *no provisions for denying a project* once geothermal leases are issued!

•The PEIS proposes to streamline the geothermal leasing process by *pre-approving areas* that would then require only minimal site-specific environmental review. The PEIS would make it possible to tier an abbreviated Environmental Assessment to the PEIS for subsequent *limited* site-specific analysis that purports to meet requirements under NEPA.

•The PEIS fails to disclose the *huge* problems
I-65-2 encountered through a similar leasing process in areas such as the Medicine Lake Highlands, Newberry Crater, and Coso Hot Springs….

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I-65-5 •*Mount Shasta* and the *Medicine Lake Highlands* must be excluded from geothermal leasing!

More info on the PEIS

For more information on the PEIS, please see:www.blm.gov/wo/st/en/prog/energy/geothermal/geothermal_nationwide/Documents.html

Please submit a comment letter by September 19th

Please consider submitting a comment letter on the Draft PEIS by the September 19th deadline. Your letter could ask BLM and the Forest Service to withhold *all* geothermal leasing decisions until *individual* Environmental Impact Statements are completed for each of the specific areas that are contemplated for geothermal leasing *nominations* on 19 million acres of public lands, and to exclude Mount Shasta and the Medicine Lake Highlands from geothermal leasing, plus any of the points made in this article.

Comments can be sent via email to geothermal_EIS@BLM.gov; or faxed to 1.866.625.0707; or mailed to:

Geothermal Programmatic EIS,
c/o EMPSI
182 Howard Street, Suite 110
San Francisco, CA 94105.

I AM TOTALLY AGAINST this streamlining OF REVIEW I've been to the MEDICINE LAKE HIGHLANDS AND THE 4-MILE HILL AREA AFTER IT WAS DEEMED NOT VIABLE FOR GEO THERMAL. CAL PINE HAS TAKEN ADVANTAGE OF THE US GOVT AND USED FUNDS WASTEFULLY KNOWING FULL WELL THERE WASN'T ENOUGH WATER TO MAKE IT WORK. THIS PROCESS WILL LEAD TO MORE LAW SUITS WHICH COULD BE PREVENTED. THE MONEY FOR GEO THERMAL SHOULD BE MORE THOUGHTFULLY USED IN AREAS THAT WILL SUPPORT THE DRILLING AND HAVE WHAT IS needed to MAKE IT WORK. THIS IS A BAD POLICY & DOES NOT PROTECT, the enviroment, the public, or GOVT FUNDS FROM BEING manipulATED BY greed, for a FEW. THIS IS JUST A WAY FOR A COMPANY to GET MONEY AND NOT BE HELD RESPONSIBLE. I HAVE SEEN IT IN ACTION FOR THE LAST 5 YEARS BY CALPINE, creating work for a few till the money runs-out. Why do you think they're bankrupt so much of the time? I-65-6

530-677-7703

Ronno Kamer

I-65-1

Leasing geothermal resources vests with the lessee a non-exclusive right to future exploration and an exclusive right to produce and use the geothermal resources within the lease area subject to existing laws, regulations, formal orders, and the terms, conditions, and stipulations in or attached to the lease form or included as conditions of approval to permits. Permitting requires additional, site-specific NEPA analysis. Lease issuance alone does not authorize any ground-disturbing activities to explore for or develop geothermal resources without site-specific approval for the intended operation.

I-65-2

The purpose of the PEIS is to facilitate future geothermal leasing in an environmentally responsible manner. It is outside the scope of this PEIS to discuss the details of past leasing processes.

I-65-3

The comment is noted. The individual Forest Supervisors and BLM Field Office Managers will determine if the analysis contained in the PEIS is sufficient for their decision making.

I-65-4

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

I-65-5

As described in Section 2.2.2 *Procedures Prior to Leasing*, prior to inclusion of a lease in a competitive bidding process, including any leases in Mount Shasta or the Medicine Lake Highlands, the BLM or FS would review the lease area for sensitive resources and would provide the necessary stipulations to protect these resources. This review would include consultation with appropriate Native American Tribal Governments, as necessary.

I-65-6

The comment is noted.

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Geothermal Programmatic EIS,
c/o EMPSI
182 Howard Street, Suite 110
San Francisco, CA 94105.

9-16-08

I-66-6 I am against streamlining the process of geothermal leasing. Any of this planned for the Medicine Lake Area should not occur.

Patty Davidson
4245 Abraham Wy
Carmichael, CA 95608

I-66-1

Leasing geothermal resources vests with the lessee a non-exclusive right to future exploration and an exclusive right to produce and use the geothermal resources within the lease area subject to existing laws, regulations, formal orders, and the terms, conditions, and stipulations in or attached to the lease form or included as conditions of approval to permits. Permitting requires additional, site-specific NEPA analysis. Lease issuance alone does not authorize any ground-disturbing activities to explore for or develop geothermal resources without site-specific approval for the intended operation.

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Geothermal Programmatic EIS,
c/o EMPSI
182 Howard Street, Suite 110
San Francisco, CA 94105.

AFTER BEING AT MEDICINE LAKE FOR THE FIRST TIME AND SEEING WHAT CALPINE IS PROPOSING AND HAS ALREADY DONE, THE ONLY "GREEN" IN THIS IS THE FINANCIAL UPSIDE. I AM TOTALLY AGAINST THIS. I-67-6

MARK KESSELL
4245 ABRAHAM WY
CARMICHAEL, CA
916-944-0449

I-67-1

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I-67-6

The comment is noted.

September 12, 2008

Geothermal Programmatic EIS
c/o EMPS Inc.
182 Howard Street
Suite 110
San Francisco, CA 94105-1611

My name is Olivia ForrestDavis. I am a member of the Hewise Band of the Pit River Tribe. Our ancestral territory includes the North Warner Mountains area of northeastern California.

I am writing this letter in opposition to leasing of lands in the greater North Warner Mountains area for geothermal development. This area contains multiple, significant ceremonial sites for our people, and especially, my family. We continue to use this area for our spiritual needs. I-68-1

I oppose development on the pending lease application sites identified in Chapter 13 of the draft PEIS; especially CACA 043744 and CACA 043745. Although some scholars claim these sites are in historic Northern Paiute territory, this is also the ancestral land of our Band. In the old days, there were no definitive tribal boundaries and we shared resources and sacred sites. Our tribal territories overlapped. Therefore, these lease application sites for geothermal development are of great concern to me.

Any geothermal development would interfere with our present-day traditional ceremonial practices and alter the spiritual energy of the area at the application sites and surrounding mountains. I ask that no lease applications be approved here.

Sincerely,

Olivia M. Forrest Davis

Olivia M. ForrestDavis

cc: Michelle Berditschevsky, Coordinator, Pit River Tribe Environmental Dept.

I-68-1

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and by potential geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

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Geothermal Programmatic EIS,
c/o EMPSI
182 Howard Street, Suite 110
San Francisco, CA 94105.

*FAX ATTACHED

Sept. 18, 2008
Carmichael, CA 95608

To the attention of the B.L.M. + Forest Service,

As an annual visitor to the Medicine Lake Recreation Area in Northern California, Siskiyou County, I am very concerned over the proposed opening of that area to geothermal development. My family and I have observed over a number of years the attempt by several energy companies to develop thermal wells in lands close in to Medicine Lake. These have not been successful because water is not readily available in sufficient quantities to provide the necessary steam unless drawn from Medicine Lake which would not be allowed. This is not a large lake and fed by springs and snow water. It is totally inappropriate for such use. There have been areas razed of trees and left unused [illegible] small drill sites with ponds of contaminated water poorly protected from the public and wildlife. These wells have not been profitable. I-69-2

I would like to see you withhold all geothermal leasing until individual Environmental Impact Statements are completed for each of the specific areas contemplated for geo developments on 19 million acres of public lands, and in particular to exclude Mt. Shasta and Medicine Lake Highlands from geothermal leasing. This is scenic land and Native American cultural areas and primarily suited to recreation + wildlife habitat.

Sincerely,

Vera J. Karnes
3941 La Honda Way
Carmichael CA
95608

916 944-1912

I-69-1

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

I-69-2

Additional handwritten comments are not legible.

Medicine Lake Citizens for Quality Environment, Inc.
PO Box 34
Mt. Shasta, CA. 96067
530-926-5514, phone
530-926-1598, fax

September 17, 2008

Geothermal Programmatic EIS
C/o EMPSI
182 Howard Street, Suite 110
San Francisco, CA. 94105

Re: Programmatic Environmental Impact Statement (PEIS)

The PEIS violates the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) by proposing a process to issue leases granting exclusive rights to explore, produce and sell geothermal energy without requiring a site-specific analysis of impacts on public lands before the leases are granted. There are no provisions for denying a project once geothermal leases are issued. The PEIS must contain language that gives leasing agencies the right to deny a project based on site-specific conditions gathered through the NEPA and CEQA process. O-70-1

The issuance and renewal of geothermal leases at Medicine Lake has involved over ten years of numerous hearings, public comments, legal appeals, and lawsuits, yet the federal agencies are again considering the same faulty process in the PEIS. O-70-2

The criteria for closing lands to geothermal leasing must be expanded to include headwater sources, sensitive Native American cultural areas, scenic lands used primarily for recreation, and lands containing fragile environmental resources and wildlife habitat. Medicine Lake Highlands and Mount Shasta must be excluded from geothermal leasing.

A board member for the Medicine Lake Citizens for Quality Environment attended the public hearing in Sacramento, and was told that cultural areas and recreational areas would be given serious consideration for closing lands for geothermal leasing. This should be considered on the top of the list in the PEIS. This should be considered top priority for the damage that will be done to the Native American cultural area and the recreation area. The damage would be irreversible. O-70-3

Geothermal development industrializes an area and has adverse impacts on air, water, wildlife habitat recreational areas and Native American cultural values.

Thank you for considering my comment.

Jim Shott

Jim Shott
Medicine Lake Citizens for Quality Environment
605 Glen Mar Drive
Mt. Shasta, CA. 96067

O-70-1

Leasing geothermal resources vests with the lessee a non-exclusive right to future exploration and an exclusive right to produce and use the geothermal resources within the lease area subject to existing laws, regulations, formal orders, and the terms, conditions, and stipulations in or attached to the lease form or included as conditions of approval to permits. Permitting requires additional, site-specific NEPA analysis. Lease issuance alone does not authorize any ground-disturbing activities to explore for or develop geothermal resources without site-specific approval for the intended operation.

O-70-2

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O-70-3

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MR. JACK PETERSON
BLM IDAHO STATE OFFICE
1387 S. VINNELL WAY
BOISE IDAHO 83906

RECEIVED
BLM ISO MR
SEP 19 2008
9:00 A.M.

SEPTEMBER 18 2008

VIEWPOINTS AGAINST GEOTHERMAL AT THE MEDICINE LAKE HIGHLANDS

HOW CAN THE U.S. FEDERAL GOVERNMENT ALLOW THIS??

I-71-1 Geo thermal development will threaten not only a beautiful pristine area, but possibly ruin our aquaducts and cultural areas sacred to different tribes in the area. Medicine Mountain is still used for COMING OF AGE rituals by young men.

HOW CAND THE U.S. FEDERAL GOVERNMENT ALLOW THIS ??

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I-71-4 THE CRITERIA FOR CLOSING LANDS TO GEOTHERMAL LEASING MUST BE EXPANDED TO INCLUDE HEADWATER SOURCES , sensitive native american CULTURAL AREAS, SCENIC LANDS USED PRIMARILY FOR RECREATION, AND LANDS CONTAINING FRAGILE ENVIRONMENTAL RESOURCES AND WILDLIFE HABITAT,

MOUNT SHASTA AND THE MEDICINE LAKE HIGHLANDS MUST BE EXCLUDED FROM GEOTHERMAL LEASING.

PLEASE BLM AND U. S. FOREST SERVICE

I-71-5 PLEASE WITHHOLD ALL GEOTHERMAL LEASING DECISIONS UNTIL INDIVDUAL ENVIORNMEMTAL IMPACT STATEMENTS ARE COMPLETED FOR EACH OF THE SPECIFIC AREAS THAT ARE CONTEMPLARED FOR GEOTHERMAL LEASING NOMINATIONS ON 19 MILLION ACRES OF PUBLIC LAND AND TO EXCLUDE MOUNT SHASTA AND MEDICINE LAKE HIGHLANDS FROM GEOTHERMAL LEASING.

WHAT US CITIZEN WANTS INDUSTRY CITIES IN THE MIDST OF OUR PARKLANDS ??

SINCERELY,

Trudy C. Eastman

TRUDY C. EASTMAN CONCERNED CITIZEN
PO 577
TULELAKE, CALIFORNIA 96134

I-71-1

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The authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

It is also important to note that lands allocated as open are subject to existing laws, regulations, and formal orders, which could prohibit some lands from leasing.

Sauk-Suiattle Indian Tribe
Point Elliott Treaty of 1855

5318 Chief Brown Lane
Darrington, Washington 98241-9420
Health & Social Services
(360) 436-1400
Fax (360) 436-0242

September 18, 2008

Jack G. Peterson
U.S. Bureau of Land Management

Electronic Correspondence

Reference: Draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States

Dear Mr. Peterson:

The Sauk-Suiattle Indian Tribe is a federally recognized Indian Tribe and a signatory to the Treaty of Point Elliot of 1855. This letter serves as the Sauk-Suiattle Tribe's comments on the Programmatic Environmental Impact Statement (PEIS) and the four pending lease applications in the Mount Baker-Snoqualmie National Forest.

<u>Draft Programmatic EIS</u>

The Bureau of Land Management (BLM) proposes to programmatically open federal lands in 12 western states to geothermal leasing. The geographic scale of this proposed action and the varied environmental conditions are too great to deal with programmatically. The appropriate decision level for evaluating geothermal development as an appropriate land use activity is the BLM District Office and National Forest Service (NFS) Forest Office. At the BLM District or NFS Forest level appropriate detail of analysis and local environmental knowledge can best determine if geothermal development is appropriate on the district or forest. The environmental analysis in the PEIS is too broad to support the proposed action to open 192 million acres of federal land to geothermal leasing. The Sauk-Suiattle Tribe supports the No Action Alternative which leaves the decision to amend land use plans to include geothermal leasing at a local level. A-72-1

<u>Pending Lease Applications in the Mount Baker-Snoqualmie National Forest</u>

All four lease areas lie within the core area of the Nooksack Elk Herd. The Nooksack Elk Herd population has been depressed for a number of years with a low population estimate of 300 in A-72-2

2001. Despite intensive efforts by the Tribes and the Washington Department of Fish and Wildlife (WDFW) the current population estimate of 700 elk remains approximately 40 percent below the WDFW and Tribal population goal. Geothermal development in the core area of the Nooksack Herd may retard the recovery the Tribes are working so hard to achieve. Elk are sensitive to disruption by human activity including noise levels that would be associated with geothermal production. Geothermal development may disrupt migratory pathways and may drive the Nooksack herd off a portion of its range. There is not sufficient analysis in the Analysis of Pending Lease Applications of the effect of geothermal development on the Nooksack Elk Herd to justify granting leases.

In addition, there are several important salmon bearing tributaries to Baker Lake in the proposed lease areas. Survival of salmon may be reduced by runoff of geothermal fluids or industrial pollutants. Geothermal development in the Baker River Basin may reduce the Tribe's ability to harvest salmon.

Geothermal development in the Baker River basin may adversely impact fish and wildlife resource that are essential to the Sauk-Suiattle Tribe's way of life. There is not sufficient detail in the environmental analysis to evaluate the potential of that impact. This level of analysis does not meet BLM's or NFS's trust responsibility to the Sauk-Suiattle Tribe for the protection of tribal resources.

If the BLM and NFS intend to issue any of the four leases in the Baker River Basin the Sauk-Suiattle Tribe requests direct government to government consultation before the final decision is made.

The Sauk-Suiattle Indian Tribe appreciates the opportunity to comment on the Geothermal PEIS and proposed leases on the Mount Baker-Snoqualmie National Forest. If you have any questions about our comments or would like to set up a government to government consultation please contact Stan Walsh of the Skagit River System Cooperative at (360) 466-1512 or email swalsh@skagitcoop.org.

Sincerely,

for
Cynthia Harris, Chairperson
Sauk-Suiattle Indian Tribe

cc Rob Iwamoto, Mount Baker-Snoqualmie Forest Supervisor
Jon Vanderheyden, Mount Baker District Ranger
Tracy Parker, U.S. Forest Service National Energy Mineral Program Director
Stan Walsh, SRSC
Richard Wolten, Sauk-Suiattle NR Director

Regina Hovet, Sauk-Suiattle Office of Legal Counsel
Brian Cladoosby, Swinomish Indian Tribal Community
Scott Schuyler, Upper Skagit Indian Tribe
File

A-72-1

The Tribe's support for the No Action alternative is noted.

A-72-2

Consultation will occur prior to site-specific development and utilization of the geothermal resource.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

SEP 2 6 2008

In Reply Refer To:
FWS/DHRC/BCPA/DCN-037587

Memorandum

To: Director, Bureau of Land Management

From: Deputy Director Kenneth Stansell

Subject: Comments on the Bureau of Land Management's (BLM) Draft Programmatic Environmental Impact Statement for Leasing of Geothermal Resources in 11 Western States and Alaska (EC08/0005)

The U.S. Fish and Wildlife Service (Service) has reviewed the Bureau of Land Management (BLM) and Forest Service (FS) Draft Programmatic Environmental Impact Statement (PEIS), and has prepared the enclosed detailed comments pursuant to the: (1) Fish and Wildlife Coordination Act; (2) Endangered Species Act; (3) Migratory Bird Treaty Act; (4) the Clean Water Act; (5) National Wildlife Refuge System Administration Act of 1966; (6) Energy Policy Act of 2005 (EPAct), and other applicable Executive Orders, regulations and policies.

We acknowledge the need for the development of renewable energy and we commend BLM for its comprehensive approach in the Draft PEIS. We have provided General Comments in Attachment 1 and Specific Technical Comments in Attachment 2 to assist BLM in preparation of the Final PEIS. Attachment 3 is an existing species conservation agreement with the Utah BLM office for oil and gas lease sales. Our comments focus on the need to consider habitat, prioritize development in areas with existing infrastructure, consider all effects of development including groundwater, and to work cooperatively with the Service as specific development proposals are considered

We appreciate the opportunity to provide comments and recognize BLM for their efforts to coordinate with the Service. We look forward to continuing to work together with the BLM, FS and other agencies and stakeholders through this process. Please contact Mr. Gary Frazer, Assistant Director - Fisheries and Habitat Conservation, at (202) 208-6394 or Nancy Lee, Chief, Branch of Conservation Planning Assistance, at (703) 358-2440 if you have any questions.

Attachments

cc: 3245/AFHC 840/DFHC 840/DHRC/BCPA 840/DHRC/BCPA Staff
FWS/DHRC-BCPA/SStavrakas:lem:9-16-08/703-358-2161/S/DHRC/DTS ‘08/037587

Attachment 1

Fish and Wildlife Service (Service) General Comments on the Bureau of Land Management's (BLM) Draft Programmatic Environmental Impact Statement for Leasing of Geothermal Resources in 11 Western States and Alaska (EC08/0005)

GENERAL COMMENTS

1. Consideration for Siting of Geothermal Projects

Large-scale, disjunct geothermal energy projects may compromise recovery of listed species and otherwise negatively impact numerous additional species, through habitat loss, population and habitat fragmentation, changes in water flow (both surface and groundwater), introduction of pollutants and non-native species, mortality by vehicle encounters, and alterations to natural predator-prey dynamics. Alterations to conservation areas, defined as lands targeted for species conservation such as Desert Wildlife Management Areas, Wildlife Management Areas, Areas of Critical Environmental Concern, and designated critical habitat may be affected by geothermal development. These land designations were assigned because these areas are considered environmentally sensitive and play an important role in the recovery and conservation of listed and sensitive species. The Service recommends that these areas be removed from consideration for geothermal development and minimization of edge-effects to these areas. A-73-1

In addition to avoiding ecologically-sensitive lands, the Service recommends that the Draft PEIS prioritize geothermal development and first focus on lands already disturbed. Such sites are often close to existing infrastructure which would decrease potential habitat disturbance from new roads and transmission lines.

2. Invasive Species

As with all projects that require surface disturbance, there is a high potential for introduction and spread of non-native, invasive weeds. The spread of invasive species is known to alter fire ecology and increased frequency of wildfire. The Service recommends incorporating all possible measures to prevent the introduction or further proliferation of invasive species including standard stipulations specific to mitigation, revegetation, and restoration efforts for impacts to wildlife and plant habitats. Additionally, the Service recommends that BLM and FS require monitoring and performance standards to address invasives as an element of the leasing program. Finally, we recommend avoiding development in contiguous blocks of healthy sagebrush. A-73-2

3. Cumulative Impacts

"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person A-73-3 undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Because of the number of applications already received and an unknown number expected to be submitted, the cumulative impacts of renewable energy projects, including solar, wind, and geothermal energy on listed, sensitive, and other wildlife and plant species are likely to be substantial. In particular, there is potential wide-spread loss, degradation, or fragmentation of habitats due to direct, indirect, or cumulative effects of numerous large-scale renewable energy projects on public lands. As a result recovery of threatened and endangered species may be impeded and there may be an increased risk of extirpation or extinction. In addition, other species may be affected to the point where listing may be warranted. Although the Service is supportive and recognizes the need for development of renewable energy, we are concerned that the magnitude and severity of impacts from the many large-scale projects on Federal lands may have significant and unintended adverse consequences on our trust resources.

The Service recommends addressing affects of geothermal energy development, taking into consideration other renewable development within each State, on the landscape. Factors to consider in these analyses include:

1) Total acres affected by all proposed development and acreage of Service trust resources affected, e.g. acres of refuges, hatcheries, critical habitat, etc.;

2) The geographic scope of the proposed action, in relationship to affected trust resources and their supporting habitat, in terms of habitat loss and degradation, population decline, water quality and quantity, and related impacts;

3) The relevant timeframe in which the potential impacts will likely occur, e.g. over the next 50 years; and

4) The collective impact of the proposed action on trust resources, when considered together with the existing policies or proposals of other jurisdictions, e.g. federal, state, regional, local, tribal.

4. National Wildlife Refuges

Based on the National Wildlife Refuge System Administration Act (NWRSAA) of 1966 (16 USC 668 [dd]), National Wildlife Refuges should be excluded from the planning area. Any enterprise conducted on a refuge has to meet the compatibility standard. The Service believes geothermal energy facility would not meet the compatibility standard. A-73-4

The Service recommends adding lands managed by the National Wildlife Refuge System to the list of areas excluded from the planning area based primarily on the National Wildlife Refuge System Administration Act (NWRSAA) of 1966 (16 USC 668 [dd]) and other existing laws.

Attachment 2

Fish and Wildlife Service (Service) Specific Technical Comments on the Bureau of Land Management's (BLM) Draft Programmatic Environmental Impact Statement for Leasing of Geothermal Resources in 11 Western States and Alaska (Draft PEIS) (EC08/0005)

SPECIFIC TECHNICAL COMMENTS

VOLUME I

Chapter 1

- *On page 1-33, section 1.13.10.*

The first full paragraph states that the "Migratory Bird Conservation Act makes it unlawful…." The Migratory Bird Conservation Act allows for the "acquisition, including the location, examination, and survey, of suitable areas of land, water, or land and water, for use as migratory bird reservations…."

A-73-5

The Service recommends amending the above passage to reference the Migratory Bird Treaty Act, as amended (MBTA), which was implemented for the protection of migratory birds. We also recommend including Executive Order 13186 in your discussion of the MBTA in section 1.13.10. The MBTA makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. Executive Order 13186, signed January 10, 2001, sets forth the responsibilities of Federal agencies to further implement the provisions of the MBTA by integrating bird conservation principles and practices into agency activities by ensuring that Federal actions evaluate the effects of actions and agency plans on migratory birds.

Chapter 2

- *Page 2-7, proposed areas closed for geothermal leasing: Sensitive Habitats for Federally Listed Species and Sensitive Wildlife.*

Based on staff-level coordination between the Service and the BLM, we developed a Priority Special Management Areas map for the California Desert Conservation Area (CDCA) and presented it to BLM representatives at a meeting on June 27, 2008. The map largely depicted lands with various levels of planned conservation per BLM's bioregional management plans [Northern and Eastern Mojave Plan, Northern and Eastern Colorado Plan, Western and Eastern Colorado Plan, etc.] and serves as the basis for recommending areas that are environmentally sensitive and not suitable for extensive, surface disturbing uses. The Service recommends the following special management areas within the CDCA be considered not suitable for development: A-73-6

- Designated critical habitat for federally listed species,
- Desert Wildlife Management Areas,
- Wildlife Habitat Management Areas,
- Core habitat and linkages for desert tortoise (*Gopherus agassizii*) and desert bighorn sheep (*Ovis canadensis*),
- Sand dunes and playa habitats,
- Flat-tailed horned lizard (*Phrynosoma mcallii*) management areas, and
- Other special management areas identified in the CDCA Plan.

- *Page 2-7, proposed areas closed for geothermal leasing: Sensitive Habitats for Federally Listed Species and Sensitive Wildlife.*

We are currently evaluating the status of the greater sage-grouse (*Centrocercus urophasianus*) and pygmy rabbit (*Brachylagus idahoensis*) under the Endangered Species Act of 1973, as amended (ESA) through our 12-month status review process. Both species are widely distributed throughout the western United States, occurring on much of the BLM and FS managed lands under evaluation for this Draft PEIS. Although the specific elements of their respective habitats vary, sage-steppe ecosystems are a primary habiatat component for both species and would likely be similarly impacted from geothermal energy development. Sage-grouse are sensitive to a variety of disturbances above and beyond the physical footprint of site development including noise, habitat fragmentation, and presence of tall structures such as transmission lines. The Service recommends conducting a thorough analysis and comparison of siting locations to determine how they may affect seasonal habitats and movement patterns of the greater sage-grouse, similar to the approach currently recommended by the Service for the siting of wind turbines. Additionally, we recommend curtailing development in these areas. A-73-7

- *Page 2-7, proposed areas closed for geothermal leasing: Riparian Areas and Wetlands.*

Streams, seeps, springs, and isolated wetlands are important aquatic features in the arid west that provide habitat for many species of macroinvertebrates, amphibians, reptiles, fish, birds, mammals, and plants. Many of the Service trust resource species occur within these habitats, and may be highly localized. Upland buffers around these aquatic habitats provide a zone of protection from areas of development. Upland buffers also provide corridors for wildlife movement, nesting habitat, and upland foraging habitat in conjunction with water quality protection. The Service recommends avoiding impacts to these areas, and considering both aquatic habitats and the adjacent upland buffers in project-specific design. Because of their importance and relative scarcity in the arid southwest, impacts to aquatic and riparian resources should be avoided and unavoidable impacts should be mitigated. A-73-8

- *Page 2-7, proposed areas closed for geothermal leasing: Additional Areas of Avoidance.*

The Amargosa toad (*Bufo nelsoni*), a toad species endemic to the Oasis Valley in Nevada and protected under Nevada State law, may be impacted by geothermal development. A conservation agreement was completed in 2000, which identifies specific conservation measures that are expected to reduce or eliminate threats to the species, enhance habitat, and maintain a properly functioning ecosystem for the species of Oasis Valley. This species is mostly at risk from depletion of the Amargosa River and groundwater resources within the hydrologic basin. Geothermal development has the potential to reduce groundwater resources, and affect the quantity and quality of habitat for the toad in the Oasis Valley. The Service is currently reviewing the Amargosa toad status. A-73-9

Development in Independence Valley and Clover Valley in Elko County may affect the presence of small endemic populations of fish associated with local systems. The two species of speckled dace associated with these areas are listed under the ESA but do not currently have designated critical habitat.

Geothermal development has the potential to directly and indirectly impact the Amargosa toad and small endemic fish populations and their habitats. In addition, groundwater withdrawal that may be required to run the geothermal facilities may affect these habitats. We recommend that Oasis, Independence, and Clover Valleys be excluded from geothermal leasing by BLM and FS and added to the list of areas closed to geothermal lease.

- *Table 2-1 on page 2-9.* The City of Vernal is shown as occurring in Wyoming. The City of Vernal is located in Utah. Please update the table. A-73-10

<u>Chapter 3</u>

- *Page 3-11 land management plans.*

The Draft PEIS has identified Critical Biological Zones as part of FS Land Management Plans in the Angeles, Cleveland, Los Padres, and San Bernardino national forests. According to the Land Management Plans, "Activities and modification to existing infrastructure are allowed if they are beneficial or neutral to the species for which the zone was primarily designated" (USFS 2005[1], Part 2, page 9). Critical Biological Zones are zoned as not being suitable for numerous activities including activities related to renewable energy resources (USFS 2005, Part 2, page 6). The Service recommends designated critical habitat be considered as a Critical Biological Zone and be excluded on these national forests from geothermal leasing. A-73-11

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[1] USFS (U. S. Forest Service). 2005. Land management plan, Angeles National Forest, Cleveland National Forest, Los Padres National Forest, San Bernardino National Forest.

- *Pages 3-136 – 3-140, Migratory Birds.*

To complete BLM and FS migratory bird analysis, the Service recommends including the following measures:

- Land clearing, or other surface disturbance associated with proposed projects, should be conducted outside the avian breeding season to avoid potential destruction of bird nests or young, or birds that breed in the area. If this is not feasible, a qualified biologist may survey the area prior to land clearing. If nests are located, or if other evidence of nesting (*i.e.*, mated pairs, territorial defense, carrying nesting material, transporting food) is observed, a protective buffer (the size depending on the habitat requirements of the species) should be delineated and the entire area avoided to prevent destruction or disturbance to nests until they are no longer active.

- Incorporate the Guidelines into the Draft PEIS as voluntary guidelines for construction and operation of proposed transmission lines. These guidelines may help prevent avian electrocution from use of transmission lines that may be associated with the geothermal energy development. The APP Guidelines can be found at www.aplic.org. A-73-12

- Avoid occupied nests for the western burrowing owl (*Athene cunicularia hypugea*). The western burrowing owl is a BLM sensitive species and identified by the Service as a bird of conservation concern. The reduction of habitat in southern Nevada is a major threat to this species. If avoidance is not possible, please incorporate our recommendations in the Service pamphlet, "Protecting Burrowing Owls at Construction Sites in Nevada's Mojave Desert Region" (Attachment 1), into the Best Management Practices for geothermal energy development projects.

- Refer to our raptor guidance for proposed facilities or structures during construction to prevent bird injury and/or entrapment in the Mojave Desert.

<u>Chapter 4</u>

- *Page 4-93 habitat fragmentation.*

This section states that best management practices will effectively minimize impacts. The Draft PEIS does not describe impacts to wildlife. Although best management practices will help to minimize the impacts to migratory birds and other wildlife, the Service recommends the Draft PEIS disclose and discuss the suite of impacts that would result from geothermal energy development including habitat fragmentation, habitat loss, and increased predation. A-73-13

- *Page 4-95, Section 4.11.2 potential effects of geothermal leasing on threatened and endangered species.*

The Service recommends amending the criteria used in the evaluation of threatened and endangered species as follows: A-73-14

- o The first bullet should reflect that an adverse affect to a listed species would occur if the action resulted in impacts that violated the ESA, Bald and Golden Eagle Protection Act (BGEPA), MBTA; and
- o The second bullet should reflect that any impact to an individual of a federally listed species is an adverse impact.

Chapter 6

- *Page 6-4, Endangered Species Act Consultation.*

Section 7 of ESA consultation process and procedures are not clearly depicted in this section. The Service recommends BLM and FS clarify how they will comply with Section 7 consultation. Additionally, please identify at what level consultation will be initiated. A-73-15

- *Page 6-4, Endangered Species Act Consultation – Listed and Sensitive Species and Surface and Groundwater Withdrawal.*

Proposed geothermal energy projects may affect listed and sensitive species dependent on regional groundwater flow systems. Desert fish species may be impacted by small changes in groundwater levels, water quality, or flow patterns, as many inhabit spring systems that are recharged by one of these systems. Potential long-term hydrological effects and impacts to federally listed and sensitive species as they relate to geothermal energy projects should be carefully considered. Water may be needed in significant amounts for power generation, depending on the technology used for the proposed geothermal energy projects. Reductions in groundwater flows and the ability to recharge associated aquifers can result in surface hydrological changes on hundreds of thousands of acres. A-73-16

The Service recommends including in the NEPA review, as well as in the BLM and FS lease permits, quantification and analyses of expected surface and groundwater requirements to construct, operate, and maintain geothermal facilities and assessment of potential impacts to the aquatic resources, associated terrestrial resources, and wildlife species and plants. The evaluation should also include both the use of groundwater by individual projects and the impacts to desert washes that feed dry lakes and aid the recharge of groundwater. The Service is available to work with BLM and/or FS to best determine the scope and scale of this analysis.

Additionally, the Service recommends the Draft PEIS include the best management measures or some other identification of measures that will be taken during project planning, construction, and operation to avoid, minimize, and mitigate impacts to listed and sensitive species that are dependent on surface and groundwater resources. The Service also recommends the BLM and FS include in their policy a requirement that project proponents must use technology that utilizes the least amount of water for power generation.

- *Page 6-4, Endangered Species Act Consultation – Habitat Loss, Degradation, and Fragmentation.*

Significant portions of land that will be considered for geothermal energy development in the Draft PEIS contain priority ecological areas (e.g. existing conservation lands, including Federal Wilderness Areas, Aquatic Preserves, National Estuarine Research Reserves, Wild & Scenic Rivers, roadless areas of native habitat or Category 1 lands) and migration linkages between these areas. Habitat loss and fragmentation on such a large scale would affect the structure and function of the landscape for wildlife. Activities adjacent to lands allocated for conservation (National Landscape Conservation System lands, Areas of Critical Environmental Concern (ACEC), Wildlife Habitat Management Areas, Desert Wildlife Management Areas, National Wildlife Refuge System lands, National Park Service lands, designated critical habitats, etc.) can affect animal and plant populations and the effectiveness of conservation and recovery actions occurring within these management area boundaries. The Service believes that lands already designated for conservation should be the baseline for focus of recovery efforts. A-73-17

The Service recommends BLM and FS use the information in State Wildlife Plans, species recovery plans, designated critical habitat, Audubon important bird areas, and other sensitive habitats (as mentioned above), to conduct a thorough analysis of habitat loss and fragmentation on a landscape level. This information should be used to make informed decisions regarding lands, as available, for geothermal energy development.

VOLUME II – Case Specific

<u>Chapter 10</u>

- *Proposed Action to Issue Leases in Nye County, Nevada (NVN 074289) and Modoc County, California (CACA 042989, CACA 043744, CACA 043745)*

The Service responded to a Species List request initiated by Environmental Management Associates on behalf of Lake City Geothermal, LLC on December 10, 2004. Although the details of the proposed action are slightly different, it appears the original Species List request corresponds to the pending lease applications described in the Draft PEIS occurring in Modoc County, California. Contained within our response was a list of species that may occur within the proposed project area and be affected by the proposed project. This list included the Modoc sucker (*Castostomus microps*), Carson wandering skipper (*Pseudocopaeodes eunus obscurus*), bald eagle (*Haliaeetus leucocephalus*), Warner sucker (*Catostomus warnerensis*), slender orcutt grass (*Orcuttia tenuis*), and Western yellow-billed cuckoo (*Coccyzus americanus*). Since this time, the bald eagle has A-73-18 been removed from the list of threatened and endangered species maintained by the Fish and Wildlife Service. However, the species is still protected by the BGEPA and as such deserves continued consideration.

The proposed action in Nye County, Nevada may occur in greater sage-grouse and pygmy rabbit habitat. Additionally, there is an endemic fish species (Big Smoky Valley tui chub (*Gila bicolor spp.*)) that occurs in the area. The Service recommends coordinating with the local U.S. Fish and Wildlife Service Office for project specific details.

Appendix A – State of States and State of Tribal Lands

- Please describe the current status of the Blundell geothermal plant. According to the first full paragraph on page A-38, the Blundell geothermal plant was expected to expand operations with additional binary units due to go online in November 2007. A-73-19

- Figure A-40 is not legible. The Service recommends improving the quality of this figure. A-73-20

Appendix C – Preliminary List of Areas of ACEC Status

- Appendix C lists areas with ACEC status throughout the project area, with the exception of ACECs occurring in the State of Utah. The Service recommends amending this list to include ACECs in Utah. The following web-site provides a list of current ACECs designated in Utah: http://www.blm.gov/ut/st/en/prog/blm_special_areas/acecs/utah_acecs.html. A-73-21

Appendix D – Best Management Practices (BMP)

- The Service recommends that a separate section for threatened and endangered species be included in Appendix D. A-73-22

- Appendix D has the following BMPs repeated throughout all phases of geothermal exploration, development and restoration "Drip pans should be used under fuel pumps and valve mechanisms…." The Service recommends any containers used to collect liquids be enclosed to prevent access to contaminants by wildlife and migratory birds. A-73-23

- Another BMP repeated is "Employees, contractors, and site visitors should be instructed to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. In addition, pets should be controlled to avoid harassment and disturbance of wildlife." In occupied habitat of certain federally listed species (i.e. desert tortoise), the Service recommends that pets not be allowed. In addition, we recommend no disturbance on or around wildlife during reproductive seasons. The Service recommends working with the local field office for appropriate time restrictions during nesting and breeding seasons for specific species. A-73-24

- Two measures repeated throughout are, “The BLM, FS, and operators should contact appropriate agencies early in the planning process to identify potentially sensitive ecological resources that may be present in the area of proposed geothermal development” and “The operators should conduct surveys for federal- and state protected species and other species of concern within the project area.” We recommend including BMPs that will commit to the identification of appropriate conservation measures based on survey results and consultation with the Service. A-73-25

- The Service’s Utah Field Office has worked with the Utah BLM to determine conservation measures for oil and gas development that provide protection to listed species. These conservation measures are provided in an attachment to these comments. Because the Draft PEIS describes the impacts of geothermal resource development as comparable to those of oil and gas resource development, the Service recommends that the conservation measures jointly prepared for oil and gas development also be incorporated into the Geothermal Energy Draft PEIS. A-73-26

- Some of the BMPs under phase 4, reclamation and abandonment, for vegetation and fish and wildlife do not appear to apply to this phase of geothermal resource development. For instance, some of the measures discuss development of new access roads. The Service recommends removing measures that do not actually apply to this phase of geothermal resource development and including BMPs for monitoring to ensure that desired conditions are met after final reclamation and abandonment of sites. A-73-27

Appendix H – Federally Listed Species

- Appendix H contains all federally listed species. Not all of the species listed would actually be impacted by geothermal resource development projects. Additionally, some noted species and critical habitat areas are not accurately noted. The Service recommends the following amendments to the species list:

    - Maguire daisy occurs from the San Rafael Swell in Emery County, Utah, south into Wayne and Garfield Counties, Utah, through the Waterpocket Fold in Capitol Reef National Park. The range of the species does not occur within the planning area of your Draft PEIS (figure 2-1, page 2-2). A-73-28

    - The Eskimo curlew does not occur in Utah; please see the species information at http://ecos.fws.gov/speciesProfile/SpeciesReport.do?spcode=B01A.

    - The grizzly bear has been extirpated from Utah; please see the species information at http://ecos.fws.gov/speciesProfile/SpeciesReport.do?spcode=A001.

    - The Mesa Verde cactus does not occur in Utah; please see the species information at http://ecos.fws.gov/speciesProfile/SpeciesReport.do?spcode=Q21J.

- Shrubby reed-mustard, *Schoenocrambe suffrutescens*, is listed as occurring in "Y", it should be "UT".

- Munz's onion (*Allium munzii*), Bear Valley sandwort (*Arenaria ursina*), Nevin's barberry (*Berberis nevinii*), ash-gray paintbrush (*Castilleja cinerea*), Vail Lake ceanothus (*Ceanothus ophiochilus*), southern mountain buckwheat (*Eriogonum kennedyi* var. *austromontanum*), Mexican flannelbush (*Fremontodendron mexicanum*), willowy monardella (*Monardella linoides* ssp. *viminea*), and spreading navarretia (*Navarretia fossalis*) have designated critical habitats. Designated critical habitat becomes final for San Diego thornmint (*Acanthomintha ilicifolia*) on September 26, 2008.

- In addition, critical habitat has been proposed for San Bernardino bluegrass (*Poa atropurpurea*) and California taraxacum (*Taraxacum californicum*). Further, Quino checkerspot butterfly (*Euphydryas editha quino*), San Bernardino kangaroo rat (*Dipodomys merriami parvus*), and Peninsular bighorn sheep (*Ovis canadensis*) have both designated and proposed critical habitats.

- Finally, for Coachella Valley milk-vetch (*Astragalus lentiginosus* var. *coachellae*) and San Jacinto Valley crownscale (*Atriplex coronata* var. *notatior*) our designation of critical habitat consisted of zero acres each, since all essential areas were excluded from critical habitat designation (71 FR 14538 and 70 FR 74111).

A-73-1

By regulation, "Fish hatcheries or wildlife management areas administered by the Secretary" are closed to leasing (43 CFR 3201.11).

On pages 2-6 and 2-7 of the Draft PEIS, there are a number of land types that may be closed to leasing. Specifically, under the proposed action, ACECs would be closed where the BLM determines that geothermal leasing and development would be incompatible with the purposes for which the ACEC was designed or that have management plans that expressly preclude new leasing or development.

For other sensitive areas (e.g., riparian areas and sensitive species habitat), stipulations are proposed to avoid, minimize, and mitigate any potential impacts.

This phased approach would not meet the stated purpose and need of facilitating geothermal leasing because the geothermal resource base for commercial development is concentrated, distinct, and localized.

A-73-2

The BLM supports the control of nonnative, invasive species. The Proposed Action provides a list of BMPs that could be applied as conditions of approval to subsequent permits to control invasive species for the particular site conditions.

Mitigation measures, including lease stipulations, conditions of approval, and the general operation of geothermal developments, would be monitored by the lessee or the appropriate Federal agency to ensure their continued effectiveness throughout all phases of development. Using adaptive management strategies, where mitigation measures are determined to be ineffective at meeting the desired resource conditions, the BLM and FS would take steps to determine the cause and would require the operator to take corrective action. This information would also be used to inform future geothermal leasing and development.

A-73-3

Additional discussion has been added to the cumulative impact analysis. As noted in Chapter 5, past, present, and reasonably foreseeable actions, including commercial uses of public and federal lands, are documented and analyzed.

Based on the analysis in Chapter 5 *Cumulative Impacts*, about 17 million acres of public land have commercial uses. Based on the reasonable foreseeable development scenario for geothermal development, by 2025 up to about 90,000 acres of federal land would be impacted by geothermal development. A typical geothermal electrical generation plant can disturb between 50 and 370 acres of land. Solar and wind facilities generally require 500 to 3,500 acres. Geothermal development will result in cumulative impacts to land, water, and other public lands uses, but the use is a fraction of the other uses on public lands and is relatively minor in scope compared to other uses.

A-73-4

Section 1.5.2 includes a list of areas statutorily unavailable for leasing and quotes from the regulations at 43 CFR 3201.11. Paragraph 3201.11 (e) excludes "…wildlife management areas administered by the Secretary." Since national wildlife refuge system lands are included in the above description, text has been added to Chapters 1 and 2 clarifying that lands managed by the National Wildlife Refuge System are closed to new leasing.

A-73-5

The Final PEIS has been corrected and the text has been revised as suggested by the comment.

A-73-6

Lands designated as closed and open in the CDCA follow the criteria listed on pages 2-6 and 2-7 of the Draft PEIS and the decisions within the management plans for the CDCA. The BLM is not proposing to amend the CDCA plans.

Decisions on siting and mitigation for any subsequent development will be assessed during the permit application process and would address the management areas provided in the comment. Any revisions of the CDCA plans would also address these management areas and their suitability for all types of developments.

A-73-7

The BLM is proposing to include a Sensitive Species Stipulation for leases in areas that have agency-designated sensitive species, including sage-grouse. The stipulation could be a NSO, CSU, or TL in order to meet resource objectives (Page 2-19 of the Draft PEIS). This approach provides the flexibility to respond to the dynamic national and regional planning and protection efforts for these species. During the permitting process for any subsequent drilling or development applications, the BLM would conduct the appropriate analysis on siting locations, as noted in the comment.

To provide further protection for threatened, endangered, and sensitive species, the BLM will impose an Endangered Species Act stipulation (see Section 2.2.2) on all geothermal leases.

A-73-8

As noted on pages 2-16 and 2-17 of the PEIS, the Proposed Action includes NSO and CSU stipulations specific to water bodies, riparian areas, wetlands, playa, and floodplains in order to avoid any subsequent development in these fragile areas. In addition, there are a number of BMPs (Appendix D) that could be applied as conditions of approval to future development permits to avoid or mitigate any impacts to these resources.

A-73-9

Additional lands do not have to be closed to provide protection for the species discussed in the comment.

Lands designated as open to leasing are subject to existing laws, regulations, and formal orders. In complying with these laws, regulations, and orders, some of the open lands may not be available for leasing. Chapter 2 explains, under *Procedures Prior to Leasing*, that the BLM and FS would comply with the requirements of the Endangered Species Act, including determining if any listed or proposed threatened or endangered species, or critical habitat, is present on nominated lease parcels and may be affected by any decision to lease. Chapter 6 of the FPEIS, in turn, explains that the agencies have determined that the decision to lease has no effect on listed species or critical habitat.

To provide further protection for threatened, endangered, and sensitive species, the BLM will impose an Endangered Species Act stipulation (see Section 2.2.2) on all geothermal leases.

A-73-10

The suggested change has been made.

A-73-11

Under the proposed action considered in the PEIS, the FS is not proposing to make any administrative or discretionary closures or to amend any land use plans. Prior to any leasing on NFS lands, the FS would have to provide consent. Through this process, the FS must identify specific lands that are administratively available and closed for leasing and under what conditions. This process will require environmental review, including NEPA documentation. Designating Critical Biological Zones on Forest Service lands would take place in the consent or land use plan amendment process. Pages 1-26 and 1-27 discuss the FS decisions resulting from the PEIS and required subsequent NEPA analysis.

A-73-12

Thank you for your comments. The measures have been added to Appendix D, BMPs, where they do not already exist. For migratory birds (including burrowing owls), measures are already included. They are also present for raptors.

A-73-13

General impacts to wildlife resulting from habitat fragmentation are discussed on page 4-78. A complete discussion of the potential impacts on wildlife from all aspects of geothermal leasing and development are found on pages 4-74 through 4-92.

A-73-14

Thank you for your comment. The recommended change has been made.

A-73-15

Text has been added on the consultation process.

In Chapter 2, under *Procedures Prior to Leasing*, it is noted that the BLM and FS would determine if any listed or proposed threatened or endangered species, or critical habitat, is present on nominated lease parcels to comply with the Endangered Species Act.

A-73-16

In Chapter 2, under *Procedures Prior to Leasing*, it is noted that the BLM and FS would determine if any listed or proposed threatened or endangered species, or critical habitat, is present on nominated lease parcels and would comply with the Endangered Species Act prior to issuing the lease. Any potential impacts to site-specific hydrology and species would be addressed as part of the ESA evaluation.

A procedure prior to leasing has been added as follows:

> The authorized officer of the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states manage and typically have regulatory authority for water quality, water rights, and wildlife. During the environmental review for any subsequent permit applications for drilling or development, the BLM and FS would conduct the necessary environmental review and analysis based on the proposed site development and technology. Such location- and technology-specific information is critical to assess localized resources like hydrology and groundwater. BMPs are provided in Appendix D and could be applied as conditions of approval to permits. The list is not inclusive and could be expanded by the BLM and FS to address site-specific conditions.

A-73-17

The comment has been noted. The analysis in Chapter 4 is commensurate with the scope of the proposed action for the PEIS. Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife.

This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis.

A-73-18

These species have been added to the document as requested. Coordination with the USFWS would occur as part of the NEPA process prior to any exploration or development.

A-73-19

Appendix A has been revised.

A-73-20

Appendix A has been revised.

A-73-21

As described in Section 2.2.1 *Lands Identified for Leasing*, ACECs will be closed to leasing where the BLM determines that geothermal leasing and development would be incompatible with the purposes for which the ACEC was created, or where management plans preclude new leasing or development for oil and gas or geothermal resources. Data for ACECS closed or open to leasing presented in Appendix C was provided by BLM state offices and may not represent the comprehensive list. The ACECS list on the website provide by the commentor does not include stipulations or indicate if ACECs are closed or open to oil and gas and or geothermal leasing; therefore, these areas were not added to the appendix.

A-73-22

The comment is noted. A separate section for threatened and endangered species has been added to Appendix D.

A-73-23

The suggested change has been made.

A-73-24

Changes made to the BMPs include the control of pets. In regards to disruption of wildlife during breeding, it is not possible to avoid all disturbance of all wildlife during all reproductive seasons. Measures are already included to protect migratory birds, big game, and special status species during important reproductive, calving, and courting periods.

A-73-25

The recommended change has been made to the document.

A-73-26

Thank you for providing the list. The conservation measures are very helpful. Given the specific nature of the conservation measures, they have not been included specifically. In Chapter 2 under *Procedures Prior to Leasing*, it is noted that the BLM and FS would determine if any listed or proposed threatened or endangered species, or critical habitat, is present on lease parcels and would comply with the Endangered Species Act prior to issuing the lease. In addition, at the time projects are proposed, additional measures may be developed through consultation, as appropriate.

A-73-27

Changes have been made to the document. The inappropriate BMPs have been removed, and measures for monitoring have been added.

A-73-28

Thank you, all changes have been made to the table.

San Luis Valley Ecosystem Council

Citizens for San Luis Valley Water Protection Coalition

September 19, 2008

Delivered via electronic mail to: geothermal_eis@blm.gov and hard copy U.S. post

Draft Geothermal Leasing PEIS
c/o EMPSi
182 Howard Street, Suite 110
San Francisco, CA 94105-1611

Re: Scoping Comments on the Draft Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States, May 2008.

To Whom It May Concern:

We appreciate the opportunity to respond to and offer input on the U.S. Forest Service and Bureau of Land Management Programmatic Environmental Impact Statement (PEIS) for agency-wide geothermal energy programs and policy. Enclosed are our scoping comments submitted jointly on behalf of the Citizens for San Luis Valley Water Protection Coalition and San Luis Valley Ecosystem Council.

Our organizations serve the Upper Rio Grande River basin including the headwaters and greater San Luis Valley, CO. The San Luis Valley (SLV) is the world's largest semi-alpine Valley. Roughly 122 miles long and 74 miles wide, the 8,100 mile^2 SLV contains six rural Colorado counties; Saguache, Alamosa, Rio Grande, Conejos, Costilla and Mineral Counties. Over 71% of the SLV is public land including much of the 1.86 million acre Rio Grande National Forest, San Luis District of the Bureau of Land Management, the Great Sand Dunes National Park and the Alamosa, Monte Vista and Baca National Wildlife Refuges.

The Citizens for San Luis Valley Water Protection Coalition (WPC) is a grassroots organization representing a broad spectrum of interests. It's members are united by the belief that the vital ecological, wildlife, cultural, agricultural and water resources of the upper Rio Grande and Closed Basins of the SLV should not be jeopardized by destructive industrialization of any kind. By working with communities, local government and various stakeholder groups, WPC is actively engaged in developing an SLV Citizens Energy Initiative that is responsive to the demands of climate change while protecting the vital natural and cultural resources are the foundation of our communities.

The mission of the San Luis Valley Ecosystem Council (SLVEC) is to protect and restore - through research, education and advocacy - the biological diversity, ecosystems, and natural resources of the upper Rio Grande bioregion, balancing ecological values and human needs. On behalf of more than 4,500 supporters, SLVEC has worked extensively with Federal agencies (including the US Forest Service and Bureau of Land Management) to identify priorities, make recommendations and develop prescriptions for travel management and vegetation, watershed, wetland, wildlife habitat and corridors, and cultural and Natural Heritage Program sites using a GIS/landscape-level approach.

The SLV is rapidly emerging as a major focal point for renewable energy generation development in the region. As federal, state and regional energy policies evolve, we expect the unique biogeography of the SLV to place us squarely in the middle of the new energy economy.

We support taking immediate action to limit and even reverse dangerous levels of carbon emissions and greenhouse gases. Our dependency on fossil fuels is undeniably jeopardizing global climate systems and the need to transform our energy economy is urgent. Such an energy transformation offers a tremendous opportunity to start anew and avoid mistakes of past energy policies. With ecosystem processes being taxed to an extreme and biological diversity collapsing as a result of our unwise resource use, the relatively pristine, intact ecosystems still extant in the SLV are priceless and constitute vital life and economic sustaining resources for our region and beyond. We urge the USFS and BLM to work in partnership with public lands advocacy organizations such as ours to ensure that issues of scale, siting and water demands of geothermal plants on or near public lands in the SLV are resolved efficiently and affectively.

Colorado was assessed for its geothermal energy potential in the late 1970s and early 1980s. Many low and moderate temperature resources suitable for direct use applications were found, but no conclusive evidence of a high temperature resource that could be used for electrical power generation was identified. The 2006 Western Governors Association report ranked Colorado fourth among western states in the number of potential sites for geothermal power generation. New technologies and methods of assessing geothermal resources such as the use of velocity of seismic P-waves are currently being applied and indicate that high elevation geological active zones, such as those found in central and southern Colorado may emerge as some of the best geothermal sources in the West.

Colorado exhibits high heat flow, volcanism, recent faulting and continental rifting – geologic features considered indicative of geothermal resources with power generation potential. The Rio Grande rift zone extends along both sides of the SLV. According to the Colorado Geothermal Development Strategic Plan (2007), the San Luis Basin has "large potential resources ranging from low temperature at intermediate depths (2,000-4,000 ft) to above-boiling temperatures at deep depths (7,000-9,500 ft)", (see attachment A). A recent MIT study (2006) described the northern Rio Grande Rift extending into the SLV as having "probably the highest basement Enhanced Geothermal System (EGS) potential on a large scale." The Western Governors' Geothermal Task Force identified Colorado as having the potential for 20MW of power generation within a decade and they are in the process of updating their geothermal database and evaluating potential geothermal energy sources in response to the States renewable energy portfolio standard (Matthews, 2007).

While we support the development of geothermal energy production as a much more desirable and appropriate energy solution for the SLV than traditional fossil fuel development, we are concerned that intensified, industrial-scale development could jeopardize the broader environmental values, in particular the extensive but fragile aquifers that underlie these values, that we, and the citizens of the SLV have worked long and hard to protect.

The SLV is uniquely suited to serve as a 'pilot study' area for balanced alternative energy development, where appropriate scale technologies enhance rather than overwhelm existing natural and cultural systems, and strengthen and diversify rather than dominate local economies. Collectively, we have decades of experience promoting Valley-wide initiatives, public awareness and citizen action, problem solving and planning processes addressing a wide-range of issues of concern to the bioregion. The SLV was chosen for a US Environmental Protection Agency Pilot Study on regional sustainability (EPA Office of Research and Development, Cincinnati, Ohio). As a natural outgrowth of our work, we have initiated a SLV Citizens Energy Initiative (CEI) with the goal of establishing a regional model for renewable energy development.

Stakeholder participation is important at this early stage of development, and will continue to be for years to come and the CEI will be a powerful vehicle for stakeholder input. As organizations with long-standing and proven successes in community education and organizing around environmental issues, and extensive knowledge and involvement in important water, public lands and resource use issues in the Valley, we invite USFS and BLM to collaborate with us in developing the CEI and the PEIS as they move forward.

We welcome the opportunity to serve as an active stakeholder in creating a model for the future that embraces both the need for new energy solutions and rigorous protection of our fragile ecosystems. We believe in a future where energy production and protection of our fragile ecosystem processes go hand-in-hand.

We are submitting these comments today via electronic mail and also forwarding a copy with attachments to you separately. Thank you for considering these scoping comments and for your collective commitment to supporting responsible renewable energy development. We look forward to continuing to participate with you in this process.

Sincerely,

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Scoping Comments on the Geothermal Energy Programmatic Environmental Impact Statement submitted jointly by the San Luis Valley Ecosystem Council and the Citizens for San Luis Valley Water Protection Coalition

I. Large-scale Geothermal Energy Leasing Requires Development of a Thoughtfully Designed Approach

A. The risks and unknowns specific to geothermal energy development require caution before rushing into a large-scale program

According to the Energy Information Association, there are currently roughly 2,400 megawatts (MW) of installed geothermal electricity generation in the western United States, less than 1% of total U.S. generation capacity. The Reasonably Foreseeable Development Scenario (RFD) for the Draft PEIS forecasts that within the planning area, 12,100 MW of geothermal potential are considered viable for commercial electrical generation from 242 power plants by 2025; the RFD further estimates direct use applications of 4,200 thermal MW by 2025. Such massive development of geothermal resources will no doubt have significant impacts to the public lands and their many resources. We believe development predicted on this scale warrants careful studies of the impacts to public land, water (especially aquifers), wetlands, wildlife and other affected natural resources prior to finalizing the PEIS and approval and issuing specific leases.

While significant development of flash steam power plants has allowed analysis of impacts from this indirect use of geothermal resources, most of the geothermal power plants planned for construction in the U.S. are binary-cycle. Though impacts from binary-cycle plants do not appear to be radically different from flash steam plants, additional technologies are being developed that will require much greater analysis before their impacts can be understood. In particular, "co-produced geothermal fluids," also known as "produced water cut", and "enhanced geothermal systems" are emerging technologies whose impacts are relatively unknown. Development of these resources should not be done without close examination of potential risks and impacts, and if development does occur it should be done slowly, in a phased manner, to ensure ongoing study can identify and fix problems and issues that arise.

For new technologies such as enhanced geothermal systems, a cautious approach emphasizing monitoring and phased development is critical. Though the Draft PEIS states that, "It is anticipated that there may be applications for research and development drilling on public and NFS lands in the future. While it is a viable and proven technology, it is unlikely that it will be applied at a large scale in the western US within the next 20 years," (Draft PEIS 1-9), this technology has not been thoroughly tested in the US and requires further investigation to ensure that unacceptable impacts are avoided, especially in geologically complex and poorly understood areas like the Rio Grande Rift complex in the San Luis Valley. 0-74-1

While Chapter 4 of the Draft PEIS examines the general types of impacts expected from geothermal development, the inability to predict future development scenarios, including types of development, timing, location and risks will require additional site-specific analysis *prior to* leasing lands for project development.

Recommendations: Due to the projected scale of geothermal development and relative lack of knowledge of the impacts of such development, the agencies should approach geothermal development on public lands in a measured manner. We recommend that a pilot project be developed and operated for a sufficient time period to yield a more complete understanding of unforeseen problems, impacts and best management practices unique to the Rio Grande Rift before permitting private utility geothermal projects in the SLV. Beyond this, we recommend phased development and monitoring to ensure that impacts are well studied and, where avoidable, effective mitigation measured developed. Avoidance of negative impacts should, of course, be a priority. Where new and developing technologies are being proposed, research and development should be undertaken with caution and large-scale deployment of new technologies should only be done after thorough analysis. We strongly recommend that BLM work closely with local government entities and citizen groups to carefully plan and implement projects in accordance with the *SLV Citizens Energy Initiative* before consideration of large-scale or multi project leasing in the San Luis Valley.

B. Geothermal development is not always renewable: water use of certain geothermal development systems demands in-depth analysis.

Because of water use, certain types of geothermal development are not "renewable" in the way that other renewable energy sources are. The Draft PEIS acknowledges that for flash steam facilities, "about 15-20 percent of the fluid would be lost due to flashing to steam and evaporation through cooling towers and ponds." (p. 2-47). The Draft PEIS further addresses these impacts in Chapter 4, stating that potential impacts on water resources could occur if reasonably foreseeable actions were to result in "Substantially depleted groundwater supplies or interfered substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater 0-74-2 table level;" or "Resulted in changing conditions so that the geothermal resource itself was degraded." (p. 4-40). During drilling operations,

> **Extracting geothermal fluids could result in drawdowns in connected shallower groundwater aquifers, with the resulting potential to affect streams or springs that are connected to the water table aquifer.** The potential for these types of adverse impacts is reduced through extensive aquifer testing, which is the basis for designing the geothermal plant and for locating, designing, and operating the extraction and injection wells. Combined with the requirement to comply with state and federal regulations that protect water quality and with limitations imposed by water rights issued by the state engineer, the impacts on water quality and the potential for depleting water resources is expected to be minimized. **There is a medium risk for moderate to high impacts on groundwater supplies from the use of groundwater for geothermal activities** (p. 4-43) (emphasis added).

During utilization,

> Geothermal resource utilization could affect groundwater resources because of consumption of water by evaporation and the need to reinject water to replenish the geothermal reservoir. The magnitude of the effects would vary depending on groundwater conditions and availability within the basin and on the type of geothermal plant. Availability of water resources could be a limiting factor, affecting the expansion of geothermal resource development in a given area (p. 4-44).

The Draft PEIS further states that, "withdrawing shallow groundwater or surface water for cooling purposes could affect nearby springs." (p.4-45).

Clearly, flash cycle plants have significant potential for depleting the water that is a critical component of the geothermal resource, limiting the "renewable" nature of this development. Further, all geothermal development has the potential for impacts to surface and groundwater quality and quantity, and analysis and mitigation must focus on limiting these impacts.

Recommendation: The Closed Basin confined and unconfined aquifer system is one of the most complex and poorly understood aquifer systems in the state. Protracted water wars have led to a number of Federal, state and local water protection statutes that must be considered in light of geothermal development in the SLV. While we are not suggesting that geothermal be completely removed from consideration in the SLV, it should be in context to the relative value of renewable resources in the region. The SLV is rated as fifth nationally and first in the state for its solar energy generation potential. Given the considerable conflicts that geothermal development presents with traditional agriculture and water users, agencies should prioritize renewable solar development over geothermal development, where depletion is a cognizable risk. The BLM and Forest Service should also prioritize binary cycle geothermal development over flash steam development to reduce the risk of depleting geothermal resources. The PEIS should specifically require additional site-specific analysis of potential impacts to geothermal and water resources of individual lease and project proposals and, in the SLV, require compatibility with the SLV Citizens Energy Initiative.

The following specific concerns need to be considered before approval of geothermal leasing in the San Luis Valley:

C. Ground Water Use and Protection of the Closed Basin Aquifer

The MIT study concluded that "the major environmental issues for EGS are associated with ground-water use and contamination" (1-27). Because of the presence of the confined and unconfined Closed Basin aquifer in District 3, these concerns are of paramont importance in the SLV. Below are some specific legal, political and environmental statutes and concerns that require serious consideration before leasing Federal lands for geothermal in the SLV:

A. Colorado water rights, rules and stipulations;
B. Cumulative affects on aquifer depletion;
C. Protection of significant aquifer recharge areas (stream runoff areas, wetlands, artisan wells, etc.); 0-74-3
D. Rio Grande Compact conflicts;
E. Compliance with federal, state, and county water use statutes, regulations and rules, specifically, but not limited to;
   1. The Great Sand Dunes National Park and Preserve Act of 2000. A unique aspect of this legislation, outlined in Section 6, is its adoption to specifically protect the unique hydrogeology which supports the Great Sand Dunes formation;
   2. Colorado 98-1011 authorizing the Rio Grande Decision Support System (RGDSS) Study. Among other things, the RGDSS created the scientific framework for Colorado State Law 04-222 by establishing the

geo-hydrological context for regulating water allocation in Water District 3 based on the finite nature of the Closed Basin aquifer system.)

3. Colorado State Law 04-222, "Rules Governing New Withdrawals of Groundwater in Water Division 3 Effecting the Rate or Direction of Movement of Water in the Confined Aquifer System". Promulgated pursuant to the authority granted to the State Engineer in section 37-90-137 (12)(b)(I), C.R.S. (2003), and section 37-92-501, C.R.S. (2003) as amended by Senate Bill 04-222. *"These rules have as their objective the optimum use of water consistent with preservation of the priority system of water rights and protection of Colorado's ability to meet its interstate compact obligations…allowing fluctuations in the artesian pressures in the Confined Aquifer within the ranges that occurred during the period of 1978 through 2000, and allowing artesian pressures to increase in periods of greater water supply and to decline in periods of lower water supply in much the same manner and within the same ranges of fluctuation as occurred during the period of 1978 through 2000, while maintaining average artesian pressure levels similar to those that occurred in 1978 through 2000."*
4. The Land Use, Master Planning and 1041 Codes and Regulations of the six counties comprising the San Luis Valley. In particular, Saguache County's Land Development Code, Article XVIII "Significant Groundwater Recharge Zones"; adopted to "*…regulate identified areas designated as significant groundwater recharge zones, to prevent immediate or foreseeable degradation of quality to the ground water and/or connecting subsurface water, surface water, flood plains, wet lands, or riparian areas. To prevent material impact to aquatic life, wildlife, agricultural, and the health, safety and welfare of Saguache County residents…to otherwise plan for and regulate the use of land overlying ground water recharge zones so as to provide for planned and orderly use of land and protection of the environment and health, and safety and welfare of Saguache residents in a manner consistent with Federal, State and County regulations";*
5. Renewable energy regulations currently enacted or under consideration in any of the six counties of the San Luis Valley;
6. Reinjection. Due to over appropriation of the confined aquifer in the San Luis Valley, the Colorado Division of Water (CDW) the surface disposal of geothermal fluids augmentation is not allowed. Geothermal projects will have to include re-injection wells, even for shallow and warm direct use applications. Additional hydrogeological consultation with experts in the Closed Basin aquifer will be needed to establish the appropriate depth to which geothermal spent fluids should be re-injected in order to avoid disruption of essential hydrologic processes. DWR regulations for drilling Type A and Type B geothermal wells will require additional information that will require an initial exploration well, in addition to the production and re-injection wells.
7. Geohazards. The same attributes that make the SLV a prime area for geothermal energy generation also bring high geohazard risks. The MIT study specifically sites concerns about induced seismicity or subsidence "as a result of water injection and production" (1-27). The geologically young Rio Grande Rift runs along both sides of the San Luis Valley. Its hydrogeological relationship with the aquifers of the Closed Basin is complex and not well understood. The Rift resulted from a process of regional extension and mantle upwelling in Neogene times (beginning 29 million years ago), and continues to widen today. Ongoing geologic activity is evident through high heat flow, hot springs, continued seismicity, geodetic observations, and some of North America's most recent lava flows (Veatch, 1998). Geothermal development employs the same fracturing techniques used for oil and gas development. Additionally, the highest temperature geothermal resources occur at depths of up to 10,000 meters. Given the volcanic and seismic history of the area, there are concerns that significant underground explosions/disturbances could induce unintended seismic activity and result in large-scale damage to a wide array of resources. Potential geohazards, in particular induced seismicity and subsidence need to be analyzed and thoroughly assessed, and in-depth, site-specific studies completed as part of any comprehensive geothermal facility siting process.

D. Geothermal leasing and development should not be implemented in the same way as oil and gas leasing and development

The Draft PEIS repeatedly mentions the perceived similarities between oil and gas drilling and geothermal development and the intent of the agencies to rely on their experience with oil and gas development for fashioning their approach to managing geothermal energy development. The Draft PEIS states:

> BLM and FS have had a great deal more experience managing lands for development of oil and gas resources, and many more management plans address these resources. Development of oil and gas resources result in many of the same kinds of impacts as development of geothermal resources (e.g., surface disturbance resulting from the footprints of facilities, wells, pads and pipelines, as described in Section 2.5, Reasonably Foreseeable Development Scenario); therefore, BLM and FS have determined that it is appropriate to take an approach to development of geothermal resources similar to that taken to development of oil and gas resources. Areas that require protection from the effects of development of fluid resources are more likely to require protection from the similar effects of development of geothermal resources (p. 2-6). O-74-4

Although similarities exist in the development and impacts of developing geothermal energy and oil and gas, there are also fundamental differences and opportunities. As discussed above and throughout these comments, the technologies used and still in development for geothermal energy often require significant amounts of water and can have different effects than oil and gas drilling. Also, while development of these energy sources can cause significant damage to other resources, such as wilderness qualities, wildlife, water, vegetation, and recreation opportunities, the agencies have already made major commitments to oil and gas leasing, and seen the devastating results to the public lands.

The BLM and Forest Service should take the opportunity offered by this programmatic document and subsequent analysis to avoid the mistakes of the oil and gas program. Significant problems have beset the oil and gas program, including: inappropriate prioritization of leasing and drilling over all other resources and values; lack of adequate impacts analysis; failure to use the best available scientific research to inform management; insufficient monitoring and mitigation of impacts; inadequate leasing stipulations and Best Management Practices (BMPs) to protect other resources; abuse of exceptions and waivers from stipulations and BMPs; failure to employ true phased development; and inadequate bonding and reclamation. The failure to work with local government and communities, carefully plan, consider impacts and avoid damage to other resources and users of the public lands has resulted in serious conflict and devastating impacts to the public lands, as well as negative impacts to our economy and public health and considerable expense both to the federal government, ecological systems, biodiversity values and public health.

Geothermal development offers the opportunity to increase our national energy supplies while limiting greenhouse gas emissions and subsequent impacts from climate change. However, if the agencies do not learn from and avoid a repeat of the mistakes of the oil and gas program, any potential benefits could be outweighed by the recurrence of the problems listed above. BLM should instead adopt a cooperative measured approach that maximizes the benefits of geothermal development while limiting impacts to other resources and values. This PEIS provides an important opportunity to design a thoughtful approach to geothermal leasing and development that avoids the mistakes of the past.

Recommendation: BLM should adopt a cooperative measured approach to geothermal development, taking into consideration the unique aspects of geothermal development and avoiding the problems of the oil and gas program in order to maximize the benefits of geothermal development while minimizing conflicts with other stakeholders, communities and impacts to other resources and values.

E. Geothermal development should be conducted to achieve a net decrease in greenhouse gas emissions and related impacts from climate change

The development of renewable energy sources, including geothermal, offers the opportunity to limit damaging impacts from climate change by displacing electricity production from fossil fuels and thus reducing greenhouse gas emissions. As stated in the Draft PEIS:

> "A study comparing greenhouse gas emissions from electrical generation using fossil fuels and geothermal fluids found that geothermal produces an order of magnitude less in carbon dioxide, hydrogen sulfide, methane, and ammonia (Bloomfield *et al.* 2003)" (p. 1-20).
>
> "Direct use of geothermal resources, such as using geothermal to heat buildings, has the potential to displace 18 million barrels of oil per year (WGA 2006). Increased geothermal energy utilization could help the US reduce greenhouse gas emissions and meet policy goals (Bloomfield *et al.* 2003)." (p. 1-20). O-74-5

We support the BLM's recognition of the importance of analyzing the effects of its action on climate change. Global climate change is now acknowledged to be a major consideration for effects of major federal actions. The Supreme Court has concluded that "[t]he harms associated with climate change are serious and well recognized." *Massachusetts v. E.P.A.*, 127 S.Ct. 1438, 1455 (2007). Further, the Supreme Court has held that while agency action may not completely reverse the effects of climate change, it does not relieve the agencies of the responsibility to take action to reduce it. Id. at 1458. In fact, an order issued by the Secretary of the Interior requires that:

> Each bureau and office of the Department will consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for scientific research and investigations, when developing multi-year management plans, and/or when making major decisions regarding the potential utilization of resources under the Department's purview.

U.S. Dept. of the Int., Sec. Order No. 3226 (Jan. 19, 2001), Section 3.

While there are many anticipated benefits to geothermal energy production over fossil fuels, the PEIS must address the potential for geothermal energy to have adverse impacts on climate change. For example, many western landscapes are already becoming increasingly fragile due to global climate change. In addition, these landscapes have important value as carbon "sinks," which could be lost if they are developed.[1] Further, undeveloped land has value as potential habitat as wildlife migrates to respond to climate changes. The destruction of these lands for geothermal energy production would thus contribute to the negative impacts of climate change.

Though the Draft PEIS does address impacts to air quality and climate from geothermal development, it does so only in the context of comparisons between geothermal development and fossil fuels development. The PEIS should further analyze negative impacts to climate change from geothermal development and seek to mitigate negative impacts on climate change through the designation of appropriate lands open to geothermal energy development and lease stipulations and BMPs to limit negative impacts. An additional factor to consider is whether fossil fuels will be transmitted on lines designated for geothermal energy.

The agencies must analyze net impacts of geothermal energy development on climate change and include consideration of landscapes and wildlife that already are or have the potential to be affected by climate changes. The BMPs incorporated into this PEIS should include practices to mitigate potential climate change impacts.

Because geothermal development does result in some greenhouse gas emissions, the agencies should weigh also geothermal development against other forms of renewable energy development such as wind and solar. Though wind and solar development can also have negative impacts on climate change due to impacts to carbon sinks, wildlife habitat, and migration corridors, they create almost no greenhouse gas emissions (http://www.sciam.com/article.cfm?id=a-solar-grand-plan). The agencies should analyze climate change impacts of geothermal development in the context of these other renewable energy sources, particularly solar, and prioritize whichever type of development that results in the greatest net benefit.

Cumulative Impacts. Being the most northeasterly source of quality solar energy in the nation, the SLV has become a focal point for utility-scale solar energy development. It is critical that geothermal development be assessed in this context and that **cumulative impacts be analyzed for all renewable energy initiatives being considered now or in the foreseeable future for the entire SLV, including private and other non-federal lands.** A cumulative impact assessment must include, at the least, effects on aquifer and surface water resources, wetlands, essential ecological processes, wildlife habitat and corridors, sensitive species (including state listed), noise, economic, cultural resources, visual, pubic safety and land use.

Recommendations: The agencies should manage geothermal development on the public lands in a manner that will result in a net benefit to climate change. The PEIS should analyze climate impacts of geothermal development in the context of both the negative impacts to carbon-sinks and wildlife habitat and migration corridors, as well as the positive impacts in displacing fossil fuels electricity production. The PEIS should also weigh geothermal development against other renewable energy development and prioritize whichever type of development that results in the greatest net benefit, taking into account relative need for water or use of geothermal resources. Further, the PEIS should require similar analyses of proposed leasing and projects at a site-specific level.

II. The Proposed Action Is Not Sufficient to Protect the Resources which the Agencies Are Charged with Managing.

A. The agencies must consider a more protective range of alternatives.

NEPA mandates consideration of a full range of alternatives. The range of alternatives is "the heart of the environmental impact statement." 40 C.F.R. § 1502.14. NEPA requires BLM to "rigorously explore and objectively evaluate" a range of alternatives to proposed federal actions. *See* 40 C.F.R. §§ 1502.14(a), 1508.25(c).

> NEPA's requirement that alternatives be studied, developed, and described both guides the substance of environmental decision-making and provides evidence that the mandated decision-making process has actually taken place. Informed and meaningful consideration of alternatives -- including the no action alternative -- is thus an integral part of the statutory scheme.

O-74-6

Bob Marshall Alliance v. Hodel, 852 F.2d 1223, 1228 (9th Cir. 1988), cert. denied, 489

[1] *See, e.g., Have Desert Researchers Discovered a Hidden Loop in the Carbon Cycle?,* Science, Vol. 320, pp. 1094-140 (June 13, 2008) (attached).

U.S. 1066 (1989) (citations and emphasis omitted).

"An agency must look at every reasonable alternative, with the range dictated by the nature and scope of the proposed action." *Nw. Envtl. Defense Center v. Bonneville Power Admin.*, 117 F.3d 1520, 1538 (9th Cir. 1997). An agency violates NEPA by failing to "rigorously explore and objectively evaluate all reasonable alternatives" to the proposed action. *City of Tenakee Springs v. Clough*, 915 F.2d 1308, 1310 (9th Cir. 1990) (quoting 40 C.F.R. § 1502.14). This evaluation extends to considering more environmentally protective alternatives and mitigation measures. *See, e.g.*, *Kootenai Tribe of Idaho v. Veneman*, 313 F.3d 1094,1122–23 (9th Cir. 2002) (and cases cited therein).

NEPA requires that an actual "range" of alternatives is considered, such that the Act will "preclude agencies from defining the objectives of their actions in terms so unreasonably narrow that they can be accomplished by only one alternative (i.e. the applicant's proposed project)." *Col. Envtl. Coal. v. Dombeck*, 185 F.3d 1162, 1174 (10th Cir. 1999), citing Simmons v. U.S. Corps of Engineers, 120 F.3d 664, 669 (7th Cir. 1997). This requirement prevents the environmental impact statement (EIS) from becoming "a foreordained formality." *City of New York v. Dep't of Transp.*, 715 F.2d 732, 743 (2nd Cir. 1983). *See also Davis v. Mineta*, 302 F.3d 1104 (10th Cir. 2002).

For this PEIS, the broad scope of the proposed action requires a broad range of alternatives. However, the Draft PEIS currently considers only two actual alternatives: the proposed alternative, Alternative B, for leasing on a broad scale and another, Alternative C, for more limited leasing based on existing transmission lines. The Draft PEIS itself states that Alternative A is not an alternative but rather a baseline against which to compare the two action alternatives. Draft PEIS, p. 2-30. This range is insufficient.

Recommendations: The PEIS should incorporate aspects of both alternatives into a broader range and expand the conservation emphasis in the range of alternatives; many additional conservation measures that are within the range between "no leasing" (Alternative A) and making the majority of lands available for leasing (Alternative B) are discussed below and should be included for consideration and in the selected alternative. In the San Luis Valley, we recommend that the agencies prioritize projects in close proximity to the 31 existing substations and two major transmission lines before considering projects that are outside of energy corridors. Also, instead of simply evaluating lease applications as received, the agencies could give priority to projects that are in non-controversial locations, have already completed a robust environmental analysis and mitigation plan, and/or sited near the existing substations or planned corridors. The agencies could also phase leasing based on the most well documented geothermal resources and limit the amount of leasing based on protecting wildlife habitat and other uses. Buffers around existing geothermal resources on lands that are protected from leasing should also be incorporated. As discussed above, we strongly recommend establishment of a research and development pilot project in the SLV before authorizing other projects.

B. The proposed action, Alternative B should not be adopted, because it formally makes the majority lands available for leasing and development without sufficient analysis or protections.

Alternative B would make 117 million acres of BLM land and 75 million acres of Forest Service land open to geothermal leasing for direct and indirect use, a total of 192 million acres comprising approximately 77% of the planning area. Draft PEIS, p. 2-7. The Draft PEIS refers to the agencies' discretion in deciding whether to issue leases, but Alternative B does not provide a reasoned approach for exercising this discretion to ensure the best use of our public lands. The decision would be made without sufficient protection for other natural values, such as wilderness characteristics and other recreational or scientific use of geothermal resources. Further, Alternative B would only provide a limited buffer around the geothermal resources in Yellowstone National Park, based on areas that are already protected by a non-discretionary closure (as opposed to the 15 miles in Alternative C). Draft PEIS, p. ES-6. Alternative B also does not encompass practical considerations, such as the availability of transmission, existing or planned, for development.

O-74-7

The Draft PEIS analogizes to the structure of oil and gas leasing. *See, e.g.*, Draft PEIS, pp. 2-6 – 2-7. In the context of oil and gas leasing, issuance of a lease is considered an irretrievable and irreversible commitment of federal resources and, unless issued with a "no surface occupancy" stipulation, cannot be presumed to allow the agencies to retain control to prohibit damage to the environment. *See, e.g.*, *Bob Marshall Alliance v. Hodel*, 852 F.2d 1223, 1227 (9th Cir. 1988); *Pennaco Energy v. U.S. Dept. of Interior*, 377 F.3d 1147, 1160 (10th Cir. 2004). Accordingly, it is important that allocations of land as open to leasing be based on thorough environmental review, in addition to providing for sufficient site-specific analysis to occur prior to leasing. Because the Draft PEIS specifically states that projects can be tiered to the PEIS and not all development will warrant additional environmental analysis, the PEIS must critically analyze the lands that it designates as open to leasing, which requires inventorying the area for wilderness and roadless characteristics and protecting those places with valuable and vulnerable resources. Alternative B does not include sufficient commitments to inventory or to apply protective measures.

Recommendation: The PEIS should not adopt Alternative B.

C. Additional elements required for an approach to be adopted in the PEIS.

Alternative C includes significant improvements from Alternative B. This alternative would still make approximately 92 million acres of land available for leasing for commercial transmission. Draft PEIS, p. ES-6. However, there would be a protective 15-mile buffer around the boundary of Yellowstone National Park and leasing would be confined to a 20-mile corridor (10 miles from centerline) from existing transmission lines and those under development, with protective management prescriptions. *Id.* Nonetheless, Alternative C fails to protect additional valuable places and resources that are at risk of damage or destruction if leased for geothermal development. O-74-8

In order to protect these values, the PEIS must:

1. Expand categories of lands that are closed to leasing.

We agree with the agencies' assessment of categories of certain lands as closed to geothermal leasing, including Wilderness Areas, Wilderness Study Areas, National Conservation Areas, Wild and Scenic Rivers, National Recreation Areas, and other special management areas. However, there are other important areas that must be excluded from geothermal leasing and development.

a) Forest Service Inventoried Roadless Areas

The Roadless Area Conservation Rule mandates no new road construction or reconstruction in inventoried roadless areas. *See,* 66 Fed. Reg. 3243, 3270 (January 12, 2001). Further, the Draft PEIS acknowledges that the need for road construction and maintenance for exploration, drilling and utilization phases of geothermal energy development. *See, generally*, Draft PEIS, pp. 2-40 - 2-46. Accordingly, since these lands cannot be developed in accordance with the Roadless Rule, they should not be made available for leasing. O-74-9

b) Lands with wilderness characteristics

The Draft PEIS states:

> BLM has the authority to address lands with wilderness characteristics and describe protective management prescriptions in RMPs. In keeping with the public involvement process that is part of all land use planning efforts, the BLM will consider public input regarding lands to be managed to maintain wilderness characteristics.

Draft PEIS, 1-25. We appreciate the BLM's acknowledgment of its authority and commitment to public participation in managing lands to protect wilderness characteristics. Since the PEIS will amend as many as 122 land use plans and many RMPs will not be revised for years after the PEIS is finalized, the inventory and protective management of lands with wilderness characteristics should occur as part of this planning process.

Pursuant to FLPMA, "The Secretary shall prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values (including, but not limited to, outdoor recreation and scenic values), giving priority to areas of critical environmental concern. This inventory shall be kept current so as to reflect changes in conditions and to identify new and emerging resource and other values." 43 U.S.C. §1711(a). Wilderness character is a resource for which BLM must keep a current inventory. As the U.S. Court of Appeals for the Ninth Circuit recently held: "wilderness characteristics are among the 'resource and other values' of the public lands to be inventoried under § 1711. BLM's land use plans, which provide for the management of these resources and values, are, again, to 'rely, to the extent it is available, on the inventory of the public lands, their resources, and other values.' 43 U.S.C. § 1712(c)(4)." *Oregon Natural Desert Ass'n v. Bureau of Land Management,* 531 F.3d 1114, 1119 (9th Cir. 2008). Therefore, BLM is required to consider "whether, and to what extent, wilderness values are now present in the planning area outside of existing WSAs and, if so, how the Plan should treat land with such values." *Id.* at 1143. O-74-10

BLM has identified "wilderness characteristics" to include naturalness and providing opportunities for solitude or primitive recreation. *See* Instruction Memoranda 2003-274, 2003-275, Change 1. These values are to be *identified and protected* in the land use planning process. *See* BLM Land Use Planning Handbook (H-1601-1, 2005); *Oregon Natural Desert Ass'n v. Bureau of Land Management, supra.* Further, BLM's national guidance provides for management that emphasizes "the protection of *some or all* of the wilderness characteristics as a priority" over other multiple uses. (emphasis added). This guidance does not limit its application to lands suitable for designation of Wilderness Study

Areas; for instance, the guidance does not include a requirement for the lands at issue to generally comprise 5,000-acre parcels or a requirement that the lands have *all* of the potential wilderness characteristics in order to merit protection.

During the scoping process, we provided GIS data regarding lands with wilderness characteristics, which not only constitutes significant new information but also facilitates the agency's review and consideration of protection. In *Oregon Natural Desert Association v. Rasmussen*, CV 05-1616-AS, Findings and Recommendations (D. Or. April 20, 2006); Order (D.Or. Dec. 12, 2006), the court found that BLM's failure to re-inventory lands for wilderness values and to consider the potential impact of decisions regarding management of a grazing allotment violated its obligations under NEPA and FLPMA, then enjoined any implementation of the decision until the agency re-inventoried the lands at issue and prepared an environmental document taking into account the impacts of its decisions on wilderness values. In *Oregon Natural Desert Association v. Rasumussen,* the district court found that BLM had violated NEPA by failing to consider significant new information on wilderness values and potential impacts on wilderness values, and had also failed to meet its obligations under FLPMA by failing to engage in a continuing inventory of wilderness values. It concluded:

> The court finds BLM did not meet its obligation under NEPA simply by reviewing and critiquing [a local environmental group's] work product. *It was obligated under NEPA to consider whether there were changes in or additions to the wilderness values* within the East-West Gulch, *and whether the proposed action in that area might negatively impact those wilderness values,* if they exist. The court finds BLM did not meet that obligation by relying on the one-time inventory review conducted in 1992. *Such reliance is not consistent with its statutory obligation to engage in a continuing inventory so as to be current on changing conditions and wilderness values.* 43 U.S.C. § 1711(a).
>
> BLM's issuance of the East-West Gulch Projects [environmental analysis] and the accompanying Finding of No Substantial Impact (FONSI) in the absence of current information on wilderness values was arbitrary and capricious, and, therefore, was in violation of NEPA and the [Administrative Procedure Act].

Id. (emphasis added).

The Geothermal PEIS presents an opportunity for the BLM to consider information that has previously been submitted regarding lands with wilderness characteristics in the lands at issue in the PEIS and to inventory these lands, which contain numerous areas proposed for wilderness designation in citizen's wilderness inventories and/or found to have wilderness characteristics. Prior to identifying lands open to geothermal leasing and development, we recommend that the agencies assess information received regarding wilderness characteristics, including inventorying lands identified, and exclude lands with wilderness characteristics, citizen-proposed wilderness, and wilderness inventory units from the lands available for consideration of siting geothermal energy projects.

c) Important habitat and migration corridors

The WGA has recently produced the Wildlife Corridors Initiative Report (available at http://www.westgov.org/wga/publicat/wildlife08.pdf), which identifies important wildlife corridors and habitats in the western states and makes recommendations for best protecting these crucial areas. The agencies should consult this report for information on the areas identified and/or confer with the WGA Western Wildlife Habitat Council before completing the PEIS, in order to incorporate this data into decisions regarding which lands will be available for leasing. The agencies should also ensure that additional analysis is conducted, in the PEIS and/or prior to leasing and development, to accurately determine the present of important habitat and migration corridors and to take appropriate measures to avoid or otherwise mitigate potential damage, as discussed in further detail in the following section of these comments. O-74-11

d) Places that would be excluded from development under bills pending in Congress

All areas that would be closed to geothermal development under bills currently pending in Congress should be excluded from leasing in the PEIS. This should include lands that are included in pending legislation for designation in one of the categories listed as closed to leasing in the Draft PEIS or would otherwise include provisions that prohibit geothermal energy development O-74-12

e) Recommended Areas for Exclusion in the San Luis Valley

As stated above, because siting of geothermal energy development will have significant and long lasting impacts on public lands, it is critical that the agency gather, analyze, and make available to the public any GIS layers that describe O-74-13 sensitive or protected areas. In addition to the lands with wilderness characteristics, citizen proposed wilderness, and wilderness inventories discussed above, we recommend that the agencies collect and use the following GIS data layers to map areas that are unacceptable for siting geothermal energy projects and in siting projects to avoid impacting the identified areas:

1. Baca, Alamosa and Monte Vista National Wildlife Refuges;
2. Great Sand Dunes National Park;
3. National Inventory Wetlands;
4. Riparian and significant (aquifer) recharge areas;
5. Colorado Division of Wildlife identified wetlands, wildlife habitat, corridors, wintering & calving grounds;
6. Colorado Natural Heritage Program wetlands, sensitive species habitat and Potential Conservation Areas (PCA's);
7. State designated Natural Areas;
8. Sites registered or eligible for registry under the National Historical Preservation Act (available from the Colorado Historical Society);
9. National Conservation Areas;
10. Other lands within BLM's National Landscape Conservation Systems such as Rio Grande Natural Area;
11. National Historic and National Scenic Trails;
12. Areas of Critical Environmental Concern (ACECs);
13. Citizen-proposed wilderness areas such as San Luis Hills/Flat Top Mesa pending legislation for designation in one of the above categories;
    a. Threatened, endangered and sensitive species habitat (available from USFWS[2], the Colorado Division of Wildlife and, for BLM lands, from NatureServe[3]; critical cores and linkages for wildlife habitat (available from USFWS and state wildlife agencies) and the Colorado Natural Heritage Program; and
    b. Riparian areas (available from SWReGAP[4], except for California, which is available from the UCSB Biogeography Lab[5]);
    c. Areas designated or under consideration for designation as "unique and irreplaceable" areas;
    d. Areas identified in the SLV Citizens Energy Initiative as unsuitable for geothermal development.

2. Designate minimum 10-mile buffer zones to protect geothermal resources already prioritized for recreational/scenic values.

a) Research shows that drilling for geothermal energy in proximity to other known geothermal features can disturb and damage these features.

The National Park Service's web page on Yellowstone's geothermal resources states, "In Iceland and New Zealand, geothermal drill holes and wells 2.5 - 6.2 miles distant have reduced geyser activity and hot spring discharge." (http://www.nps.gov/yell/naturescience/geothermalresources.htm) This confirms the necessity of creating buffer zones around geothermal resources with surface features that are part of protected areas, such as national parks, or have been identified for the recreational and scenic values. The SLV has a number of existing geothermal facilities including Valley View Hotsprings, Joyful Journey Hotsprings, Sand Dunes Swimming Pool & RV Park, and Colorado Alligator Farm. Siting additional geothermal installations near these facilities could have major negative economic and environmental impacts. Avoidance of Sand Dunes National Park, the Town of Crestone and adjacent Baca subdivision that houses the nations highest concentration of retreat centers should also be avoided. Tourism would decrease as a result of loss of thermal features, and endemic species that depend on the geothermal resources of the area would likely suffer. O-74-14

The New Zealand Geothermal Association provides evidence of damages caused to thermal features as a result of geothermal development that is not well-planned. Some environmental effects that have been documented include loss of active geysers, unsustainable draw down, and subsidence. According to the association, "Of more than 200 geysers in active in the central North Island in the 1950s, only about 40 remain."

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[2] http://www.fws.gov/southwest/es/newmexico/ES_home.cfm

[3] NatureServe was contracted to identify and map locations of threatened and endangered species habitat that exist only on BLM lands – making these areas even more critical to the survival of the species. This data can be found at www.natureserve.org

[4] http://ftp.nr.usu.edu/swgap/

[5] http://www.biogeog.ucsb.edu/projects/gap/gap_home.html

(http://www.nzgeothermal.org.nz/environmental/surface_effects.asp) These potential impacts are unique to geothermal resources, and therefore must be analyzed thoroughly.

3. Identify and prioritize for leasing places that would be more appropriate for geothermal

In addition to avoiding ecologically and culturally sensitive lands, the PEIS can identify areas that are more likely to be suitable for development and non-controversial; and leasing could be prioritized in these areas. Factors that should be considered are set out below.

a) Impaired or degraded lands

The PEIS should require that lands that are already impaired be considered first for proposed geothermal development. Abandoned mines, developed oil and gas fields, and other brownfields, which are not being restored to ecological function, provide opportunities for geothermal energy development without loss of other uses and values. Such sites are often close to existing infrastructure, which is another important consideration, both in conjunction with degraded sites and as a separate factor. O-74-15

b) Proximity to existing infrastructure

The San Luis Valley has 31 existing electrical transmission substations. Prioritization of areas in proximity to these substations and other existing infrastructure will minimize new road construction or major roadway improvements (such as paving and widening), avoiding another set of impacts on the public lands. Further, proximity to the load that will be served by the project will limit the amount of new transmission needed and reduce related income. O-74-16

c) Areas identified in the SLV Citizens Energy Initiative

We invite and strongly encourage local USFW and BLM agency participation in the development of a SLV Citizens Energy Initiative. Agency/citizen collaboration will allow many issues and potential conflicts to be worked out early on in the planning process, thus resulting in better decision-making and a better outcome for all involved. O-74-17

d) Co-siting with solar energy projects

Federal land agencies are currently in the process of completing a PEIS for solar energy development as well. Both solar and geothermal energy are long-term, industrial uses of public lands. While we support the development of renewable, clean energy sources, we encourage the agencies to mitigate the impacts of all energy development to the extent possible. One mitigation measure that could prove greatly beneficial is the possibility of co-siting geothermal and solar energy projects, thereby reducing environmental impacts. The agencies should explore this possibility in the PEIS, and create terms to encourage this type of development. **Again, we caution that cumulative impacts of combined solar and geothermal proposals be carefully considered.** O-74-18

4. Consider phased leasing or conditional development leases

Because the current BLM geothermal program is very small in scale when compared to the reasonably foreseeable development scenario laid out in the Draft PEIS, the agencies should consider phased leasing until technologies are proven successful both in the utilization phase and in the reclamation phase.

We also reiterate our scoping comment that the PEIS should analyze the use of conditional-development lease stipulations. As it is often difficult at the time of leasing to have the best data on site-specific impacts for future geothermal full-field development within an area, a leasing stipulation that conditions the right of development on the results of future and more-detailed studies provides an opportunity to clarify that development may ultimately be limited. This type of stipulation could also be used to support a research and development program, as discussed below. O-74-19

5. Restrict development initially to traditional geothermal resources and/or established technology; commit to an R&D leasing program to develop additional technologies

a) Only technologies analyzed in this PEIS can be approved by tiering to the PEIS and important to use R&D leasing O-74-20

It is essential that the PEIS clearly states that only geothermal technologies described and analyzed for impacts in the PEIS can be tiered to this document. These are specifically dry steam, flash steam, and binary-cycle power plants.

b) The agencies should support a program for developing new technologies, using R&D leasing

While we support research and development (R&D) of new geothermal technologies, especially those that reduce impacts on public lands by utilizing heat differential technology and thus do not require use of limited water sources, R&D activities require new NEPA analysis. Applications for R&D, including "enhanced geothermal systems," cannot be tiered to this PEIS because their impacts are not analyzed in the document. However, the PEIS could describe and commit the agencies to develop and support a R&D leasing program for new technologies, which could be facilitated through the use of conditional development leases. O-74-21

Recommendation: The management alternative to be selected for the PEIS should include the protective and proactive measures described above.

III. The PEIS Does Not Adequately Assess Environmental Consequences to Key Resources.

NEPA requires that the scope of environmental analysis be commensurate with the proposed action. *Kern v. United States Bureau of Land Management,* 284 F.3d 1062, 1072 (9th Cir. 2002). In light of the multistate range of lands and millions of acres that would be affected by the decisions in the PEIS, a more thorough analysis of potential impacts to other resources and values is necessary, as detailed below.

A. The agencies are required to assess the planning projects of other federal agencies and local governments in order to provide adequate cumulative impact analysis.

NEPA requires the agencies to consider the cumulative impacts of and related to the PEIS. NEPA regulations define "cumulative impact" as:

> "the impact on the environment which results from the *incremental impact of the action when added to other past, present, and reasonably foreseeable future actions* regardless of what agency (Federal or non-Federal) or person undertakes such other actions. *Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*"

40 C.F.R. § 1508.7 (emphasis added).

To satisfy NEPA's hard look requirement, the cumulative impacts assessment must do two things. First, BLM must catalogue the past, present, and reasonably foreseeable projects in the area that might impact the environment. O-74-22 *Muckleshoot Indian Tribe v. U.S. Forest Service,* 177 F.3d 800, 809–10 (9th Cir. 1999). Second, BLM must analyze these impacts in light of the proposed action. *Id.* If BLM determines that certain actions are not relevant to the cumulative impacts analysis, it must "demonstrat[e] the scientific basis for this assertion." *Sierra Club v. Bosworth,* 199 F.Supp.2d 971, 983 (N.D. Ca. 2002). A failure to include a cumulative impact analysis of actions within a larger region will render NEPA analysis insufficient. *See, e.g., Kern v. U.S. Bureau of Land Management,* 284 F.3d 1062, 1078 (9th Cir. 2002) (analysis of root fungus on cedar timber sales was necessary for an entire area).

This definition clearly encompasses the other large-scale energy development being planned for the same lands under analysis in this PEIS, which will inevitably compound the effects of leasing and development of geothermal energy on the natural resources of our public lands, such as wildlife habitat, wilderness character and roadlessness, water, scenic beauty, and cultural resources.

Further, NEPA, as explained by the Council on Environmental Quality, also directs agencies to consider potential conflicts with the objectives of other plans, policies or controls, which requires an assessment of possibilities for resolving conflicts and a thorough consideration of how not resolving the conflict could "impair the effectiveness of land use control mechanisms for the area." 40 C.F.R. § 1502.16(c); *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations,* 23a. Similarly, FLPMA requires that the BLM's guidance and management policies shall "be consistent with officially approved and adopted resource related policies and programs of other Federal agencies, State and local governments and Indian tribes." 43 U.S.C. § 1712(c)(9); 43 C.F.R.§1610.3-2.

There are currently several major planning processes underway in the Western United States that we want to highlight for the BLM to address in the Geothermal PEIS because of the potential overlap in goals. California's Renewable Energy Transmission Initiative (RETI), the Western Governors Association's (WGA) Western Renewable Energy

Zones (WREZ), and the West-wide Energy Corridors PEIS are all transmission initiatives in the project area. The states of Colorado, New Mexico, and Nevada also have initiatives to identify locations and provide incentives for renewable energy development and transmission.

The West-wide Energy Corridor PEIS is of particular relevance to the Geothermal PEIS. These two processes should be viewed as an opportunity for synergy and as an opportunity to bring more renewable energy into the American electricity grid while minimizing environmental degradation. If both energy corridors and geothermal energy development projects are properly sited and renewable technologies such as solar, wind, and geothermal energy are given preference in new transmission rights-of-way within the corridors, these efforts together can help America reduce its reliance on the fossil fuels responsible for global climate change. Currently, the West-wide Energy Corridor PEIS is the subject of significant controversy, due to the failure to assess the need for corridors to support renewable energy, as well as the failure to avoid ecologically important areas. Although the Draft PEIS makes note of this initiative, it fails to provide analysis of the cumulative impacts that will result from both of these programs being established in the same project area.

In addition, BLM is preparing a solar energy program and oil shale/tar sands program and has recently completed a wind energy program. All of these planning processes impact lands in the western states and will utilize transmission corridors, and in combination have the potential to disturb a majority of public and Forest Service lands in the West.

Chapter 5 of the Draft PEIS states that geothermal development would have a minor cumulative impact on resources such as vegetation and soil due to its comparatively small footprint: "The contribution to cumulative impacts of geothermal projects on public and FS lands would be small or negligible unless a significant permanent, uncompensated loss of the current productive use of a site occurred, or if future uses were precluded" Draft PEIS at 5-18. However, in context of a small area cleared for geothermal, and other areas all over the West cleared for solar, wind, oil shale, and transmission for all of these energy sources, the cumulative impacts can actually be expected to be quite large, with geothermal development making a significant contribution. In addition, because transmission will be necessary for indirect use geothermal projects, it is imperative that the agencies analyze transmission initiatives in the project area and provide cumulative impact analysis. Disregard of these processes may lead to duplicative corridors and unnecessary lands, wildlife and natural resource impacts.

Before preparing the Final PEIS, the agencies must go back and analyze not just the small impacts from geothermal plants, but the *cumulative* impacts of geothermal plants and transmission in context with solar plants, wind turbines, oil shale and tar sands mines, and the many other planning processes in the project area.

Recommendation: Because leasing of land for geothermal development is a commitment of the resource for future exploration and development, the agencies must conduct cumulative impact analysis of reasonably foreseeable future actions in context of other energy development and transmission projects in the western states.

B. Socioeconomic analysis.

There are several areas where the Draft PEIS for Geothermal Leasing in the Western US (Draft PEIS) falls short in the analysis of the potential socioeconomic impacts associated with leasing public lands for the development of geothermal energy. These are described briefly below and discussed in greater detail in the sections which follow.

1) The socioeconomic analysis in the Draft PEIS is rather superficial and is based heavily on documents which were produced by the geothermal energy industry itself.

2) The analysis of the socioeconomic impacts is one sided, focusing only on the potential benefits of geothermal energy development without assessing the potential costs of such development on public lands.

   a. The Draft PEIS fails to address the potential impacts to rural economies from potential impacts to public lands. Many economies benefit from undeveloped public lands and this potential impact should be analyzed in the Final EIS.

   b. The Draft PEIS does not account for the non-market values, including the impacts on local quality of life, which are associated with the undeveloped public lands that may be impacted by geothermal energy development.

These specific concerns are discussed in detail in the sections below.

1. **The socioeconomic analysis in the Draft PEIS is rather superficial and is based heavily on documents that were produced by the geothermal energy industry itself.**

The Draft PEIS presents only the most general estimates of the potential jobs and royalties (and these are based only on industry references), without any in-depth analysis or even a qualitative discussion of the overall potential socioeconomic impacts associated with large scale developments on public lands in rural areas.

The socioeconomic analysis in the Draft PEIS refers frequently to several documents that were produced by or for geothermal industry advocacy groups. One of these documents is a two-page promotional document touting only the potential beneficial economic impacts of the industry. They are clearly self-serving for this specific industry, and while potentially a valuable source of information, they should not be the only source of information about the socioeconomic impacts of large-scale geothermal energy development on public lands. O-74-23

In preparing the Final EIS we request that the BLM and FS do a review of the economic literature on modern rural economies and include analysis of a broader range of impacts. In particular, the emerging economy of the San Luis Valley relies increasingly upon visitors to the Crestone area that attracts tens of thousands of visitors every year to its many retreat centers. This somewhat unique "retreat economy" depends upon quietude, scenic views, a pristine environment and maintenance of a rural ambiance. Other important aspects of the SLV's emerging economy are recreation, and cultural and ecological tourism. The PEIS and management planning analysis must also include input and research on these important emerging "non-traditional" economies rather then relying solely on conventional industry analyses.

2. **The analysis of the socioeconomic impacts is one sided, focusing only on the potential benefits of geothermal energy development without assessing the potential costs of such development on public lands.**

While it is certainly possible that the benefits to local communities from geothermal energy development may be substantial, it is also quite likely that such development will have certain costs as well. The Draft PEIS does not analyze the potential costs associated with leasing millions of acres of BLM and FS lands for geothermal energy. The Draft PEIS merely assumes that mitigation, stipulations and BMPs will result in minimal impacts. O-74-24

Western communities often face the need to balance extractive development and other industrial uses of the region's abundant public lands with the economic and aesthetic benefits that are derived from these lands in their undeveloped state. The economy of the western United States has long been viewed as one dependent upon the extraction of natural resources. However, recent research has shown that this assumption is no longer valid. Commercial geothermal development would be yet another such industrial use, with many of the attendant pitfalls and issues. Yet the Geothermal DPIES does not assess the impacts associated with continued reliance on extraction industries in the context of the changing economy of the region.

a) **The Draft PEIS fails to address the potential impacts to rural economies which benefit from undeveloped public lands – lands which will be impacted by the development of geothermal energy projects and related transmission corridors.**

The omission of the potential costs to the western economies affected is reflected in the list (on page 4-139 of the Draft PEIS) detailing the conditions under which potential impacts on socioeconomics and environmental justice could occur. This list focuses very narrowly on commodity impacts, jobs and income in the geothermal industry, and revenues from royalties and taxes that might accrue. The list mentions the potential for increases in population and the potential for these increases to strain local resources; however, the analysis does not treat this potential impact with any depth. Missing from the list are the potential impacts on businesses and individuals who may rely on the presence of protected public lands to attract employees, to attract customers or for their own quality of life. O-74-25

In the last 30 years, the West has evolved beyond being a region whose economy was largely focused on extractive industries, into a more diverse economy (Beunett and McBeth, 1998; Johnson, 2001). As the economies of rural communities in the West evolve, the impact of public land management on these economies also evolves, and the management of our public lands must as well. Sociological and economic research conducted over the last two-plus decades indicates that the environmental amenities provided by public lands are an important economic driver in the rural West. For several examples see: Rudzitis and Johansen, 1989; Johnson and Rasker, 1993, 1995; Rasker 1994; Power, 1995, 1996; Duffy-Deno, 1998; Rudzitis, 1999; Rasker,et al. 2004; Holmes and Hecox, 2004; Whitelaw, et al. 2003.

These indicators include the growing importance of non-labor income from investments and retirement, increasing employment in high technology, knowledge-based, and service industries, the important role that recreation and tourism plays in providing jobs and income, and the rise of small businesses and other entrepreneurial endeavors. The Draft PEIS fails to analyze or account for negative impacts on these segments of the economy. Large-scale geothermal energy development is likely to have negative impacts such as habitat fragmentations, loss of quality of life, loss of quality recreation, and reduced quality of hunting and fishing. These impacts can, in turn, have detrimental consequences for non-traditional sectors of the economy that have come into prominence in the West. These non-traditional sectors have been shown to rely upon protected, undeveloped public lands. Such lands enhance the attractiveness of rural western communities for businesses, workers and retirees who are not tied to specific locations for income or employment. These sectors have for decades been the largest portion of almost every county in the U.S. This is particularly true for the San Luis Valley, Colorado.

The recreation opportunities alone provided by wilderness quality and other undeveloped public lands yield direct economic benefits to local communities. The Draft PEIS socio-economic analysis does not include an analysis of the income and jobs associated with recreation, hunting and fishing from each alternative. In our scooping comments, we included a document entitled "Socio-Economic Framework for Public Land Management Planning: Indicators for the West's Economy," which details our expectations for the baseline analysis of the region's economy as well as the analysis of the potential impacts of this program. We request that you re-review the document and that your analysis for the Final EIS follow the approach set out in this document.

b) The Draft PEIS does not account for the non-market values, including the impacts on local quality of life, which are associated with the undeveloped public lands that may be impacted by geothermal energy development.

Public lands provide numerous values, some of which are realized when natural resources are extracted, and others which require that the natural ecosystems remain intact. The benefits of these various values often flow to different groups or individuals. Some of the benefits from public lands are more likely to flow to individuals or companies (market benefits), and others are available for the entire population (non-market benefits).

Any time that unique or irreplaceable resources or values are at risk, there is a strong component of non-market value which must be assessed. One of the primary purposes of the public lands system is the provision of public goods such as the protection of unique landscapes, ecological diversity, wildlife habitat, wilderness, and cultural and archeological resources. Large-scale geothermal energy development may put these resources at risk. O-74-26

To facilitate informed decisions about publicly owned wildlands, economic analysis must take into consideration both market and nonmarket benefits and costs (Loomis 1993). It is important that the FS and BLM examine both market and non-market benefits and costs of large-scale geothermal energy development. Non-market benefits must be measured and compared with the market benefits that accrue to companies and individuals when undeveloped public lands are developed.

In analyzing the socioeconomic impacts of geothermal energy leasing and development, the agencies must complete a full accounting of the costs and benefits associated with this development including non-market costs and benefits. The agencies' accounting should recognize the multiple use aspects and the full extent and value of existing wilderness character and wildlands as a resource within and near new geothermal energy development, which include formally designated Wilderness and Wilderness Study Areas, as well as other areas with wilderness and special characteristics identified by citizens and proposed for protective management. The multiple benefits that derive from protecting wilderness quality and other undeveloped lands include positive economic impacts to local communities. In developing the Final EIS, the agencies should analyze the benefits of protecting all existing wilderness character and wildlands against impairment from large-scale geothermal energy development, and should also consider how managing these lands will affect wildlands and wildlife in other locations and in turn the economies in local communities.

Recommendations: In preparing the Final EIS for geothermal leasing, the BLM and FS must:

- consider the increasing importance of industries and economic sectors that rely on public lands for environmental amenities;
- examine the potential impacts that large-scale geothermal development on public lands may have on key indicators which characterize the modern western economy; and
- estimate the potential non-market benefits and costs associated with large-scale geothermal energy.

C. Visual resources

NEPA requires the agencies to "assure for all Americans . . . aesthetically . . . pleasing surroundings." 42 U.S.C. § 4331(b)(2). FLPMA specifically directs the BLM to prepare and maintain inventories of the visual values of all public lands, 43 U.S.C. § 1711(a), and manage public lands "in a manner that will protect the quality of . . . scenic . . . values," §1701(a)(8). BLM has interpreted these mandates as a "stewardship responsibility" to "protect visual values on public lands" by managing all BLM-administered lands "in a manner which will protect the quality of the scenic (visual) values." BLM Manual 8400 – Visual Resource Management .02, .06(A). BLM utilizes visual resource inventories during its land use planning process to establish management objectives, organized into four classes. These objectives are as binding as any other resource objectives contained in the RMP. *See Southern Utah Wilderness Alliance*, 144 IBLA 70, 84 (1998). O-74-27

These statutory and regulatory responsibilities are especially important because of the scenic values associated with use and enjoyment of the public lands and national forests, and also with the use and enjoyment of geothermal areas, specifically. The agencies should ensure that natural settings are protected – these settings are often vital to local and regional economies and for cultural resources. Viewsheds and scenic values should be considered as a factor for establishing buffers of protection from surface disturbance that are particularly important to local retreat-based economies of Crestone and other communities located at the Mountain/Valley intersect in the San Luis Valley.

D. Wildlife habitat and fragmentation analysis

1) Endemic species

Warm and hot water ecosystems are unique in the San Luis Valley. There are numerous species that rely on the geothermal characteristics of their habitat for survival. The PEIS should clearly identify these species, their range, potential impacts, and appropriate protections and mitigation measures and research needed to protect these unique organisms and ecosystems. O-74-28

2) Habitat fragmentation analysis

Significant portions of the land that will be considered for geothermal energy development in the PEIS contain core habitat areas and migration linkages between those core areas, all of which need to be preserved in order for the regional ecosystems to continue to function. The San Luis Valley is home to numerous elk, pronghorn, mule deer and bighorn sheep and other wildlife populations that must migrate to survive, reproduce and maintain genetically diverse (and thus healthy) populations.

Fragmentation of wildlife habitat and migration corridors affects the genetics, ecological composition, structure, and functions of populations and landscapes. Habitat fragmentation has been defined as the "creation of a complex mosaic of spatial and successional habitats from formerly contiguous habitat" (Lehmkuhl and Ruggiero 1991). **Although fragmentation can be difficult to measure, there are a variety of metrics that can be used to assess the degree of existing habitat fragmentation and the condition of the landscape, then applied to available data regarding distribution of wildlife and habitat, and ultimately used to make decisions regarding appropriate locations for geothermal energy projects. We recommend that the agencies complete such an analysis as part of the PEIS.**

Existing road density can be calculated by measuring the length of linear features in a given sub-area at regular intervals and then reported as miles of route per square mile (mi/mi^2). The degree of habitat fragmentation, the distribution of unroaded areas, or core areas, can also be measured and calculated based on the amount of land beyond a given distance or effect zone, from transportation routes (Forman, 1999). Wildlife species respond to disturbances related to this type of network at varying distances, so determining the size distribution of core areas for a range of effect zones (i.e., of 100ft, 250ft, 500ft and 1320ft) from all routes is also important. Wildlife literature will yield information on the effect zones for different species. For instance, an ongoing study by Sawyer et al. (2005, 2004, 2001) of GPS collared deer on the Pinedale Anticline observed that deer utilized habitat progressively further from roads and well pads over three years of increasing gas development and showed no evidence of acclimating to energy-related infrastructure. Birds are also impacted by roads and management practices associated with energy development, due to fragmentation, changes in vegetation and noise (Mabey and Paul, 2007; Robel, et al., 2004). O-74-29

In addition to geothermal projects themselves, habitat fragmentation can be caused by transmission corridors, which will be necessary to transmit geothermal energy to electricity grids. Wildlife habitat fragmentation caused by transmission lines, pipelines, and roads generally fall into three broad categories:

1. Construction impacts (access, right-of-way clearing, construction of towers, stringing of cables);
2. Line maintenance impacts (inspection and repair); and
3. Impacts related to the physical presence and operation of the transmission line.

As such, wildlife habitat must be examined on an individual project and site-specific basis. The only way to accomplish this requirement is to ensure that each individual geothermal project is spatially evaluated for direct, indirect and cumulative impacts.

Specific activities that negatively impact wildlife and cause destruction of core habitat or habitat fragmentation include the construction of facilities, disturbance of soil by the use of heavy machinery, site clearing and grading, noisy machinery during construction and maintenance, removal of vegetation, use of herbicides, well drilling, and accidental release of hazardous materials.

The effects of these activities on wildlife can be severe and include removal of habitat, fragmentation of habitat, and the creation of edge effect vegetation and habitat (changes in composition, structure, microclimate, etc. of area adjacent to facility and transmission corridor). Species shown to avoid edges include red-backed vole, snowshoe hair, pine marten and red squirrels. In addition, it is logical to suspect that construction of facilities and transmission in previously undisturbed areas will lead to a direct loss of life to wildlife during construction, operation and service of transmission lines.

We recommend that the BLM consult our organizations and utilize other resources including the Wilderness Society's most recent Science and Policy Brief, "Habitat Fragmentation from Roads: Travel Planning Methods to Safeguard BLM Lands". This report provides a summary of available scholarly and government reports and studies on the impact of habitat fragmentation on wildlife, provides methods for calculating habitat fragmentation, and provides recommendations on how to integrate fragmentation analysis into management. BLM should use the information provided in the SLV Citizens Energy Initiative, in this brief as well as related information from State Wildlife Action Plans, Audubon Important Bird Areas, and the Wildlands Network to identify core areas, measure habitat fragmentation, conduct a thorough fragmentation analysis, and inform decisions regarding designation of lands as available for geothermal energy in the PEIS, as well as incorporating these requirements into the PEIS to guide analysis of specific projects.

E. Wilderness and/or roadless and wetlands characteristics

As mentioned above, because the PEIS will be used to amend land use plans and tiered to in analyzing specific projects, the agencies must inventory the project area for lands with wilderness and/or roadless and wetlands characteristics and exclude these areas from leasing and development, in order to prevent destruction of these values. O-74-30

F. Cultural resources

The San Luis Valley is a treasure trove of cultural resources. Human history can be traced as far back as 11,500 years, to the early Clovis Hunters and the first *Homo sapiens* to enter the New World. Smithsonian Institute archeologists have long studied the Valley and recognized its invaluable contribution to our understanding of human history in North America. Native and prehistoric cultures also prize geothermal resources, such that there is a significant overlap between geothermal resources and sacred sites. The National Historic Preservation Act affords heightened protection to these resources, establishing a cooperative federal-state program for the protection of historic and cultural resources. In particular, the review process set out in Section 106 (16 U.S.C. § 470f) obligates the agencies to consider the effects of management actions on historic and cultural resources listed or eligible for inclusion under NHPA. Further, Section 110 of the NHPA requires the BLM to assume responsibility for the preservation of historic properties it owns or controls (16 U.S.C. § 470h-2(a)(1)), and to manage and maintain those resources in a way that gives "special consideration" to preserving their historic, archaeological, and cultural values. Section 110 also requires the BLM to ensure that all historic properties within the National Monument are identified, evaluated, and nominated to the National Register of Historic Places. *Id.* § 470h-2(a)(2)(A). O-74-31

The agencies must place special importance on consultation with archeological experts (including Smithsonian) and institutions such as the Colorado Historical Society (Office of Archaeology and Historic Preservation) and Native American Tribes and the PEIS should comment to a specific plan for ensuring identification, evaluation, nomination and protection of cultural resources prior to issuing leases.

G. GIS Data

As stated in our scoping comments, geographic information systems (GIS) data is critical for ensuring that existing resources can be mapped and considered in this PEIS and subsequent decisions. The agencies should not only obtain and analyze this data, they should also make it available to the public for use in understanding and commenting on impacts, as was done with the West-wide Energy Corridors Draft PEIS. O-74-32

1) Lands with wetlands and recharge characteristics: GIS layers needed to complete the PEIS.

Prior to identifying areas appropriate for geothermal energy development as part of the PEIS, it is imperative that the agencies gather the necessary information to ensure that wetlands are not disturbed. By collecting and using appropriate GIS data layers before considering appropriate places for geothermal leasing and development, the agencies can ensure that they avoid disturbing important areas and resources in the San Luis Valley. **We recommend that the agencies consider the SLV Citizens Energy Initiative recommendations and collect and use a wide variety of data layers to map areas that are unacceptable for siting geothermal projects and in siting projects to avoid impacting highly sensitive and resource rich areas.** O-74-33

We are not sure of the state of wetlands designations within the SLV beyond the National Wetlands Inventory. BLM should incorporate all available data on wetlands and recharge areas in the SLV to identify exclusion areas for geothermal leasing. Further, in identifying additional lands with wetlands and recharge characteristics, BLM should use GIS mapping to identify exclusion areas, and the agency should make these data layers available to the public as part of their PEIS.

2) Other GIS layers needed to complete the PEIS

As stated above, because the siting of geothermal projects will have significant and long lasting impacts on public lands, it is critical that the agency gather, analyze, and make available to the public any GIS layers that describe sensitive or protected areas. In addition to the lands with wilderness, wetland and recharge characteristics, citizen proposed wilderness, and wilderness inventories discussed above, we recommend that the agencies **collect and use the following GIS data layers to map areas that are unacceptable for siting geothermal projects and in siting projects to avoid impacting the identified areas:**

1. Designated Wilderness Areas;
2. Wilderness Study Areas;
3. National Inventory Wetlands;
4. Significant Recharge Areas; O-74-34
5. National Parks and Monuments;
6. National Wildlife Refuges;
7. National Conservation Areas;
8. Potential cultural resources sites;
9. Other lands within BLM's NLCS;
10. National Historic and National Scenic Trails;
11. National Wild, Scenic, and Recreational Rivers, study rivers and segments, and eligible rivers and segments;
12. ACECs;
13. Threatened, endangered and sensitive species habitat (available from USFWS[6], state wildlife agencies and, for BLM lands, from NatureServe[7]; critical cores and linkages for wildlife habitat (available from USFWS and state wildlife agencies, including in State Wildlife Action Plans, as well as the Wildlands Project and its affiliated regional organizations[8]) important bird areas (available from BLM and the National Audubon Society[9]); and

[6] http://www.fws.gov/southwest/es/newmexico/ES_home.cfm

[7] NatureServe was contracted to identify and map locations of threatened and endangered species habitat that exist only on BLM lands – making these areas even more critical to the survival of the species. This data can be found at www.natureserve.org

[8] http://www.twp.org/cms/page1158.cfm

[9] http://www.audubon.org/bird/IBA/

14. Riparian areas (available from SWReGAP[10], except for California, which is available from the UCSB Biogeography Lab[11]).

Recommendations: The agencies should complete the additional collection of data and analysis of impacts outlines above, then revise the PEIS to incorporate the results into the selected alternative.

IV. Additional Analysis Is Required Prior to Leasing and Development.

The agencies have stated that this PEIS will be used to "develop a comprehensive list of stipulations, best management practices, and procedures to serve as consistent guidance for future geothermal leasing and development on public and NFS lands" and to "amend the BLM Resource Management Plans (RMPs) to adopt the resource allocations and procedures." 73 Fed.Reg. 33803. These uses require that the PEIS include sufficient environmental analysis to justify decisions and also commit the agencies to further analysis prior to approval of leasing. O-74-35

A. Tiering to the PEIS must be limited and unequivocal commitments to site-specific NEPA analysis included in the PEIS and land use plan amendments.

The PEIS will identify lands that are available for leasing. In order to support amendment of BLM land use plans and for the Forest Service and the BLM to tier to the PEIS in connection with subsequent decision-making processes, the analysis conducted under NEPA must be sufficiently robust to support the determination that specific lands are suitable for development. NEPA requires the agencies to take a "hard look" at the potential environmental consequences of this proposed action, so that they must assess impacts and effects that include: "ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative." 40 C.F.R. § 1508.8. In the context of a programmatic EIS, "the overview or area-wide EIS would serve as a valuable and necessary analysis of the affected environment and the potential cumulative impacts of the reasonably foreseeable actions under that program or within that geographical area." Council on Environmental Quality, *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, Question 24b, available at http://ceq.hss.doe.gov/nepa/regs/40/40p3.htm. For future projects, the agencies can tier to the environmental analysis in the PEIS, but this incorporation "would be followed by site-specific or project-specific EISs," which "would make each EIS of greater use and meaning to the public as the plan or program develops." *Id.*, Question 24c.

In addition, NEPA requires the consideration of a reasonable range of alternatives as part of evaluation of a proposed action. NEPA requires the agencies to "rigorously explore and objectively evaluate" a range of alternatives to proposed federal actions. *See* 40 C.F.R. §§ 1502.14(a), 1508.25(c). "An agency must look at every reasonable alternative, with the range dictated by the nature and scope of the proposed action." *Nw. Envtl. Defense Center v. Bonneville Power Admin.*, 117 F.3d 1520, 1538 (9th Cir. 1997). An agency violates NEPA by failing to "rigorously explore and objectively evaluate all reasonable alternatives" to the proposed action. *City of Tenakee Springs v. Clough*, 915 F.2d 1308, 1310 (9th Cir. 1990) (quoting 40 C.F.R. § 1502.14). This evaluation extends to considering more environmentally protective alternatives and mitigation measures. *See, e.g., Kootenai Tribe of Idaho v. Veneman*, 313 F.3d 1094,1122–23 (9th Cir. 2002) (and cases cited therein). In the context of analyzing specific leases, the range of alternatives should also include an alternative not to lease at all.

The PEIS acknowledges the need for additional environmental analysis, although it defers the level of review for individual permits to be determined at the BLM field office or FS unit and provides for that analysis to be either an EIS or a "tiered environmental assessment (EA)," depending on the extent to which "this PEIS anticipates issues and concerns associated with individual projects, including potential cumulative impacts." Draft PEIS, p. 2-22. This statement properly acknowledges the need for site-specific analysis, but is too general.

Recommendation: Based on the general level of analysis included in the Draft PEIS, the PEIS and the subsequent amendments to BLM land use plans should specifically and unequivocally require site-specific environmental review prior to approval of projects, including opportunities for public comment and addressing direct, indirect and cumulative impacts. Both of these documents should state that an EIS will be presumed to be required unless the Forest Service or BLM determines that all site-specific concerns have been addressed in this PEIS and the cumulative impact analysis has not substantively changed. There should also be a specific commitment to considering a range of alternatives, including an alternative not to issue a lease for geothermal development.

B. Additional limitations on tiering.

[10] http://ftp.nr.usu.edu/swgap/
[11] http://www.biogeog.ucsb.edu/projects/gap/gap_home.html

The Draft PEIS acknowledges that the RFD, which forms the basis for the cumulative impact analysis, is limited, stating:

> The RFD was based on a review of recent government and industry reports providing assessments of geothermal potential across the western US (Western Governors' Association 2006; DOE and BLM 2003; NREL 2006; BLM 2007a; Geothermal Energy Association 2007a) and the typical impacts associated with geothermal development (GeothermEx 2007). Few quantitative evaluations have been conducted at this scale, and those that exist are considered largely speculative due to the wide array of variables around future geothermal development. These variables include the speculative estimation of unexplored geothermal resources, the development of geothermal technologies that may allow for extraction of resources currently unusable, the unknown nature of future energy markets, and the unknown future of regulatory and political climates. O-74-36

Draft PEIS, p. 2-33. Accordingly, where technologies not specifically addressed in the PEIS are proposed, their environmental consequences have not been thoroughly discussed, requiring a new assessment. Similarly, where leases are proposed in areas that were not identified in the PEIS, new analysis is required. Further, if new technologies, geographic areas or economic, regulatory or other conditions change, the cumulative impact analysis in the PEIS will no longer by accurate.

Recommendations: The PEIS should clearly state the limitations of the issues analyzed, the limitations on tiering to the PEIS for environmental analysis, and the need to update the cumulative impacts analysis if relevant factors change.

C. Best management practices must be mandated for incorporation in all permits and should not be subject to waiver, exception or modification.

The Draft PEIS sets out important protective terms and conditions that should be incorporated into permits. *See*, Draft PEIS, pp. 2-16 – 2-17. However, different portions of the Draft PEIS refer to these terms and conditions as those that "will" or "may" apply, giving the impression that some of these terms are required to be incorporated into permits and others may not be, even when they are applicable to a proposed location. Further, since the BLM routinely permits waiver, exception and modification of stipulations and conditions in the context of oil and gas development, there is not guarantee that these measures will be applied. O-74-37

Best management practices are an important vehicle for mitigating impacts of geothermal development. However, without a definitive commitment to their use, these practices cannot be relied upon to reduce environmental consequences. *See, e.g.*, Council on Environmental Quality, *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, Question 19, *Davis v. Mineta*, 302 F.3d 1104, 1125 (10th Cir. 2002).

Recommendation: The PEIS must clearly state that all best management practices, stipulations and conditions are required to be incorporated into permits where the resources that they are designed to protect are present. Further, these provisions should not be subject to waiver, exception or modification unless very narrow, specific qualifications are met and should not be available at all in the context of no surface occupancy stipulations.

D. Compliance with Section 106 of the NHPA and Section 7 of the ESA.

The San Luis Valley is a treasure trove of cultural and historical resources. Smithsonian Institute researchers have worked in the SLV for over 20 years. They and the Colorado Office of Archaeology and Historic Preservation should be Cooperating Agencies on any geothermal proposal in the SLV. The Draft PEIS states that consultation under Section 106 of the National Historic Preservation Act and Section 7 of the Endangered Species Act will occur prior to leasing and additional consultation will occur as needed for specific projects. Draft PEIS, p. 2-21. O-74-38

Recommendation: The PEIS should maintain a specific commitment to engaging in consultation prior to leasing and as needed throughout evaluation of a project.

V. <u>The Pending Applications Should Be Assessed in Accordance with the Recommendations Set Out for New Leasing.</u>

A. Pending lease applications should be subject to the screens listed in Section II prior to approval

O-74-39

The 19 pending lease applications should be subject to the screens listed in Section II. Any pending lease applications which conflict with the screens in Section II should either be required to alter their boundaries to avoid citizen-proposed wilderness, inventoried roadless areas, lands with wilderness characteristics and other lands with special values, or the leases should be denied.

Recommendation: If pending applications conflict with the screens in Section II, the agencies should either alter the lease boundaries to avoid the conflict or deny the application.

B. Because the pending lease applications anticipate the use of binary cycle systems, the agencies should consider phased or limited approval and use of conditional development leases until the technology is proven to be successful

O-74-40

As stated in the sections above, because the binary cycle technology proposed for development in the pending lease applications has not been thoroughly tested, the proposed development requires a careful, measured approach to minimize potential impacts.

Recommendation: The agencies should consider phased/limited approval and use of conditional development leases until technology is proven to be successful.

VI. Cumulative Effects Under the National Environmental Policy Act.

For the energy corridors, the geographic area of impact should include a comprehensive inventory of resources (including but not limited to significant recharge areas, wetlands, riparian areas, wildlife habitat, wintering and birthing grounds), within areas of proposed development and their habitat extending outside such areas. The agencies can and should take the overall impacts of the corridors on the affected landscapes into account when considering their potential environmental consequences. *See*, e.g., Newmont Mining Corp., 151 IBLA 190 (1999) (Where the Bureau of Land Management could take into account the overall degradation from existing and connected proposed operations, a cumulative analysis of all impacts was required); Kern v. United States Bureau of Land Management, supra. (BLM must perform cumulative impact analysis of reasonably foreseeable future timber sales on spread of root fungus before approving single proposed sale). A landscape level analysis is an important part of a programmatic EIS, even if site-specific analysis might be deferred until authorization of specific projects. For instance, the U.S. Court of Appeals for the Ninth Circuit has held that analyzing the overall environmental risks involved in transporting oil from off-shore leases was appropriate and necessary in a PEIS, although specific analysis of individual pipeline locations could be deferred. County of Suffolk v. Secretary of Interior, 562 F.2d 1368, 1376-1377 (2nd Cir. 1977) (It was "essential to consider and weigh the environmental aspects of transportation, as well as of exploration and production."). In order to fulfill the mandate of NEPA that the agencies make an informed assessment of the environmental consequences of its actions, the landscape level effects of an expanded large-scale corridor system must be assessed.

O-74-41

3. Cumulative impact analysis should include other pending programmatic efforts (including solar) and additional development to be supported by new corridors.

As noted above, NEPA requires the agencies to consider the cumulative impacts of proposed projects and corridors. The CEQ's NEPA regulations define "cumulative impact" as:

> "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

40 C.F.R. § 1508.7.

The analysis of impacts in the PEIS must address the cumulative impacts of both the development of utility-scale geothermal energy projects, solar energy projects and other foreseeable connected activities within the same general area. The San Luis Valley is a contained, interdependent bioregion. Activities occurring in an isolated location can affect the entire valley. This is true especially for water and air – related impacts. The SLV is suitable for both geothermal and solar energy development, therefore it is **imperative that cumulative impacts be assessed for the Reasonable Foreseeable Future long-term effects of both solar and geothermal alternative energy development as a whole on the San Luis Valley.** The resources that allow an ecosystem to function often share a common geography, such that changes in the water quantity and/or quality in an aquifer or river system or impacts to an air shed (which may be affected by activities such as oil and gas drilling), all contribute in common. Similarly, changes to these resources may affect the core habitat and linkages that are critical for survival of wildlife and vegetation in a region. Accordingly, where there are shared environmental resources that can act as indicators of the health of ecosystems, the agencies must analyze all of the direct and indirect impacts that affect them.

The Environmental Protection Agency provides the following guidance to its reviewers on assessing the range of other activities to be considered in cumulative impacts analysis:

1. the proximity of the projects to each other either geographically or temporally;
2. the probability of actions affecting the same environmental system, especially systems that are susceptible to development pressures (such as in an aquifer system);
3. the likelihood that the project will lead to a wide range of effects or lead to a number of associated projects;
4. whether the effects of other projects are similar to those of the project under review;
5. the likelihood that the project will occur -- final approval is the best indicator but long range planning of government agencies and private organizations and trends information should also be used; and
6. temporal aspects, such as the project being imminent. U.S. Environmental Protection Agency, 1999, *Consideration Of Cumulative Impacts In EPA Review of NEPA Documents.*

In this case, the BLM's obligation to analyze impacts must encompass not only the proposed and projected geothermal energy projects, but also the cumulative impacts of the projects, taken together with the impacts of existing, proposed, or reasonably foreseeable projects, (including proposals currently being considered) on the environment. Thus, the BLM must analyze the cumulative impacts not just of the geothermal development projects, but also of other projects that will impact resources in common with this proposed action. As discussed above, there are other initiatives to support development and transmission of renewable energy projects and it is critical that the BLM coordinate with these processes and consider the cumulative impacts, which presumably can be reduced by proactive coordination, as well.

In determining the appropriate scope of environmental analysis for an action, the Government must consider not only the single proposed action, but also three types of related actions:

(1) Connected actions - Actions which are closely related and:
(i) Automatically trigger other actions that may require environmental impact statements;
(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously; or
(iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

(2) Cumulative actions – Actions, which when viewed with other proposed actions, have cumulatively significant impacts.

(3) Similar actions – Actions, which when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. 40 C.F.R. § 1508.25. Under any of these classifications, the coordinated actions that the agencies are taking though this PEIS trigger a broader assessment of the cumulative impacts.

The increased level of geothermal energy development projects that will follow the completion of this PEIS are also connected to new transmission projects that are likely to trigger preparation of an EIS. Impacts from transmission projects include direct affects to lands, wildlife and natural resources from the construction, ongoing maintenance and monitoring of transmission infrastructures and rights-of-way (ROW). These impacts include direct impacts to soils and vegetation due to clearing ROW, as well as direct wildlife impacts in terms of avian collisions and electrocutions. Indirect impacts include wildlife displacement, increased raptor prey opportunities on vertical structures and habitat fragmentation impacts on a variety of wildlife species. Additional transmission/ROW impacts to consider include noise, EMF, visual and aesthetic concerns.

In addition, the clustering of geothermal and solar energy development projects with projects to develop more traditional forms of energy in order to access the new transmission corridors proposed in the West-wide Energy Corridor PEIS are likely to have a cumulatively significant effect on the resources in the area. And, since the energy corridors and new transmission will be tied, at least to some extent, on the location of developable energy sources, including geothermal, these projects are certainly similar in terms of geography. Both the various programs and the increased development projects will have a connected and cumulative effect on resources ranging from elk and pronghorn herds to bird of prey populations, sage grouse populations, air quality, water quality (and erosion and sedimentation), and overall potential for primitive recreation. Therefore, their combined impact should be taken into account as part of the analysis of cumulative impacts associated with this PEIS.

With the western U.S. already possessing over 100,000 linear miles of power lines, the Geothermal PEIS should analyze opportunities to maximize current grid assets to transport newly developed geothermal energy instead of new power lines in new ROW. In addition, the PEIS should analyze opportunities at the major population centers to reduce generation import (and therefore transmission) needs by maximizing efficiency, distributed generation resources and other demand-reducing efforts.

Partial List of Documents Used to Formulate these Comments:

Habitat Fragmentation from Roads: Travel Planning Methods to Safeguard BLM Lands, The Wilderness Society.

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O-74-1

DOE and others are actively funding research to better understand the viability of recovering the heat from hot fluids from oil and gas wells (e.g., Rocky Mountain Oilfield Testing Center near Casper, Wyoming and research symposia and research at Southern Methodist University). It has been a very slow process, taking almost five years for both to get off the ground. In addition, with the publication of The Future of Geothermal Energy: Impact of Enhanced Geothermal System (EGS) in the United States by MIT in 2006, followed two years later by both the Department of Energy's recent RFP regarding further R&D on EGS, and Google Foundation's 2008 announcement of its funding of further EGS research and development, EGS development studies are ongoing. While neither BLM nor FS are research agencies, they pay very close attention to these studies.

Site-specific analysis of leases and project applications will also be necessary to address the particular impacts of future leases and projects from various technologies.

The PEIS also provides for mitigation and monitoring of leases, stipulations, and permit conditions, as discussed on page 2-20 of the Draft PEIS.

O-74-2

Please see response to comments I-2-4 and I-2-6 for a discussion of flash steam technology.

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1 *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

O-74-3

Prior to leasing, the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states typically manage and have regulatory authority for water quality, water rights, and wildlife. Site-specific impacts on water resources, including groundwater, would be addressed as part of the environmental analysis for the permitting process. All development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis, including public involvement as appropriate. BLM and FS would work with interested and affected parties to identify and resolve user or resource conflicts. Appropriate site-specific mitigation would be developed as necessary.

As discussed in section 1.5.1, water rights are administered and adjudicated at the state level. Each prospective lessee-developer will be required to apply for and obtain an adjudicated state water right before actually attempting to recover geothermal resources (see section 1.5.1).

O-74-4

As noted in the comment and in the PEIS, there are similarities in the leasing process and how geothermal resources are explored, drilled, and developed. The BLM and FS have appropriately applied many of the lessons of oil and gas to the development of the proposed action, including proactive stipulations.

O-74-5

The PEIS has been modified to include additional climate change discussion for affected resources. Please see the water, soil, vegetation, fish and wildlife, and other resource sections in the Final PEIS.

O-74-6

In accordance with 40 CFR Section 1502.13, the purpose of and need for the proposed action is used to define a range of reasonable alternatives (purpose of and need for action is defined in Sections 1.2 and 1.3). The BLM is making an allocation decision here and adopting a list of stipulations, BMPs, and compliance procedures to be incorporated in the land use plans. The PEIS analyzes in detail the Proposed Action, a No Action alternative, and a Leasing Near Transmission lines alternative. The Final PEIS incorporates input from public comments on the Proposed Action. Another alternative considered but eliminated from detailed study included no leasing or development of geothermal resources on public or NFS lands (Section 2.4.1). As explained in Section 2.4.1, this alternative, which would have been the most protective (from a ground disturbance standpoint), was eliminated because it would violate the multiple use provisions of FLPMA and is inconsistent with the President's National Energy Policy, the Energy Policy Act of 2005, and Executive Order 13212 and would not have fulfilled the purpose and need for the proposed action.

The alternatives analyzed represent a range of acreages as potentially available for leasing. See CEQ's *Forty Most Asked Questions Concerning the CEQ's NEPA Regulations*, Question 1b ("When there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in the EIS.") In particular, the Leasing Near Transmission Lines alternative was developed based on public scoping comments to represent a limited development alternative. Instead of inventing a variety of alternatives that would lie between the alternatives presented, the BLM and FS elected to include protective measures (i.e., stipulations, BMPs, and compliance procedures) in each of the action alternatives. Further, those planning areas whose plans include more protective measures may elect to keep those measures in place, instead of the stipulations, BMPs, and compliance procedures presented in the Final PEIS.

O-74-7

The commentor's concerns with Alternative B are noted.

See the above responses in this letter for details on level of analysis and protections provided in the PEIS.

O-74-8

The commentor's concerns with Alternative C are noted.

O-74-9

The existing case law regarding the roadless rule is inconsistent. On August 12, 2008, the Wyoming District Court found the 2001 Roadless Rule violated NEPA and the Wilderness Act (*State of Wyoming v. US Department of Agriculture,* 07-CV-17-B, Wyoming District Court, Cheyenne, Wyoming [2008]). The District Court ordered the 2001 Roadless rule "set aside" and "permanently enjoined." This order is subsequent to a 2006 California District Court ruling that set aside the 2005 State Petitions Rule and reinstated the 2001 Roadless Rule. See *California ex re. Lockyer v. US Department of Agriculture*, 459 F.Supp.2d 874 (N.D. Cal 2006). The United States Justice Department, on behalf of the Department of Agriculture, has filed motions with both the Wyoming and California courts seeking adjustments of those courts' conflicting judicial orders. Neither the Wyoming nor California District Court rulings bar the Department of Agriculture from promulgating other roadless area regulations. To address this inconsistency, the PEIS includes the following Department of Agriculture Roadless Area Stipulation, "If future legislation or regulation change the roadless area designation, the restriction would be revised along with any appropriate environmental review." An appropriate NEPA review would be required prior to any changes to the Roadless Area Stipulation.

O-74-10

Decisions regarding the management of areas with wilderness characteristics are made at the field office level as part of the local land use planning process and not in this PEIS. This allows wilderness characteristics to be evaluated at a finer scale than afforded at a programmatic level. The management and level of protection of the wilderness characteristics on non-WSA lands is discretionary and not bound by requirements of the Wilderness Act of 1964 or the WSA Interim Management Policy (IMP, H-8550-1; BLM 1995); thus, these areas have no official status that removes them from consideration for leasing. Nonetheless, the BLM must consider in its NEPA analyses possible impacts on wilderness characteristics, if present, and may manage the lands to protect and/or preserve some or all of those characteristics through the local land use planning process.

As noted in Chapter 2 of the Draft PEIS, before making any leasing decisions, the BLM will assess whether the existing NEPA is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis. For example, additional NEPA analysis may be required in light of new information, or from a potential change in management approach regarding resources identified for special management (e.g., travel management planning or areas under consideration by BLM for management for wilderness characteristics).

O-74-11

Thank you for your comment. The PEIS does provide BMPs and stipulations that protect important migration corridors. Language has been revised in Section 2.2.2 *Procedures Prior to Leasing* to state:

- The authorized officer of the BLM or FS would collaborate with appropriate state agencies, especially in the case of geothermal energy, as the states manage and typically have regulatory authority for water quality, water rights, and wildlife; and

- The authorized officer of the BLM or FS would review the lands for any other sensitive resources (e.g., paleontological, BLM sensitive status species, and FS species of local concern) and provide for the necessary stipulations to protect these resources and ensure compliance with the land use plan. Assessment of the resource would include consulting with agency experts, coordinating with other appropriate agencies, and site surveys, if warranted.

- Prior to any geothermal development, site-specific NEPA would be conducted and migration corridors and important wildlife habitats would be identified. Appropriate measures, including but not limited to those provided in the list of BMPs, would be applied to protect these areas.

O-74-12

The BLM and operators would work with agencies and local stakeholders to identify areas requiring protection and mitigate impacts to special designation areas. See Section 4.2.8 for discussion of areas closed to leasing by Congressional designation.

O-74-13

Before issuing any leases the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and site-specific resources, such as those included in the list provided in this comment. See chapter 2 for an in-depth discussion of areas closed to leasing.

O-74-14

Given that impact on geothermal resources from adjacent development may vary based on site-specific conditions, no specific buffer zone has been established for Yellowstone under the proposed action.

The BLM and FS are committed to working with the NPS to avoid adverse impacts to thermal features within NPS units. The language in Section 1.5.4 *Environmental Review Requirements Prior to Leasing* has been revised to clarify further that the BLM is prohibited from geothermal leasing on NPS lands as well as on lands where the Secretary has determined that geothermal operations are reasonably likely to result in a "significant adverse effect on a significant thermal feature" in a unit of the NPS. In addition, a list of the 12 units of the NPS with significant thermal features that occur in the study areas is now included.

Prior to inclusion of any specific parcels in a lease sale, the BLM and FS would coordinate with the National Park Service to determine if there would be any impacts to thermal or hydrological features within NPS units in proximity to a proposed lease. Language has been added to Section 2.2.2 *Procedures Prior to Leasing* to reiterate this point.

In addition, should development be determined to be reasonably likely to have an "adverse effect" on a significant thermal feature, the BLM would include appropriate lease stipulations to protect the park unit.

If it is determined in advance of leasing that exploration, development, or utilization of the lease parcel would "reasonably likely result in a significant adverse effect on a significant thermal feature of a National Park System unit," then the lease would not be issued (30 USC Section 1026[c]). While preexisting leases and permits are beyond the scope of this PEIS, the statute also provides that, if it is determined that use of an existing lease or permit would be "reasonably likely to adversely affect" any significant thermal feature within a National Park System unit, then stipulations are included on leases and permits to protect the thermal features (30 USC Section 1026 [d]).

O-74-15

This PEIS allocates areas as being available or closed to geothermal leasing. Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to address sensitive issues and conditions.

O-74-16

Please see response to comment O-74-16, above.

O-74-17

Please see response to comment O-74-16 above.

O-74-18

Please see response to comment O-74-16 above.

O-74-19

Please see response to comment O-74-16 above.

O-74-20

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential and does discuss some of the available technologies, but it is not intended to provide full analysis of all phases of development. All development and utilization, including impacts of the specific technology used at plants, would be subject to further site-specific permitting and environmental analysis.

O-74-21

See the above response.

O-74-22

Additional discussion has been added to the cumulative impact analysis, including discussion on various ongoing transmission line projects and reasonably foreseeable transmission efforts. As noted in Chapter 5, past, present, and reasonably foreseeable actions, including commercial uses of public and federal lands, are documented and analyzed.

O-74-23

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-74-24

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-74-25

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-74-26

Additional text has been added to the socioeconomics sections in Chapter 3 and Chapter 4 to address non-market values.

O-74-27

The comment is noted. No surface use stipulations for important viewsheds and BMPs for the protection of visual resources (see Appendix B) would be applied, as appropriate to land use plan revisions.

O-74-28

The BLM is proposing to include a Sensitive Species Stipulation for leases in areas that have agency-designated sensitive species. The stipulation could be a NSO, CSU, or TL in order to meet resource objectives (Page 2-19 of the Draft PEIS). This approach provides the flexibility to respond to the dynamic national and regional planning and protection efforts for these species. During the permitting process for any subsequent drilling or development applications, the BLM would conduct the appropriate analysis on siting locations, as noted in the comment.

To provide further protection for threatened, endangered, and sensitive species, the BLM will impose an Endangered Species Act stipulation (see Section 2.2.2) on all geothermal leases.

O-74-29

Thank you for your comment. Unfortunately, this level of data analysis is beyond the scope of the PEIS. The analysis in Chapter 4 is commensurate with the scope of the proposed action for the PEIS.

O-74-30

Decisions regarding the management of areas with wilderness characteristics are made at the field office level as part of the local land use planning process and not in this PEIS. This allows wilderness characteristics to be evaluated at a finer scale than afforded at a programmatic level. The management and level of protection of the wilderness characteristics on non-WSA lands is discretionary and not bound by requirements of the Wilderness Act of 1964 or the WSA Interim Management Policy (IMP, H-8550-1; BLM 1995); thus, these areas have no official status that removes them from consideration for leasing. Nonetheless, the BLM must consider in its NEPA analyses possible impacts on wilderness characteristics, if present, and may manage the lands to protect and/or preserve some or all of those characteristics through the local land use planning process.

As noted in Chapter 2 of the Draft PEIS, before making any leasing decisions, the BLM will assess whether the existing NEPA documentation is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis. For example, additional NEPA analysis may be required in light of new information, or from a potential change in management approach regarding resources identified for special management (e.g., travel management planning or areas under consideration by BLM for management for wilderness characteristics).

Please see the response to comment O-74-9 regarding roadless area regulations.

O-74-31

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and potential geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

The programmatic EIS does not change existing closures, avoidance or protective measures developed for cultural resources, or tribal concerns. It does not constrain local FS or BLM offices from determining new restrictions or closures in land use plans or through special designations. It does describe a process to ensure that these concerns are addressed through tribal consultation at each phase of leasing and development.

O-74-32

The PEIS was based on the best available GIS data available and appropriate for the analysis, including from data sets used in the West-wide Energy Corridors Draft PEIS. The scope of the GIS data is discussed in Section 1.9.3 *Scope of GIS Data and Graphics of the Draft PEIS*.

While the BLM used the GIS data for programmatic level analysis, it is not necessarily appropriate for site-specific analysis. Maps from the Final PEIS will be provided on the public project website.

O-74-33

Available GIS data for the criteria listed in the Proposed Action (Section 2.1.1 *Identify Lands for Leasing*) were used for analysis, data calculations, and graphics.

O-74-34

Figures and acre calculations were developed using GIS for the criteria outlined in the Proposed Action (Section 2.1.1 *Identify Lands for Leasing*). As noted in this section, it included many of the layers listed in the comment. Other layers, including habitat data, watersheds, and soils, were used in preparing the affected environment sections and for the impact analysis.

O-74-35

Prior to making leasing decisions, BLM will assess whether the existing NEPA documentation is adequate (i.e., through completion of a DNA), or whether there is new information or new circumstances that warrant further analysis. As stated in the above responses, all development, utilization, and reclamation activities would be subject to further site-specific permitting and environmental analysis. This document does predict a general level of anticipated future geothermal development in BLM areas that have geothermal potential, but it is not intended to provide full analysis of all phases of development. There are several subsequent stages of decision making necessary to approve geothermal resource development, each with its own environmental compliance requirements, including public involvement, as applicable. This document covers only the land use planning and lease issuance stages.

O-74-36

Because it is difficult or even impossible to foresee all future permutations of possible geothermal development, the BLM could not create an exhaustive list of the limitations on the future use of this PEIS. Rather, as stated in the Draft PEIS, prior to making leasing decisions the BLM would asses whether the existing NEPA documentation is adequate (through completion of a DNA) or whether there is new information or new circumstances that warrant further analysis (see Section 2.2.2 *Procedures Prior to Leasing*).

O-74-37

It is important to clarify that stipulations are applied to leases, while BMPs are optional actions that can be applied to subsequent development permits based on local site conditions. As noted in Chapter 2 of the Draft PEIS, the stipulations provided in the PEIS would serve as the minimal level of protection and would be adopted into local land use plans upon signing of the ROD. If existing land use plans offer more protective measures or have resource-specific commitments, those more protective measures would apply instead. Section 2.2.2, subsection *Lease Exceptions, Waivers, and Modifications* discusses the limited circumstances under which lease stipulations can be excepted, waived, or modified.

O-74-38

As stated in PEIS Section 2.2.2 *Procedures Prior to Leasing*, the authorized officer for the BLM or FS will consult with Native American Tribal governments, Alaska Natives, and State Historic Preservation Officers. Through consultation, the agencies would identify tribal interests and traditional cultural resources or properties that may be affected by the federal leases and potential geothermal energy development and the presence of archaeological sites and historic properties per Section 106 of the National Historic Preservation Act.

O-74-39

The comment for suggested revision of lease boundaries has been noted.

The authorized officer always retains the discretion to reject geothermal lease applications or lease parcels prior to issuance or sale, respectively.

Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

Please see response to comment O-74-9 above for discussion of roadless area regulations.

O-74-40

The PEIS covers geothermal leasing. Issuance of a lease does not require the lease holder to specify what kind or size of plant would be developed on the lease site; therefore, discussion of alternate technologies is not appropriate in this analysis (see Section 1.11.1 *BLM and FS Decisions to be Made Following Subsequent NEPA Analysis* for further discussion of permitting). All development and utilization and reclamation activities would be subject to further site-specific permitting and environmental analysis.

O-74-41

Additional discussion has been added to the cumulative impact analysis. As noted in chapter 5, past, present and reasonably foreseeable actions including commercial uses of public and federal lands are documented and analyzed.

Stipulations have also been identified that would be applied to protect sensitive resources. Before issuing any leases, the BLM would conduct the necessary review to ensure that leasing would be compatible with the local land use plan and would comply with all applicable Federal, state, and local laws and regulations. As noted in Section 2.2.2, there are a variety of stipulations and BMPs that could be applied to protect sensitive issues and conditions.

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O-74-40

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O-74-41

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