



# APPENDIX D

## BEST MANAGEMENT PRACTICES

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# **APPENDIX D**

## **BEST MANAGEMENT PRACTICES – MITIGATION MEASURES**

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Best Management Practices (BMP) are state-of-the-art mitigation measures applied on a site-specific basis to reduce, prevent, or avoid 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 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 could be applied to the use authorizations on a site-specific basis as conditions of approval or could be proactively incorporated into the permit application by the lessee. 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 permit as conditions of approval or rights-of-way stipulations.

All offices shall 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 set of improved practices for developing geothermal energy and minimize impacts to the biophysical and cultural landscape. The list is comprehensive 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.

The list is presented according to development phase and is subgrouped by resources. Since a number of these BMPs can be applied to a variety of situations and during multiple phases of development, operations, and maintenance, there may be duplication of or similarity between them. Furthermore, although these BMPs may be identified for specific situations or

actions (e.g. drilling or road construction), they are not exclusive to those actions unless otherwise specified. A menu of typical BMPs can also be found on the BLM Washington Office Fluid Minerals web site at: [www.blm.gov/bmp](http://www.blm.gov/bmp)

## **PHASE I: EXPLORATION**

### **General**

- The area disturbed by monitoring and testing (i.e., footprint) shall be kept to a minimum.
- Existing roads shall be used to the maximum extent feasible. If new roads are necessary, they shall be designed and constructed to the appropriate standard.
- Available information describing the environmental and sociocultural conditions in the vicinity of the proposed project shall be collected and reviewed as needed to predict potential impacts of the project.
- The project shall be planned to utilize existing roads and utility corridors to the maximum extent practicable, and to minimize the number and length/size of new roads, lay-down areas, and borrow areas.
- A monitoring program shall be developed to ensure that environmental conditions are monitored during the well drilling, testing, and construction phases. The monitoring program requirements, including adaptive management strategies, shall be established at the project level to ensure that potential adverse impacts of geothermal development are mitigated. The monitoring program shall identify the monitoring requirements for each 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 standard operating procedures and BMPs.
- “Good housekeeping” procedures shall be developed to ensure that during operation the site will be kept clean of debris, garbage, fugitive trash or waste, and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards.
- All control and mitigation measures established for the project in the operation plan and the resource-specific management plans that are part of the operation plan shall be maintained and implemented throughout construction and operation of the project, as appropriate.
- Existing sites shall be used in preference to new sites.

- Site monitoring protocols defined in the operation plan shall be implemented. These will incorporate monitoring program observations and additional mitigation measures into standard operating procedures and BMPs to minimize future environmental impacts.
- Results of monitoring program efforts shall be provided to the BLM authorized officer.
- Operators shall identify unstable slopes and local factors that can induce slope instability (such as groundwater conditions, precipitation, earthquake activities, slope angles, and the dip angles of geologic strata). Operators also shall avoid creating excessive slopes during excavation and blasting operations. Special construction techniques shall be used where applicable in areas of steep slopes, erodible soil, and stream channel crossings.

#### **Land Use, Recreation, and Special Designations**

- The BLM and operators shall contact appropriate agencies, property owners, and other stakeholders early in the planning process to identify potentially sensitive land uses and issues, rules that govern geothermal energy development locally, and land use concerns specific to the region.
- The Secretary of Agriculture's rules and regulations must be complied with 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.
- To plan for efficient use of the land, necessary infrastructure requirements shall be consolidated wherever possible, and current transmission and market access shall be evaluated carefully.
- 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).
- A traffic management plan shall 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 shall 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.

- Existing roads shall be used, but only if in safe and environmentally sound locations. If new roads are necessary, they shall be designed and constructed to the appropriate standard and be no higher than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles).
- Excessive grades on roads, road embankments, ditches, and drainages shall be avoided, especially in areas with erodible soils. Special construction techniques shall be used, where applicable. Abandoned roads and roads that are no longer needed shall be recontoured and revegetated.
- Access roads and on-site roads shall be surfaced with aggregate materials, wherever appropriate.
- Access roads shall be located to follow natural contours and minimize side hill cuts.
- Roads shall be designed so that changes to surface water runoff are avoided and erosion is not initiated.
- Road use shall be restricted during the wet season if road surfacing is not adequate to prevent soil displacement, rutting, etc., and resultant stream sedimentation.
- Road use shall be restricted during the wet season if road surfacing is not adequate to prevent soil displacement, rutting, etc., and resultant stream sedimentation.
- Potential soil erosion shall be controlled at culvert outlets with appropriate structures. Catch basins, roadway ditches, and culverts shall be cleaned and maintained regularly.
- Project personnel and contractors shall 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 airborne dust.
- Traffic shall be restricted to the roads developed for the project. Use of other unimproved roads shall be restricted to emergency situations.
- Signs shall be placed along construction roads to identify speed limits, travel restrictions, and other standard traffic control information. To minimize impacts on local commuters, consideration shall be given to limiting construction vehicles traveling on public roadways during the morning and late afternoon commute time.

- Signs directing vehicles to alternative park access and parking would be posted in the event construction temporarily obstructs recreational parking areas near trailheads.
- Whenever active work is being performed, the area would be posted with “construction ahead” signs on any adjacent access roads or trails that might be affected.
- Whenever possible, construction activities would be avoided during high recreational use periods.
- Operators shall 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) shall be identified and addressed in the traffic management plan;
- Access roads shall be located to minimize stream crossings. All structures crossing streams shall be located and constructed so that they do not decrease channel stability or increase water velocity. Operators shall obtain all applicable federal and state permits.
- Stream crossings on newly constructed roads should be designed to handle a 100 year flood event, and also provide for fish passage
- Existing drainage systems shall not be altered, especially in sensitive areas such as erodible soils or steep slopes.
- Roads shall be located away from drainage bottoms and avoid wetlands, if practicable.

### **Geologic Resources and Seismic Setting**

- Prior to geothermal exploration and development, a complete subsurface geotechnical investigation would be conducted to analyze the soil and geologic conditions. The investigation would 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.
- A detailed geotechnical analysis would be performed prior to the construction of any structures; so they could 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).

### **Paleontological Resources**

- Operators shall 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 shall be developed. This plan shall include a mitigation plan for collection of the fossils; mitigation could include 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 could be required during all excavation and earthmoving in the sensitive area. A report shall be prepared documenting these activities. The paleontological resources management plan also shall (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.
- Unexpected discovery of cultural or paleontological resources during construction shall be brought to the attention of the responsible BLM authorized officer immediately. Work shall 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.

#### **Soil Resources**

- Foundations and trenches shall be backfilled with originally excavated material as much as possible. Excess excavation materials shall be disposed of only in approved areas or, if suitable, stockpiled for use in reclamation activities.
- Borrow material shall be obtained only from authorized and permitted sites.

#### **Water Resources**

- Operators shall 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 shall gain a clear understanding of the local hydrogeology. Areas of groundwater 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.

### **Air Quality and Climate**

The following BMPs would be incorporated into lease terms to minimize air quality impacts from fugitive dust:

- The number and size/length of roads, temporary fences, lay-down areas, and borrow areas shall be minimized.
- Topsoil from all excavations and construction activities shall be salvaged and reapplied during reclamation.
- All areas of disturbed soil shall be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities shall be undertaken as early as possible on disturbed areas.
- Erosion controls that comply with county, state, and federal standards shall be applied. Practices such as jute netting, silt fences, and check dams shall be applied near disturbed areas.
- Dust abatement techniques shall be used on unpaved, unvegetated surfaces to minimize airborne dust.
- Speed limits (e.g., 25 mph [40 kph]) shall be posted and enforced to reduce airborne fugitive dust.
- Construction materials and stockpiled soils shall be covered if they are a source of fugitive dust.
- Dust abatement techniques shall be used before and during surface clearing, excavation, or blasting activities.

For managing diesel exhaust, each individual project proponent should be required to prepare and submit to the BLM an Equipment Emissions Mitigation Plan. Requirements for emissions controls should be incorporated into the lease terms for individual geothermal leases. 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 should apply to all lands authorized for lease and should 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.

### **Vegetation and Fish and Wildlife**

- Installation of any equipment or well drilling shall be scheduled to avoid disruption of wildlife reproductive activities or other important behaviors.
- Operators shall review existing information on species and habitats in the vicinity of the project area to identify potential concerns.
- A habitat restoration plan shall be developed to avoid (if possible), minimize, or mitigate negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. The plan shall identify revegetation, soil stabilization, and erosion reduction measures that shall be implemented to ensure that all temporary use areas are restored. The plan shall 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.
- Existing roads should be used to the maximum extent feasible to access a proposed project area.
- If new access roads are necessary, they should be designed and constructed to the appropriate standard.
- Existing or new roads should be maintained to the condition needed for facility use.
- The area disturbed during exploration and development (i.e., temperature gradient wells, well pads, roadways) should be minimized.
- Drill pads should not be located in or near sensitive habitats or in areas where vegetation or important habitats are known to be sensitive to human activities.
- Mitigation measures should be considered during planning and design to ensure that the siting of geothermal projects and associated roadways and structures do not result in unacceptable impacts on important habitats.

- Operators should 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 facility should follow appropriate guidance and requirements from the BLM, FS, and other resource agencies, as available and applicable.
- 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.
- The operators should conduct surveys for federal- and state-protected species and other species of concern within the project area.
- The project should be planned to avoid (if possible), minimize, or mitigate impacts on wildlife and habitat.
- Habitat disturbance should be minimized by locating facilities such as pipelines and access roads in previously disturbed areas (i.e., locate transmission lines within or adjacent to existing powerline corridors).
- Existing roads and utility corridors should be used to the maximum extent feasible.
- New access roads and utility corridors should be configured to avoid high-quality habitats and minimize habitat fragmentation.
- Site access roads and utility corridors should minimize stream crossings.
- Where applicable, the extent of habitat disturbance should be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.
- Erosion controls that comply with county, state, and federal standards should be applied. Practices such as jute netting, silt fences, and check dams should be applied near disturbed areas.
- All areas of disturbed soil should be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities should be undertaken as early as possible on disturbed areas.
- Dust abatement techniques should be used on unpaved, unvegetated surfaces to minimize airborne dust.
- Construction materials and stockpiled soil should be covered if they are a source of fugitive dust.
- Erosion and fugitive dust control measures should be inspected and maintained regularly.

- All refueling should occur in a designated fueling area that includes a temporary berm to limit the spread of any spill.
- Drip pans should be used during refueling to contain accidental releases.
- Drip pans should be used under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.
- Access roads and newly established utility and transmission line corridors should be monitored regularly for invasive species establishment, and weed control measures should be initiated immediately upon evidence of invasive species introduction.
- Fill materials that originate from areas with known invasive vegetation problems should not be used.
- Certified weed-free mulch should be used when stabilizing areas of disturbed soil.
- Habitat restoration activities and invasive vegetation monitoring and control activities should be initiated as soon as possible after construction activities are completed.
- All areas of disturbed soil should be reclaimed using weed-free native shrubs, grasses, and forbs.
- Pesticide use should be limited to nonpersistent, immobile pesticides and should only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- Spills should be immediately addressed per the appropriate spill management plan, and soil cleanup and removal should be initiated, if needed.
- Access roads, utility and transmission line corridors, and geothermal plant sites should be monitored regularly for invasive species establishment, and weed control measures should be initiated immediately upon evidence of invasive species introduction.
- 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.
- BMPs to avoid or minimize the possibility of the unintentional take of migratory birds should be applied to all practices and projects. Practices should be applied to provide long-term benefits and improved vegetation community condition. If the proposed project or action does have the potential to impact migratory bird species populations which have been identified as occurring within the

project or action area, evaluate options to mitigate the project to minimize or eliminate the identified impacts during periods of concentrated nesting activity. Appropriate BMPs include:

- a. Minimize/avoid impacts to nesting migratory birds by imposing a Timing Limitation on use authorizations to mitigate vegetative disturbing activities during the primary portion of the nesting season.

Most migratory birds nest between May 15 to July 15, but dates should be adjusted for the species and environmental conditions. Timing limitations may be modified based upon the species affected and the timing or intensity of breeding activity of the species of Birds of Conservation Concern involved.

- b. Where disturbance cannot be avoided, the scale and the length of time of disturbance may be considered mitigating circumstances.
  - c. Inspect and clear an area for migratory bird nesting. These clearances could be performed by qualified personnel. Factors to weigh in considering this option include vegetation type, vegetation density, timing and cost.
  - d. Explore opportunities to replace and prioritize habitat and habitat changes on or off site based upon the needs of Birds of Conservation Concern.
- Operators shall 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 shall 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 shall be required. If trucks and construction equipment are arriving from locations with known invasive vegetation problems, a controlled inspection and cleaning area shall 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 shall 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.
  - Pesticide use shall be limited to nonpersistent, immobile pesticides and shall only be applied in accordance with label and application

permit directions and stipulations for terrestrial and aquatic applications.

- Explosives shall be used only within specified times and at specified distances from sensitive wildlife or streams and lakes, as established by the BLM or other federal and state agencies.

#### **Wild Horses and Burros**

- Employees, contractors, and site visitors shall be instructed to avoid harassment and disturbance of wild horses and burros, especially during reproductive (e.g., breeding and birthing) seasons. In addition, any pets shall be controlled to avoid harassment and disturbance of wild horses and burros.
- Observations of potential problems regarding wild horses or burros, including animal mortality, shall be reported to the authorized officer immediately.

#### **Livestock Grazing**

- Dust control measures would reduce impacts on livestock forage during construction and demolition activities;
- Development should minimize the number of structures required;
- Litter and noxious weeds should be controlled and removed regularly during construction and operation.

#### **Cultural Resources**

- Unexpected discovery of cultural or paleontological resources during construction shall be brought to the attention of the responsible BLM authorized officer immediately. Work shall 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.
- 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) shall be developed. This plan shall 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 shall be prepared documenting these activities. The CRMP also shall (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).

### **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 shall evaluate the potential visual impacts to the trail associated with the proposed project and identify appropriate mitigation measures for inclusion as stipulations in the operation plan.

### **Visual Resources**

- The BLM will consider the visual resource values of the public lands involved in proposed projects, consistent with BLM Visual Resource Management (VRM) policies and guidance.

- The public shall be involved and informed about the visual site design elements of the proposed geothermal energy facilities. Possible approaches include conducting public forums for disseminating information, offering organized tours of operating geothermal developments, and using computer simulation and visualization techniques in public presentations.
- The BLM will work with the applicant to 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. Power plants would be sited using terrain to obstruct visual impacts to the extent possible. Design elements would also include nonreflective paints, and prohibition of commercial messages on structures.
- Other site design elements shall be integrated with the surrounding landscape. Elements to address include minimizing the profile of the ancillary structures, burial of cables, prohibition of commercial symbols, and lighting. Regarding lighting, efforts shall be made to minimize the need for and amount of lighting on ancillary structures. Where practical, wells should be co-located to reduce road, pad and utility surface area and tank batteries centralized.
- Minimize the number of structures required;
- Construct low-profile structures whenever possible to reduce structure visibility;
- Select and design materials and surface treatments to repeat or blend with landscape elements;
- Control litter and noxious weeds and remove them regularly during construction and operation;
- Implement dust abatement measures to minimize the impacts of vehicular and pedestrian traffic, construction and operation, and wind on exposed surface soils;
- Operators shall reduce visual impacts during construction by minimizing areas of surface disturbance, controlling erosion, using dust suppression techniques, and restoring exposed soils as closely as possible to their original contour and vegetation.
- Nighttime lighting will be limited to areas necessary for the safe operation of the project and, where applicable, will include motion sensors to reduce nighttime lighting when not necessary.

### **Noise**

- Proponents of a geothermal energy development project shall 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.

- Whenever reasonably possible, geothermal well drilling or major facility construction operations should be restricted to non-sleeping hours (7:00 am to 10:00 pm).
- All equipment shall have sound-control devices no less effective than those provided on the original equipment. All construction equipment used shall be adequately muffled and maintained.
- All stationary construction equipment (i.e., compressors and generators) shall be located as far as practicable from nearby residences.
- If blasting or other noisy activities are required during the construction period, nearby residents shall be notified in advance.

### **Health and Safety**

- Any equipment installed for site monitoring and testing shall be inspected periodically for structural integrity.
- Operators shall 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 shall identify all hazardous materials that would be used, stored, or transported at the site. It shall establish inspection procedures, storage requirements, storage quantity limits, inventory control, nonhazardous product substitutes, and disposition of excess materials. The plan shall also identify requirements for notices to federal and local emergency response authorities and include emergency response plans.
- Operators shall 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 shall address all solid and liquid wastes that may be generated at the site.
- Operators shall 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 shall 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 shall be developed to protect both workers and the general public during construction and operation of geothermal projects.
- Regarding occupational health and safety, the program shall 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 shall 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 shall be established.
- Regarding public health and safety, the health and safety program shall 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 shall identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or rehabilitation activities. It shall 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 shall 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) shall be identified and addressed in the traffic management plan.
- Operators shall develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.
- Secondary containment shall be provided for all on-site hazardous materials and waste storage, including fuel. In particular, fuel storage

(for construction vehicles and equipment) shall be a temporary activity occurring only for as long as is needed to support construction activities.

- Wastes shall be properly containerized and removed periodically for disposal at appropriate off-site permitted disposal facilities.
- In the event of an accidental release to the environment, the operator shall document the event, including a root cause analysis, appropriate corrective actions taken, and a characterization of the resulting environmental or health and safety impacts. Documentation of the event shall be provided to the BLM authorized officer and other federal and state agencies, as required.
- Any wastewater generated in association with temporary, portable sanitary facilities shall be periodically removed by a licensed hauler and introduced into an existing municipal sewage treatment facility. Temporary, portable sanitary facilities provided for construction crews shall be adequate to support expected on-site personnel and shall be removed at completion of construction activities.
- Temporary fencing shall be installed around staging areas, storage yards, and excavations during construction to limit public access.

## **PHASE 2: DRILLING AND CONSTRUCTION**

### **General**

- The area disturbed monitoring and testing (i.e., footprint) shall be kept to a minimum.
- Existing roads shall be used to the maximum extent feasible. If new roads are necessary, they shall be designed and constructed to the appropriate standard.
- Available information describing the environmental and sociocultural conditions in the vicinity of the proposed project shall be collected and reviewed as needed to predict potential impacts of the project.
- The project shall be planned to utilize existing roads and utility corridors to the maximum extent feasible, and to minimize the number and length/size of new roads, lay-down areas, and borrow areas.
- A monitoring program shall be developed to ensure that environmental conditions are monitored during the well drilling, testing, and construction phases. The monitoring program requirements, including adaptive management strategies, shall be established at the project level to ensure that potential adverse impacts of geothermal development are mitigated. The monitoring program shall identify the monitoring requirements for each

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 standard operating procedures and BMPs.

- “Good housekeeping” procedures shall be developed to ensure that during operation the site will be kept clean of debris, garbage, fugitive trash or waste, and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards.
- All control and mitigation measures established for the project in the operation plan and the resource-specific management plans that are part of the operation plan shall be maintained and implemented throughout construction and operation of the project, as appropriate.
- Existing sites shall be used in preference to new sites.
- Site monitoring protocols defined in the operation plan shall be implemented. These will incorporate monitoring program observations and additional mitigation measures into standard operating procedures and BMPs to minimize future environmental impacts.
- Results of monitoring program efforts shall be provided to the BLM authorized officer.
- Operators shall identify unstable slopes and local factors that can induce slope instability (such as groundwater conditions, precipitation, earthquake activities, slope angles, and the dip angles of geologic strata). Operators also shall avoid creating excessive slopes during excavation and blasting operations. Special construction techniques shall be used where applicable in areas of steep slopes, erodible soil, and stream channel crossings.

#### **Land Use, Recreation, and Special Designations**

- The Secretary of Agriculture’s rules and regulations must be complied with 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.
- To plan for efficient use of the land, necessary infrastructure requirements shall be consolidated wherever possible, and current transmission and market access shall be evaluated carefully.

- 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).
- A traffic management plan shall 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 shall 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.
- Existing roads shall be used, but only if in safe and environmentally sound locations. If new roads are necessary, they shall be designed and constructed to the appropriate standard and be no higher than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles).
- Excessive grades on roads, road embankments, ditches, and drainages shall be avoided, especially in areas with erodible soils. Special construction techniques shall be used, where applicable. Abandoned roads and roads that are no longer needed shall be recontoured and revegetated.
- Access roads and on-site roads shall be surfaced with aggregate materials, wherever appropriate.
- Access roads shall be located to follow natural contours and minimize side hill cuts.
- Roads shall be designed so that changes to surface water runoff are avoided and erosion is not initiated.
- Road use shall be restricted during the wet season if road surfacing is not adequate to prevent soil displacement, rutting, etc., and resultant stream sedimentation.
- Potential soil erosion shall be controlled at culvert outlets with appropriate structures. Catch basins, roadway ditches, and culverts shall be cleaned and maintained regularly.
- Project personnel and contractors shall 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 airborne dust.
- Traffic shall be restricted to the roads developed for the project. Use of other unimproved roads shall be restricted to emergency situations.

- Signs shall be placed along construction roads to identify speed limits, travel restrictions, and other standard traffic control information. To minimize impacts on local commuters, consideration shall be given to limiting construction vehicles traveling on public roadways during the morning and late afternoon commute time.
- Signs directing vehicles to alternative park access and parking would be posted in the event construction temporarily obstructs recreational parking areas near trailheads.
- Whenever active work is being performed, the area would be posted with “construction ahead” signs on any adjacent access roads or trails that might be affected.
- Whenever possible, construction activities would be avoided during high recreational use periods.
- Operators shall 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) shall be identified and addressed in the traffic management plan;
- Access roads shall be located to minimize stream crossings. All structures crossing streams shall be located and constructed so that they do not decrease channel stability or increase water velocity. Operators shall obtain all applicable federal and state permits.
- Stream crossings on newly constructed roads should be designed to handle a 100 year flood event, and also provide for fish passage
- Existing drainage systems shall not be altered, especially in sensitive areas such as erodible soils or steep slopes.
- Roads shall be located away from drainage bottoms and avoid wetlands, if practicable.

### **Geologic Resources and Seismic Setting**

- A detailed geotechnical analysis would be performed prior to the construction of any structures; so they could 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).

### **Paleontological Resources**

- Operators shall 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 shall be developed. This plan shall include a mitigation plan for collection of the fossils; mitigation could include 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 could be required during all excavation and earthmoving in the sensitive area. A report shall be prepared documenting these activities. The paleontological resources management plan also shall (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.
- Unexpected discovery of cultural or paleontological resources during construction shall be brought to the attention of the responsible BLM authorized officer immediately. Work shall 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.

#### **Soil Resources**

- Foundations and trenches shall be backfilled with originally excavated material as much as possible. Excess excavation materials shall be disposed of only in approved areas or, if suitable, stockpiled for use in reclamation activities.
- Borrow material shall be obtained only from authorized and permitted sites.

#### **Water Resources**

- Operators shall 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 shall gain a clear understanding of the local hydrogeology. Areas of groundwater 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.

### **Air Quality and Climate**

The following BMPs would be incorporated into lease terms to minimize air quality impacts from fugitive dust:

- The number and size/length of roads, temporary fences, lay-down areas, and borrow areas shall be minimized.
- Topsoil from all excavations and construction activities shall be salvaged and reapplied during reclamation.
- All areas of disturbed soil shall be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities shall be undertaken as early as possible on disturbed areas.
- Erosion controls that comply with county, state, and federal standards shall be applied. Practices such as jute netting, silt fences, and check dams shall be applied near disturbed areas.
- Dust abatement techniques shall be used on unpaved, unvegetated surfaces to minimize airborne dust.
- Speed limits (e.g., 25 mph [40 kph]) shall be posted and enforced to reduce airborne fugitive dust.
- Construction materials and stockpiled soils shall be covered if they are a source of fugitive dust.
- Dust abatement techniques shall be used before and during surface clearing, excavation, or blasting activities.

For managing diesel exhaust, each individual project proponent should be required to prepare and submit to the BLM an Equipment Emissions Mitigation Plan. Requirements for emissions controls should be incorporated into the lease terms for individual geothermal leases. 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 should apply to all lands authorized for lease and should 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.

### **Vegetation and Fish and Wildlife**

- Installation of any equipment or well drilling shall be scheduled to avoid disruption of wildlife reproductive activities or other important behaviors.
- Operators shall review existing information on species and habitats in the vicinity of the project area to identify potential concerns.
- A habitat restoration plan shall be developed to avoid (if possible), minimize, or mitigate negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. The plan shall identify revegetation, soil stabilization, and erosion reduction measures that shall be implemented to ensure that all temporary use areas are restored. The plan shall 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.
- Existing roads should be used to the maximum extent feasible to access a proposed project area.
- If new access roads are necessary, they should be designed and constructed to the appropriate standard.
- Existing or new roads should be maintained to the condition needed for facility use.
- The area disturbed during exploration and development (i.e., temperature gradient wells, well pads, roadways) should be minimized.
- Drill pads should not be located in or near sensitive habitats or in areas where vegetation or important habitats are known to be sensitive to human activities.
- Mitigation measures should be considered during planning and design to ensure that the siting of geothermal projects and associated roadways and structures do not result in unacceptable impacts on important habitats.

- Operators should 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 facility should follow appropriate guidance and requirements from the BLM, FS, and other resource agencies, as available and applicable.
- 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.
- The operators should conduct surveys for federal- and state-protected species and other species of concern within the project area.
- The project should be planned to avoid (if possible), minimize, or mitigate impacts on wildlife and habitat.
- Habitat disturbance should be minimized by locating facilities such as pipelines and access roads in previously disturbed areas (i.e., locate transmission lines within or adjacent to existing powerline corridors).
- Existing roads and utility corridors should be used to the maximum extent feasible.
- New access roads and utility corridors should be configured to avoid high-quality habitats and minimize habitat fragmentation.
- Site access roads and utility corridors should minimize stream crossings.
- Where applicable, the extent of habitat disturbance should be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.
- Erosion controls that comply with county, state, and federal standards should be applied. Practices such as jute netting, silt fences, and check dams should be applied near disturbed areas.
- All areas of disturbed soil should be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities should be undertaken as early as possible on disturbed areas.
- Dust abatement techniques should be used on unpaved, unvegetated surfaces to minimize airborne dust.
- Construction materials and stockpiled soil should be covered if they are a source of fugitive dust.
- Erosion and fugitive dust control measures should be inspected and maintained regularly.

- All refueling should occur in a designated fueling area that includes a temporary berm to limit the spread of any spill.
- Drip pans should be used during refueling to contain accidental releases.
- Drip pans should be used under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.
- Access roads and newly established utility and transmission line corridors should be monitored regularly for invasive species establishment, and weed control measures should be initiated immediately upon evidence of invasive species introduction.
- Fill materials that originate from areas with known invasive vegetation problems should not be used.
- Certified weed-free mulch should be used when stabilizing areas of disturbed soil.
- Habitat restoration activities and invasive vegetation monitoring and control activities should be initiated as soon as possible after construction activities are completed.
- All areas of disturbed soil should be reclaimed using weed-free native shrubs, grasses, and forbs.
- Pesticide use should be limited to nonpersistent, immobile pesticides and should only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- Spills should be immediately addressed per the appropriate spill management plan, and soil cleanup and removal should be initiated, if needed.
- Access roads, utility and transmission line corridors, and geothermal plant sites should be monitored regularly for invasive species establishment, and weed control measures should be initiated immediately upon evidence of invasive species introduction.
- 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.
- BMPs to avoid or minimize the possibility of the unintentional take of migratory birds should be applied to all practices and projects. Practices should be applied to provide long-term benefits and improved vegetation community condition. If the proposed project or action does have the potential to impact migratory bird species populations which have been identified as occurring within the

project or action area, evaluate options to mitigate the project to minimize or eliminate the identified impacts during periods of concentrated nesting activity. Appropriate BMPs include:

- a. Minimize/avoid impacts to nesting migratory birds by imposing a Timing Limitation on use authorizations to mitigate vegetative disturbing activities during the primary portion of the nesting season.

Most migratory birds nest between May 15 to July 15, but dates should be adjusted for the species and environmental conditions. Timing limitations may be modified based upon the species affected and the timing or intensity of breeding activity of the species of Birds of Conservation Concern involved.

- b. Where disturbance cannot be avoided, the scale and the length of time of disturbance may be considered mitigating circumstances.
  - c. Inspect and clear an area for migratory bird nesting. These clearances could be performed by qualified personnel. Factors to weigh in considering this option include vegetation type, vegetation density, timing and cost.
  - d. Explore opportunities to replace and prioritize habitat and habitat changes on or off site based upon the needs of Birds of Conservation Concern.
- Operators shall 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 shall 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 shall be required. If trucks and construction equipment are arriving from locations with known invasive vegetation problems, a controlled inspection and cleaning area shall 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.
  - Should a development or occupancy and use site have invasive plant infestations prior to development or use, proponents should confer with the land administrator to develop an invasive plant treatment plan to eliminate and/or prevent the propagation of the species.
  - If pesticides are used on the site, an integrated pest management plan shall 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.

- Pesticide use shall be limited to nonpersistent, immobile pesticides and shall only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- Explosives shall be used only within specified times and at specified distances from sensitive wildlife or streams and lakes, as established by the BLM or other federal and state agencies.

#### **Wild Horse and Burros**

- Employees, contractors, and site visitors shall be instructed to avoid harassment and disturbance of wild horses and burros, especially during reproductive (e.g., breeding and birthing) seasons. In addition, any pets shall be controlled to avoid harassment and disturbance of wild horses and burros.
- Observations of potential problems regarding wild horses or burros, including animal mortality, shall be reported to the authorized officer immediately.

#### **Livestock Grazing**

- Dust control measures would reduce impacts on livestock forage during construction and demolition activities;
- Development should minimize the number of structures required;
- Litter and noxious weeds should be controlled and removed regularly during construction and operation.

#### **Cultural Resources**

- Unexpected discovery of cultural or paleontological resources during construction shall be brought to the attention of the responsible BLM authorized officer immediately. Work shall 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.
- 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) shall be developed. This plan shall 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 shall be prepared documenting these activities. The CRMP also shall (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).

#### **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 shall evaluate the potential visual impacts to the trail associated with the proposed

project and identify appropriate mitigation measures for inclusion as stipulations in the operation plan.

### **Visual Resources**

Assessment of visual resources needs to be factored into the early stages project pre-planning and continued throughout the life of the project for proposed activities within VRM Class I, II, III and IV areas in accordance with VRM manuals, handbooks and Instructional Memorandums.

- The BLM will consider the visual resource values of the public lands involved in proposed projects, consistent with BLM Visual Resource Management (VRM) policies and guidance.
- All proposals on BLM lands located in VRM Class II and III are to be evaluated for compliance with VRM objectives using the Contrast Rating System described within the BLM Handbook – Visual Resource Contrast Rating H-8431-I.
- The public shall be involved and informed about the visual site design elements of the proposed geothermal energy facilities. Possible approaches include conducting public forums for disseminating information, offering organized tours of operating geothermal developments, and using computer simulation and visualization techniques in public presentations.
- The BLM will work with the applicant to 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. Power plants would be sited using terrain to obstruct visual impacts to the extent possible. Design elements would also include nonreflective paints, and prohibition of commercial messages on structures.
- Other site design elements shall be integrated with the surrounding landscape. Elements to address include minimizing the profile of the ancillary structures, burial of cables, prohibition of commercial symbols, and lighting. Regarding lighting, efforts shall be made to minimize the need for and amount of lighting on ancillary structures. Where practical, wells should be co-located to reduce road, pad and utility surface area and tank batteries centralized.
- Minimize the number of structures required;
- Construct low-profile structures whenever possible to reduce structure visibility;
- Select and design materials and surface treatments to repeat or blend with landscape elements;
- Control litter and noxious weeds and remove them regularly during construction and operation;

- Implement dust abatement measures to minimize the impacts of vehicular and pedestrian traffic, construction and operation, and wind on exposed surface soils;
- Operators shall reduce visual impacts during construction by minimizing areas of surface disturbance, controlling erosion, using dust suppression techniques, and restoring exposed soils as closely as possible to their original contour and vegetation.
- Nighttime lighting will be limited to areas necessary for the safe operation of the project and, where applicable, will include motion sensors to reduce nighttime lighting when not necessary.

### **Noise**

- Proponents of a geothermal energy development project shall 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.
- Whenever reasonably possible, geothermal well drilling or major facility construction operations should be restricted to non-sleeping hours (7:00 am to 10:00 pm).
- All equipment shall have sound-control devices no less effective than those provided on the original equipment. All construction equipment used shall be adequately muffled and maintained.
- All stationary construction equipment (i.e., compressors and generators) shall be located as far as practicable from nearby residences.
- If blasting or other noisy activities are required during the construction period, nearby residents shall be notified in advance.

### **Health and Safety**

- Any equipment installed for site monitoring and testing shall be inspected periodically for structural integrity.
- Operators shall 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 shall identify all hazardous materials that would be used, stored, or transported at the site. It shall establish inspection procedures, storage requirements, storage quantity limits, inventory control, nonhazardous product substitutes, and disposition of excess materials. The plan shall also identify requirements for notices to federal and local emergency response authorities and include emergency response plans.
- Operators shall 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 shall address all solid and liquid wastes that may be generated at the site.

- Operators shall 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 shall 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 shall be developed to protect both workers and the general public during construction and operation of geothermal projects.
- Regarding occupational health and safety, the program shall 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 shall 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 shall be established.
- Regarding public health and safety, the health and safety program shall 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 shall identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or rehabilitation activities. It shall 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 shall 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) shall be identified and addressed in the traffic management plan.
- Operators shall develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.
- Secondary containment shall be provided for all on-site hazardous materials and waste storage, including fuel. In particular, fuel storage (for construction vehicles and equipment) shall be a temporary activity occurring only for as long as is needed to support construction activities.
- Wastes shall be properly containerized and removed periodically for disposal at appropriate off-site permitted disposal facilities.
- Hydrogen sulfide (H<sub>2</sub>S) emissions would be abated, for example, through the injection of hydrogen peroxide and sodium hydroxide into the test line.
- Dust emissions from well testing would be reduced by injecting water into the test line.
- In the event of an accidental release to the environment, the operator shall document the event, including a root cause analysis, appropriate corrective actions taken, and a characterization of the resulting environmental or health and safety impacts. Documentation of the event shall be provided to the BLM authorized officer and other federal and state agencies, as required.
- Any wastewater generated in association with temporary, portable sanitary facilities shall be periodically removed by a licensed hauler and introduced into an existing municipal sewage treatment facility. Temporary, portable sanitary facilities provided for construction crews shall be adequate to support expected on-site personnel and shall be removed at completion of construction activities.
- Temporary fencing shall be installed around staging areas, storage yards, and excavations during construction to limit public access.

### PHASE 3: UTILIZATION

#### General

- Existing roads shall be used to the maximum extent feasible. If new roads are necessary, they shall be designed and constructed to the appropriate standard.
- Available information describing the environmental and sociocultural conditions in the vicinity of the proposed project shall be collected and reviewed as needed to predict potential impacts of the project.
- The project shall be planned to utilize existing roads and utility corridors to the maximum extent feasible, and to minimize the number and length/size of new roads, lay-down areas, and borrow areas.
- A monitoring program shall be developed to ensure that environmental conditions are monitored during the well drilling, testing, and construction phases. The monitoring program requirements, including adaptive management strategies, shall be established at the project level to ensure that potential adverse impacts of geothermal development are mitigated. The monitoring program shall identify the monitoring requirements for each 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 standard operating procedures and BMPs.
- “Good housekeeping” procedures shall be developed to ensure that during operation the site will be kept clean of debris, garbage, fugitive trash or waste, and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards.
- All control and mitigation measures established for the project in the operation plan and the resource-specific management plans that are part of the operation plan shall be maintained and implemented throughout construction and operation of the project, as appropriate.
- Existing sites shall be used in preference to new sites.
- Site monitoring protocols defined in the operation plan shall be implemented. These will incorporate monitoring program observations and additional mitigation measures into standard operating procedures and BMPs to minimize future environmental impacts.
- Results of monitoring program efforts shall be provided to the BLM authorized officer.

- Operators shall identify unstable slopes and local factors that can induce slope instability (such as groundwater conditions, precipitation, earthquake activities, slope angles, and the dip angles of geologic strata). Operators also shall avoid creating excessive slopes during excavation and blasting operations. Special construction techniques shall be used where applicable in areas of steep slopes, erodible soil, and stream channel crossings.

#### **Land Use, Recreation, and Special Designations**

- The Secretary of Agriculture's rules and regulations must be complied with 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.
- To plan for efficient use of the land, necessary infrastructure requirements shall be consolidated wherever possible, and current transmission and market access shall be evaluated carefully.
- 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).
- A transportation plan shall be developed, particularly for the transport of power plant components, main assembly cranes, and other large pieces of equipment. The plan shall consider specific object sizes, weights, origin, destination, and unique handling requirements and shall evaluate alternative transportation approaches. In addition, the process to be used to comply with unique state requirements and to obtain all necessary permits shall be clearly identified.
- A traffic management plan shall 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 shall 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.
- Existing roads shall be used, but only if in safe and environmentally sound locations. If new roads are necessary, they shall be designed and constructed to the appropriate standard and be no higher than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles).

- Excessive grades on roads, road embankments, ditches, and drainages shall be avoided, especially in areas with erodible soils. Special construction techniques shall be used, where applicable. Abandoned roads and roads that are no longer needed shall be recontoured and revegetated.
- Access roads and on-site roads shall be surfaced with aggregate materials, wherever appropriate.
- Access roads shall be located to follow natural contours and minimize side hill cuts.
- Roads shall be designed so that changes to surface water runoff are avoided and erosion is not initiated.
- Road use shall be restricted during the wet season if road surfacing is not adequate to prevent soil displacement, rutting, etc., and resultant stream sedimentation.
- Potential soil erosion shall be controlled at culvert outlets with appropriate structures. Catch basins, roadway ditches, and culverts shall be cleaned and maintained regularly.
- Project personnel and contractors shall 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 airborne dust.
- Traffic shall be restricted to the roads developed for the project. Use of other unimproved roads shall be restricted to emergency situations.
- Signs shall be placed along construction roads to identify speed limits, travel restrictions, and other standard traffic control information. To minimize impacts on local commuters, consideration shall be given to limiting construction vehicles traveling on public roadways during the morning and late afternoon commute time.
- Signs directing vehicles to alternative park access and parking would be posted in the event construction temporarily obstructs recreational parking areas near trailheads.
- Whenever active work is being performed, the area would be posted with “construction ahead” signs on any adjacent access roads or trails that might be affected.
- Whenever possible, construction activities would be avoided during high recreational use periods.
- Operators shall 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) shall be identified and addressed in the traffic management plan;

- Access roads shall be located to minimize stream crossings. All structures crossing streams shall be located and constructed so that they do not decrease channel stability or increase water velocity. Operators shall obtain all applicable federal and state permits.
- Stream crossings on newly constructed roads should be designed to handle a 100 year flood event, and also provide for fish passage.
- Existing drainage systems shall not be altered, especially in sensitive areas such as erodible soils or steep slopes.
- Roads shall be located away from drainage bottoms and avoid wetlands, if practicable.

#### **Geologic Resources and Seismic Setting**

- A detailed geotechnical analysis would be performed prior to the construction of any structures; so they could 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).

#### **Paleontological Resources**

- Operators shall 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 shall be developed. This plan shall include a mitigation plan for collection of the fossils; mitigation could include 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 could be required during all excavation and earthmoving in the sensitive area. A report shall be prepared documenting these activities. The paleontological resources management plan also shall (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.

- Unexpected discovery of cultural or paleontological resources during construction shall be brought to the attention of the responsible BLM authorized officer immediately. Work shall 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.

#### **Soil Resources**

- Foundations and trenches shall be backfilled with originally excavated material as much as possible. Excess excavation materials shall be disposed of only in approved areas or, if suitable, stockpiled for use in reclamation activities.
- Borrow material shall be obtained only from authorized and permitted sites.

#### **Water Resources**

- Operators shall 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 shall gain a clear understanding of the local hydrogeology. Areas of groundwater 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.

#### **Air Quality and Climate**

The following BMPs would be incorporated into lease terms to minimize air quality impacts from fugitive dust:

- The area disturbed by construction and operation of a geothermal energy development project (i.e., footprint) shall be kept to a minimum by centralizing operation facilities.
- The number and size/length of roads, temporary fences, lay-down areas, and borrow areas shall be minimized.
- Topsoil from all excavations and construction activities shall be salvaged and reapplied during reclamation.
- All areas of disturbed soil shall be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities shall be undertaken as early as possible on disturbed areas.
- All electrical collector lines shall be buried in a manner that minimizes additional surface disturbance (e.g., along roads or other

paths of surface disturbance). Overhead lines may be used in cases where burial of lines would result in further habitat disturbance.

- Erosion controls that comply with county, state, and federal standards shall be applied. Practices such as jute netting, silt fences, and check dams shall be applied near disturbed areas.
- Dust abatement techniques shall be used on unpaved, unvegetated surfaces to minimize airborne dust.
- Speed limits (e.g., 25 mph [40 kph]) shall be posted and enforced to reduce airborne fugitive dust.
- Construction materials and stockpiled soils shall be covered if they are a source of fugitive dust.
- Dust abatement techniques shall be used before and during surface clearing, excavation, or blasting activities.

For managing diesel exhaust, each individual project proponent should be required to prepare and submit to the BLM an Equipment Emissions Mitigation Plan. Requirements for emissions controls should be incorporated into the lease terms for individual geothermal leases. 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 should apply to all lands authorized for lease and should 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.

### **Vegetation and Fish and Wildlife**

- Installation of any equipment or well drilling shall be scheduled to avoid disruption of wildlife reproductive activities or other important behaviors.
- Operators shall review existing information on species and habitats in the vicinity of the project area to identify potential concerns.
- A habitat restoration plan shall be developed to avoid (if possible), minimize, or mitigate negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. The plan shall identify revegetation, soil stabilization, and erosion reduction measures that shall be implemented to ensure that all temporary use areas are restored. The plan shall 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.
- Existing roads should be used to the maximum extent feasible to access a proposed project area.
- If new access roads are necessary, they should be designed and constructed to the appropriate standard.
- Existing or new roads should be maintained to the condition needed for facility use.
- The area disturbed during exploration and development (i.e., temperature gradient wells, well pads, roadways) should be minimized.
- Drill pads should not be located in or near sensitive habitats or in areas where vegetation or important habitats are known to be sensitive to human activities.
- Mitigation measures should be considered during planning and design to ensure that the siting of geothermal projects and associated roadways and structures do not result in unacceptable impacts on important habitats.
- Operators should 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 facility should follow appropriate guidance and requirements from the BLM, FS, and other resource agencies, as available and applicable.
- 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.

- The operators should conduct surveys for federal- and state-protected species and other species of concern within the project area.
- The project should be planned to avoid (if possible), minimize, or mitigate impacts on wildlife and habitat.
- Habitat disturbance should be minimized by locating facilities such as pipelines and access roads in previously disturbed areas (i.e., locate transmission lines within or adjacent to existing powerline corridors).
- Existing roads and utility corridors should be used to the maximum extent feasible.
- New access roads and utility corridors should be configured to avoid high-quality habitats and minimize habitat fragmentation.
- Site access roads and utility corridors should minimize stream crossings.
- Power lines should be configured to minimize the potential for electrocution of birds by following established guidelines (e.g., APLIC 1996; APLIC and USFWS 2005).
- Where applicable, the extent of habitat disturbance should be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.
- Erosion controls that comply with county, state, and federal standards should be applied. Practices such as jute netting, silt fences, and check dams should be applied near disturbed areas.
- All areas of disturbed soil should be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities should be undertaken as early as possible on disturbed areas.
- Dust abatement techniques should be used on unpaved, unvegetated surfaces to minimize airborne dust.
- Construction materials and stockpiled soil should be covered if they are a source of fugitive dust.
- Erosion and fugitive dust control measures should be inspected and maintained regularly.
- All refueling should occur in a designated fueling area that includes a temporary berm to limit the spread of any spill.
- Drip pans should be used during refueling to contain accidental releases.
- Drip pans should be used under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.

- Access roads and newly established utility and transmission line corridors should be monitored regularly for invasive species establishment, and weed control measures should be initiated immediately upon evidence of invasive species introduction.
- Fill materials that originate from areas with known invasive vegetation problems should not be used.
- Certified weed-free mulch should be used when stabilizing areas of disturbed soil.
- Habitat restoration activities and invasive vegetation monitoring and control activities should be initiated as soon as possible after construction activities are completed.
- All areas of disturbed soil should be reclaimed using weed-free native shrubs, grasses, and forbs.
- Pesticide use should be limited to nonpersistent, immobile pesticides and should only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- Spills should be immediately addressed per the appropriate spill management plan, and soil cleanup and removal should be initiated, if needed.
- Access roads, utility and transmission line corridors, and geothermal plant sites should be monitored regularly for invasive species establishment, and weed control measures should be initiated immediately upon evidence of invasive species introduction.
- 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.
- BMPs to avoid or minimize the possibility of the unintentional take of migratory birds should be applied to all practices and projects. Practices should be applied to provide long-term benefits and improved vegetation community condition. If the proposed project or action does have the potential to impact migratory bird species populations which have been identified as occurring within the project or action area, evaluate options to mitigate the project to minimize or eliminate the identified impacts during periods of concentrated nesting activity. Appropriate BMPs include:
  - a. Minimize/avoid impacts to nesting migratory birds by imposing a Timing Limitation on use authorizations to mitigate vegetative disturbing activities during the primary portion of the nesting season.

Most migratory birds nest between May 15 to July 15, but dates should be adjusted for the species and environmental conditions. Timing limitations may be modified based upon the species affected and the timing or intensity of breeding activity of the species of Birds of Conservation Concern involved.

- b. Where disturbance cannot be avoided, the scale and the length of time of disturbance may be considered mitigating circumstances.
  - c. Inspect and clear an area for migratory bird nesting. These clearances could be performed by qualified personnel. Factors to weigh in considering this option include vegetation type, vegetation density, timing and cost.
  - d. Explore opportunities to replace and prioritize habitat and habitat changes on or off site based upon the needs of Birds of Conservation Concern.
- Operators shall 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 shall 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 shall be required. If trucks and construction equipment are arriving from locations with known invasive vegetation problems, a controlled inspection and cleaning area shall 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.
  - Should a development or occupancy and use site have invasive plant infestations prior to development or use, proponents should confer with the land administrator to develop an invasive plant treatment plan to eliminate and/or prevent the propagation of the species.
  - If pesticides are used on the site, an integrated pest management plan shall 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.
  - Pesticide use shall be limited to nonpersistent, immobile pesticides and shall only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

- All electrical collector lines shall be buried in a manner that minimizes additional surface disturbance (e.g., along roads or other paths of surface disturbance). Overhead lines may be used in cases where burial of lines would result in further habitat disturbance.
- Explosives shall be used only within specified times and at specified distances from sensitive wildlife or streams and lakes, as established by the BLM or other federal and state agencies.

#### **Wild Horse and Burros**

- Employees, contractors, and site visitors shall be instructed to avoid harassment and disturbance of wild horses and burros, especially during reproductive (e.g., breeding and birthing) seasons. In addition, any pets shall be controlled to avoid harassment and disturbance of wild horses and burros.
- Observations of potential problems regarding wild horses or burros, including animal mortality, shall be reported to the authorized officer immediately.

#### **Livestock Grazing**

- Dust control measures would reduce impacts on livestock forage during construction and demolition activities;
- Development should minimize the number of structures required;
- Utility cables should be buried, where feasible; and
- Litter and noxious weeds should be controlled and removed regularly during construction and operation.

#### **Cultural Resources**

- Unexpected discovery of cultural or paleontological resources during construction shall be brought to the attention of the responsible BLM authorized officer immediately. Work shall 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.
- 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) shall be developed. This plan shall 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 shall be prepared documenting these activities. The CRMP also shall (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).

### **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 shall evaluate the potential visual impacts to the trail associated with the proposed

project and identify appropriate mitigation measures for inclusion as stipulations in the operation plan.

### **Visual Resources**

- Implement a Visual Resource Protection Program. The purpose of the program is to establish the criteria and methodologies to manage visual resource protection measures throughout the life of a project (from design, construction, and operation of the project through reclamation). The program would be implemented as a part of the project design criteria and mitigation measures for the project through the Record of Decision. The objectives of the program would be to prevent adverse visual impacts whenever possible, reduce the severity and extent of the adverse impacts that cannot be prevented, and rehabilitate adverse effects.
- The applicant shall include and identify a VRM specialist with demonstrated qualified credentials (e.g., licensed landscape architect) as a part of the planning team for evaluating visual resource issues and opportunities for siting options of project facilities.
- VRM treatments are to be fully integrated into the overall site development program and construction documents, including but not limited to, revegetation plans, supplemental watering plans, vegetation thinning/feathering plans, contour grading plans that quantify and provide means for measuring compliance with VRM objectives and mitigation commitments.
- The contrast rating procedures described within BLM Handbook H-843 I-I, Visual Resource Contrast Rating are to be followed for proposed activities within VRM Class I, II, and III areas.
- For proposed projects within VRM Class I, II, and III, develop suitable geo-reference terrain data covering the project area and the full context of viewshed adequate for designing and evaluating visual impacts of the proposed activities using cadd, 3-D GIS modeling, and visualization software.
- Perform evaluation using electronic 3-dimensional modeling and design capability and visual simulation tools.
- All evaluations shall also be field verified.
- Proposals determined to be out of compliance will need to be mitigated until demonstrated to be in compliance.

- Mitigation plans demonstrating VRM class objective compliance need to quantify mitigation activities and be field measurable during construction and post-project completion.
- A VRM mitigation monitoring and compliance checking strategy shall be included in the mitigation plan with activities monitored and maintained through life of the project.
- VRM best management practices may need to extend beyond the project boundary lending to additional modification to the landscape in order to fully integrate the facilities visually into the viewshed and meet VRM objectives. These modifications may require EA/EIS level analysis along with the other resource considerations and project activities. Early identification of VRM measures will help facilitate impact disclosure.
- BLM/ USFS landscape architects shall be consulted before construction begins to coordinate on VRM mitigation strategy that may include treatments to occur early in construction such as project edge treatments by thinning and feathering vegetation, enhanced contour grading, salvaging landscape materials from within construction areas, etc. Proponents will coordinate in advance to have BLM/ USFS landscape architects on site during construction to work with implementing BMPs.
- 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 possible, 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.
- 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 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.
- If topsoil piles are necessary, stage them out of sight of sensitive viewing areas.
- Where feasible, remove excess cut and fill from the site to minimize ground disturbance and impacts from fill piles.
- Bury utility cables 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.
- The BLM will consider the visual resource values of the public lands involved in proposed projects, consistent with BLM Visual Resource Management (VRM) policies and guidance.
- The public shall be involved and informed about the visual site design elements of the proposed geothermal energy facilities. Possible approaches include conducting public forums for disseminating information, offering organized tours of operating geothermal developments, and using computer simulation and visualization techniques in public presentations.
- The BLM will work with the applicant to 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. Power plants would be sited using terrain to obstruct visual impacts to the extent possible. Design elements would also include nonreflective paints, and prohibition of commercial messages on structures.
- Other site design elements shall be integrated with the surrounding landscape. Elements to address include minimizing the profile of the ancillary structures, burial of cables, prohibition of commercial symbols, and lighting. Regarding lighting, efforts shall be made to minimize the need for and amount of lighting on ancillary structures. Where practical, wells should be co-located to reduce road, pad and utility surface area and tank batteries centralized.
- Minimize the number of structures required;
- Construct low-profile structures whenever possible to reduce structure visibility.
- Select and design materials and surface treatments to repeat or blend with landscape elements.
- Control litter and noxious weeds and remove them regularly during construction and operation.
- Implement dust abatement measures to minimize the impacts of vehicular and pedestrian traffic, construction and operation, and wind on exposed surface soils.
- Operators shall reduce visual impacts during construction by minimizing areas of surface disturbance, controlling erosion, using

dust suppression techniques, and restoring exposed soils as closely as possible to their original contour and vegetation.

- Nighttime lighting will be limited to areas necessary for the safe operation of the project and, where applicable, will include motion sensors to reduce nighttime lighting when not necessary.

### **Noise**

- Proponents of a geothermal energy development project shall 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.
- The geothermal plants would be sited using terrain to further shield noise impacts to the greatest extent possible.
- Whenever reasonably possible, geothermal well drilling or major facility construction operations should be restricted to non-sleeping hours (7:00 am to 10:00 pm).
- All equipment shall have sound-control devices no less effective than those provided on the original equipment. All construction equipment used shall be adequately muffled and maintained.
- All stationary construction equipment (i.e., compressors and generators) shall be located as far as practicable from nearby residences.
- If blasting or other noisy activities are required during the construction period, nearby residents shall be notified in advance.

### **Health and Safety**

- Operators shall 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 shall identify all hazardous materials that would be used, stored, or transported at the site. It shall establish inspection procedures, storage requirements, storage quantity limits, inventory control, nonhazardous product substitutes, and disposition of excess materials. The plan shall also identify requirements for notices to federal and local emergency response authorities and include emergency response plans.
- Operators shall 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 shall address all solid and liquid wastes that may be generated at the site.

- Operators shall 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 shall 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 shall be developed to protect both workers and the general public during construction and operation of geothermal projects.
- Regarding occupational health and safety, the program shall 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 shall 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 shall be established.
- Regarding public health and safety, the health and safety program shall 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 shall identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or rehabilitation activities. It shall 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 shall 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) shall be identified and addressed in the traffic management plan.

- The project shall be planned to minimize electromagnetic interference (EMI) (e.g., impacts to radar, microwave, television, and radio transmissions) and comply with Federal Communications Commission [FCC] regulations. Signal strength studies shall be conducted when proposed locations have the potential to impact transmissions. Potential interference with public safety communication systems (e.g., radio traffic related to emergency activities) shall be avoided.
- Operators shall develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.
- Secondary containment shall be provided for all on-site hazardous materials and waste storage, including fuel. In particular, fuel storage (for construction vehicles and equipment) shall be a temporary activity occurring only for as long as is needed to support construction activities.
- Wastes shall be properly containerized and removed periodically for disposal at appropriate off-site permitted disposal facilities.
- Hydrogen sulfide (H<sub>2</sub>S) emissions would be abated, for example, through the injection of hydrogen peroxide and sodium hydroxide into the test line.
- Dust emissions from well testing would be reduced by injecting water into the test line.
- In the event of an accidental release to the environment, the operator shall document the event, including a root cause analysis, appropriate corrective actions taken, and a characterization of the resulting environmental or health and safety impacts. Documentation of the event shall be provided to the BLM authorized officer and other federal and state agencies, as required.
- Any wastewater generated in association with temporary, portable sanitary facilities shall be periodically removed by a licensed hauler and introduced into an existing municipal sewage treatment facility. Temporary, portable sanitary facilities provided for construction crews shall be adequate to support expected on-site personnel and shall be removed at completion of construction activities.
- Temporary fencing shall be installed around staging areas, storage yards, and excavations during construction to limit public access.
- Permanent fencing shall be installed and maintained around electrical substations, and facility access doors shall be locked to limit public access.

## **PHASE 4: RECLAMATION AND ABANDONMENT**

### **General**

- Existing roads shall be used to the maximum extent feasible. If new roads are necessary, they shall be designed and constructed to the appropriate standard.
- “Good housekeeping” procedures shall be developed to ensure that during operation the site will be kept clean of debris, garbage, fugitive trash or waste, and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards.
- All control and mitigation measures established for the project in the operation plan and the resource-specific management plans that are part of the operation plan shall be maintained and implemented throughout construction and operation of the project, as appropriate.
- Existing sites shall be used in preference to new sites.
- Site monitoring protocols defined in the operation plan shall be implemented. These will incorporate monitoring program observations and additional mitigation measures into standard operating procedures and BMPs to minimize future environmental impacts.
- Results of monitoring program efforts shall be provided to the BLM authorized officer.
- Operators shall identify unstable slopes and local factors that can induce slope instability (such as groundwater conditions, precipitation, earthquake activities, slope angles, and the dip angles of geologic strata). Operators also shall avoid creating excessive slopes during excavation and blasting operations. Special construction techniques shall be used where applicable in areas of steep slopes, erodible soil, and stream channel crossings.
- Prior to the termination of the ROW authorization, a decommissioning plan shall be developed and approved by the BLM. The decommissioning plan shall include a site reclamation plan and monitoring program.
- All management plans, BMPs, and stipulations developed for the construction phase shall be applied to similar activities during the decommissioning phase.
- All structures shall be removed from the site.

### **Land Use, Recreation, and Special Designations**

- 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).

- A traffic management plan shall 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 shall 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.
- Existing roads shall be used, but only if in safe and environmentally sound locations. If new roads are necessary, they shall be designed and constructed to the appropriate standard and be no higher than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles).
- Excessive grades on roads, road embankments, ditches, and drainages shall be avoided, especially in areas with erodible soils. Special construction techniques shall be used, where applicable. Abandoned roads and roads that are no longer needed shall be recontoured and revegetated.
- Access roads and on-site roads shall be surfaced with aggregate materials, wherever appropriate.
- Access roads shall be located to follow natural contours and minimize side hill cuts.
- Roads shall be designed so that changes to surface water runoff are avoided and erosion is not initiated.
- Road use shall be restricted during the wet season if road surfacing is not adequate to prevent soil displacement.
- Potential soil erosion shall be controlled at culvert outlets with appropriate structures. Catch basins, roadway ditches, and culverts shall be cleaned and maintained regularly.
- Project personnel and contractors shall 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 airborne dust.
- Traffic shall be restricted to the roads developed for the project. Use of other unimproved roads shall be restricted to emergency situations.
- Signs shall be placed along construction roads to identify speed limits, travel restrictions, and other standard traffic control

information. To minimize impacts on local commuters, consideration shall be given to limiting construction vehicles traveling on public roadways during the morning and late afternoon commute time.

- Signs directing vehicles to alternative park access and parking would be posted in the event construction temporarily obstructs recreational parking areas near trailheads.
- Whenever active work is being performed, the area would be posted with “construction ahead” signs on any adjacent access roads or trails that might be affected.
- Whenever possible, construction activities would be avoided during high recreational use periods.
- Operators shall 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) shall be identified and addressed in the traffic management plan;
- Access roads shall be located to minimize stream crossings. All structures crossing streams shall be located and constructed so that they do not decrease channel stability or increase water velocity. Operators shall obtain all applicable federal and state permits.
- Stream crossings on newly constructed roads should be designed to handle a 100 year flood event, and also provide for fish passage.
- Existing drainage systems shall not be altered, especially in sensitive areas such as erodible soils or steep slopes.
- Roads shall be located away from drainage bottoms and avoid wetlands, if practicable.

### **Paleontological Resources**

- Unexpected discovery of cultural or paleontological resources during construction shall be brought to the attention of the responsible BLM authorized officer immediately. Work shall 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.

### **Soil Resources**

- Foundations and trenches shall be backfilled with originally excavated material as much as possible. Excess excavation materials shall be disposed of only in approved areas or, if suitable, stockpiled for use in reclamation activities.

- Borrow material shall be obtained only from authorized and permitted sites.
- Topsoil from all decommissioning activities shall be salvaged and reapplied during final reclamation.

#### **Water Resources**

- Operators shall 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.

#### **Air Quality and Climate**

The following BMPs would be incorporated into lease terms to minimize air quality impacts from fugitive dust:

- The number and size/length of roads, temporary fences, lay-down areas, and borrow areas shall be minimized.
- Topsoil from all excavations and construction activities shall be salvaged and reapplied during reclamation.
- All areas of disturbed soil shall be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities shall be undertaken as early as possible on disturbed areas.
- Erosion controls that comply with county, state, and federal standards shall be applied. Practices such as jute netting, silt fences, and check dams shall be applied near disturbed areas.
- Dust abatement techniques shall be used on unpaved, unvegetated surfaces to minimize airborne dust.
- Speed limits (e.g., 25 mph [40 kph]) shall be posted and enforced to reduce airborne fugitive dust.
- Construction materials and stockpiled soils shall be covered if they are a source of fugitive dust.
- Dust abatement techniques shall be used before and during surface clearing, excavation, or blasting activities.

For managing diesel exhaust, each individual project proponent should be required to prepare and submit to the BLM an Equipment Emissions Mitigation Plan. Requirements for emissions controls should be incorporated into the lease terms for individual geothermal leases. 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 should apply to all lands authorized for lease and should 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.

#### **Vegetation and Fish and Wildlife**

- Operators shall review existing information on species and habitats in the vicinity of the project area to identify potential concerns.
- A habitat restoration plan shall be developed to avoid (if possible), minimize, or mitigate negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. The plan shall identify revegetation, soil stabilization, and erosion reduction measures that shall be implemented to ensure that all temporary use areas are restored. The plan shall 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.
- Existing roads should be used to the maximum extent feasible to access a proposed project area.
- If new access roads are necessary, they should be designed and constructed to the appropriate standard.
- Existing or new roads should be maintained to the condition needed for facility use.
- Existing roads and utility corridors should be used to the maximum extent feasible.
- New access roads and utility corridors should be configured to avoid high-quality habitats and minimize habitat fragmentation.

- Site access roads and utility corridors should minimize stream crossings.
- Where applicable, the extent of habitat disturbance should be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.
- Erosion controls that comply with county, state, and federal standards should be applied. Practices such as jute netting, silt fences, and check dams should be applied near disturbed areas.
- All areas of disturbed soil should be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities should be undertaken as early as possible on disturbed areas.
- Dust abatement techniques should be used on unpaved, unvegetated surfaces to minimize airborne dust.
- Construction materials and stockpiled soil should be covered if they are a source of fugitive dust.
- Erosion and fugitive dust control measures should be inspected and maintained regularly.
- All refueling should occur in a designated fueling area that includes a temporary berm to limit the spread of any spill.
- Drip pans should be used during refueling to contain accidental releases.
- Drip pans should be used under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.
- Access roads and newly established utility and transmission line corridors should be monitored regularly for invasive species establishment, and weed control measures should be initiated immediately upon evidence of invasive species introduction.
- Fill materials that originate from areas with known invasive vegetation problems should not be used.
- Certified weed-free mulch should be used when stabilizing areas of disturbed soil.
- Habitat restoration activities and invasive vegetation monitoring and control activities should be initiated as soon as possible after construction activities are completed.
- All areas of disturbed soil should be reclaimed using weed-free native shrubs, grasses, and forbs.
- Pesticide use should be limited to nonpersistent, immobile pesticides and should only be applied in accordance with label and

application permit directions and stipulations for terrestrial and aquatic applications.

- Spills should be immediately addressed per the appropriate spill management plan, and soil cleanup and removal should be initiated, if needed.
- Access roads, utility and transmission line corridors, and geothermal plant sites should be monitored regularly for invasive species establishment, and weed control measures should be initiated immediately upon evidence of invasive species introduction.
- 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.
- BMPs to avoid or minimize the possibility of the unintentional take of migratory birds should be applied to all practices and projects. Practices should be applied to provide long-term benefits and improved vegetation community condition. If the proposed project or action does have the potential to impact migratory bird species populations which have been identified as occurring within the project or action area, evaluate options to mitigate the project to minimize or eliminate the identified impacts during periods of concentrated nesting activity. Appropriate BMPs include:
  - a. Minimize/avoid impacts to nesting migratory birds by imposing a Timing Limitation on use authorizations to mitigate vegetative disturbing activities during the primary portion of the nesting season.

Most migratory birds nest between May 15 to July 15, but dates should be adjusted for the species and environmental conditions. Timing limitations may be modified based upon the species affected and the timing or intensity of breeding activity of the species of Birds of Conservation Concern involved.
  - b. Where disturbance cannot be avoided, the scale and the length of time of disturbance may be considered mitigating circumstances.
  - c. Inspect and clear an area for migratory bird nesting. These clearances could be performed by qualified personnel. Factors to weigh in considering this option include vegetation type, vegetation density, timing and cost.
  - d. Explore opportunities to replace and prioritize habitat and habitat changes on or off site based upon the needs of Birds of Conservation Concern.

- Operators shall 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 shall 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 shall be required. If trucks and construction equipment are arriving from locations with known invasive vegetation problems, a controlled inspection and cleaning area shall 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 shall 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.
- Pesticide use shall be limited to nonpersistent, immobile pesticides and shall only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- Explosives shall be used only within specified times and at specified distances from sensitive wildlife or streams and lakes, as established by the BLM or other federal and state agencies.
- All areas of disturbed soil shall be reclaimed using weed-free native shrubs, grasses, and forbs.
- The vegetation cover, composition, and diversity shall be restored to values commensurate with the ecological setting.

#### **Wild Horse and Burros**

- Employees, contractors, and site visitors shall be instructed to avoid harassment and disturbance of wild horses and burros, especially during reproductive (e.g., breeding and birthing) seasons. In addition, any pets shall be controlled to avoid harassment and disturbance of wild horses and burros.
- Observations of potential problems regarding wild horses or burros, including animal mortality, shall be reported to the authorized officer immediately.

#### **Livestock Grazing**

- Dust control measures would reduce impacts on livestock forage during construction and demolition activities;

- Development should minimize the number of structures required;
- Litter and noxious weeds should be controlled and removed regularly during construction and operation.

### **Cultural Resources**

- Unexpected discovery of cultural or paleontological resources during construction shall be brought to the attention of the responsible BLM authorized officer immediately. Work shall 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.
- 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) shall be developed. This plan shall 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 shall be prepared documenting these activities. The CRMP also shall (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).

### **Visual Resources**

- During final reclamation reestablish visual composition and characteristics.
- Ensure the overall form, line, color, texture, scale, and location and orientation of major landscape features blends into the adjacent area and meets the needs of the planned post disturbance land use.
- The reclaimed landscape shall not result in a change in the Scenic Quality Rating of the area. See BLM Handbook H-8410 Visual Resource Inventory.
- The reclaimed landscape shall not generate a noticeable visual contrast when comparing it to the adjacent undisturbed landscape. See BLM Handbook H-8431, Visual Resource Contrast Rating.
- Control litter and noxious weeds and remove them regularly during construction and operation.

- Implement dust abatement measures to minimize the impacts of vehicular and pedestrian traffic, construction and operation, and wind on exposed surface soils.
- Nighttime lighting will be limited to areas necessary for the safe operation of the project and, where applicable, will include motion sensors to reduce nighttime lighting when not necessary.

### **Noise**

- Proponents of a geothermal energy development project shall 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.
- All equipment shall have sound-control devices no less effective than those provided on the original equipment. All construction equipment used shall be adequately muffled and maintained.
- All stationary construction equipment (i.e., compressors and generators) shall be located as far as practicable from nearby residences.
- If blasting or other noisy activities are required during the construction period, nearby residents shall be notified in advance.

### **Health and Safety**

- Operators shall 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 shall identify all hazardous materials that would be used, stored, or transported at the site. It shall establish inspection procedures, storage requirements, storage quantity limits, inventory control, nonhazardous product substitutes, and disposition of excess materials. The plan shall also identify requirements for notices to federal and local emergency response authorities and include emergency response plans.
- Operators shall 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 shall address all solid and liquid wastes that may be generated at the site.
- Operators shall 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 shall 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 shall be developed to protect both workers and the general public during construction and operation of geothermal projects.
- Regarding occupational health and safety, the program shall 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 shall 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 shall be established.
- Regarding public health and safety, the health and safety program shall 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 shall identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or rehabilitation activities. It shall 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 shall 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) shall be identified and addressed in the traffic management plan.
- Operators shall develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.

- Secondary containment shall be provided for all on-site hazardous materials and waste storage, including fuel. In particular, fuel storage (for construction vehicles and equipment) shall be a temporary activity occurring only for as long as is needed to support construction activities.
- Wastes shall be properly containerized and removed periodically for disposal at appropriate off-site permitted disposal facilities.
- In the event of an accidental release to the environment, the operator shall document the event, including a root cause analysis, appropriate corrective actions taken, and a characterization of the resulting environmental or health and safety impacts. Documentation of the event shall be provided to the BLM authorized officer and other federal and state agencies, as required.
- Any wastewater generated in association with temporary, portable sanitary facilities shall be periodically removed by a licensed hauler and introduced into an existing municipal sewage treatment facility. Temporary, portable sanitary facilities provided for construction crews shall be adequate to support expected on-site personnel and shall be removed at completion of construction activities.
- Temporary fencing shall be installed around staging areas, storage yards, and excavations during construction to limit public access.

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