

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter describes the expected environmental effects of the proposed action. The discussion focuses on those effects that could potentially be significant. This section also includes any necessary mitigation measures to lessen adverse impacts on the environmental resource of concern.

4.2 Air Quality

4.2.1 PROPOSED ACTION

Air Emissions During Well Pad and Access Road Construction Activities

Overview

The primary pollutant of concern during construction activities for the Proposed Action (i.e., the grading of well pads and roads and construction vehicle traffic) would be particulates in the form of fugitive dust. Fugitive dust emissions would be generated by ground-disturbing activities related to transport of workers and equipment to the site, road construction and well pad construction. Hydrogen sulfide emissions may be an issue during well testing, depending on the chemical composition of the geothermal resource.

Fugitive Dust

Air quality impacts from the construction activities at the well pads and access roads would be localized and temporary. Up to three well pads (including access roads) would be constructed at a time. Particulate concentrations in the vicinity of the project would increase on a short term basis. Construction when winds exceed approximately 9 miles per hour could further increase particulate matter in the air; however, the Plan of Exploration includes a dust suppression process by watering access roads and well pads to minimize localized increases in particulate matter concentrations. These measures would minimize fugitive dust emissions during construction. Other dust suppression methods, as suggested by the Nevada Division of Environmental Protection, Bureau

of Air Quality Planning would also be implemented as necessary, including using wind fencing and covering spoils piles with tarps, plastic, or other anchored coverings.

Combustion Emissions

Diesel combustion emissions would result from the construction equipment and any diesel-fueled vehicles used to access the project site. Combustion emissions of criteria air pollutants (nitrogen dioxide (NO₂), sulfur dioxide (SO₂), carbon monoxide (CO) and fine particulate matter (PM₁₀)), criteria air pollutant precursors (volatile organic compounds (VOCs)) and air toxics (small quantities of diesel PM, acetaldehyde, benzene, and formaldehyde) would be released during well pad and road construction from the diesel engines. Given the low background concentrations of criteria pollutants in the project area and the limited emissions from construction, the project would not exceed any of the federal or state air quality standards.

Air Emissions During Well Drilling and Testing Activities

Combustion Emissions

The principal pollutants and source during the proposed drilling activities are the products of combustion associated with the large bore diesel-powered engine(s) on the drill rig. Table 4.2-1 is a worst-case emissions scenario for large bore, stationary diesel engines based on estimated maximum daily fuel consumption at the well pads. Because of the variables in operating parameters of the engines, emissions are expected to be significantly lower than in the worst-case scenario. Drilling operations and engine use are highly variable over 24-hour periods. It is unlikely that maximum daily fuel consumption would be reached at any given point in time. Additional generators and pumps may be required for the project, but these small sources are not expected to have any sizeable impact on emissions. Mitigation has been included to require using diesel engines that meet US EPA Tier 1¹ Diesel Standard Emissions for any diesel engines over 37 kW (50 horse power) in size.

Additional emissions from mobile (vehicular) sources, both combustion emissions and fugitive particulate emissions, are expected. However, these increases would not be significant.

Combustion emissions would be localized and temporary, with particulate and gaseous criteria pollutant concentrations in the vicinity of the proposed project increasing on a short-term basis. Because of the low background criteria pollutant concentrations in the area and the limited nature of the drilling activities, none of the activities would exceed either federal or state ambient air quality standards. Air emissions during the drilling activities would not cause a significant adverse effect on air quality.

Hydrogen Sulfide and Other Emissions During Well Drilling and Testing Activities

Production of the geothermal fluid would result in the release of non-condensable gases to the atmosphere. The amount and ratio of the non-condensable gas constituents within the geothermal fluid are variable among geothermal resource areas and can be substantially different among individual wells within the same geothermal project area. However, the non-condensable gas

¹ The first federal standards (Tier 1) for new nonroad (or off-road) diesel engines were adopted in 1994 for engines over 37 kW (50 hp), to be phased-in from 1996 to 2000. In 1996, a Statement of Principles (SOP) pertaining to nonroad diesel engines was signed between EPA, California ARB and engine makers (including Caterpillar, Cummins, Deere, Detroit Diesel, Deutz, Isuzu, Komatsu, Kubota, Mitsubishi, Navistar, New Holland, Wis-Con, and Yanmar). On August 27, 1998, the EPA signed the final rule reflecting the provisions of the SOP. The 1998 regulation introduced Tier 1 standards for equipment under 37 kW (50 hp) and increasingly more stringent Tier 2 and Tier 3 standards for all equipment with phase-in schedules from 2000 to 2008. The Tier 1-3 standards are met through advanced engine design, with no or only limited use of exhaust gas after treatment (oxidation catalysts). Tier 3 standards for NOx+HC are similar in stringency to the 2004 standards for highway engines, however Tier 3 standards for PM were never adopted.

Table 4.2-1: Estimated Emissions from Large Bore Diesel Engines²

Air Pollutant	Emission Factor ³ (lbs/mmBTU)	Maximum Estimated Emissions	
		Hourly (lbs/hr)	24-hour (lbs/day)
Carbon Monoxide (CO)	0.085	4.83	116.47
Carbon Dioxide (CO ₂)	165.00	942.08	22,609.95
Total Organic Compounds (as Methane (CH ₄))	0.09	0.51	12.33
Oxides of Nitrogen (NO _x)	3.20	18.27	438.49
Particulate Matter ≤ 10 microns (PM ₁₀)	0.0573	0.33	7.85
Oxides of Sulfur (as Sulfur Dioxide (SO ₂))	0.0202	0.12	2.77

SOURCE: EPA 1996

content is typically comprised of carbon dioxide (CO₂) (usually accounting for about 95 to 98 percent of the total non-condensable gas content) with smaller amounts of methane (CH₄), hydrogen sulfide (H₂S), and trace amounts of ammonia (NH₃). Trace amounts of elements such as mercury (Hg) and arsenic (As) may be present. Emissions from the wells and test facilities would be transported and dispersed by wind away from the well pads.

The amounts of methane, ammonia and heavy metals would disperse from the project area. Emission of these constituents would only occur during flow testing, which could last up to 5 days per tested well. Emissions would not be adverse because of the short duration of testing and the small amounts of these constituents being released. Carbon dioxide is a greenhouse gas. Most of the non-condensable emissions from flow testing would be carbon dioxide. The State and federal government does not have standards for CO₂ emissions at this time. Emissions would be less than significant because they would occur over a short timeframe.

Of the non-condensable gas emissions anticipated from the geothermal fluid, the principal constituent of concern is hydrogen sulfide (H₂S). H₂S can be released from a well during drilling, and would be vented with the steam and non-condensable gases during flow-testing (if the well encounters a producible resource). H₂S is a colorless, non-condensable gas with a characteristic "rotten egg" odor. H₂S can pose a threat to human health at high concentrations. Nuisance odor is of primary public concern, since this distinctive odor can be easily detected at concentrations far below levels of health concern. The closest residences are within approximately 1,742 feet from the project site; a distance over which odors would dissipate.

H₂S is typically encountered during the production zone drilling phase. There is no federal air quality standard for H₂S. Nevada has adopted an hourly ambient air quality standard of 112 µg/m³ for H₂S (0.08 ppm) (NDEP BAPQ 2007). Emissions would be mitigated through the use of properly weighted drilling mud which is expected to keep the well from flowing during drilling. H₂S gas that may be entrained in the drilling mud and return with the drilling cuttings to the solid separation process is expected to be neutralized by the high pH of the mud system. Mitigation requires monitoring devices to be installed and operated during all phases of drilling and testing. Mitigation also requires an H₂S abatement plan be developed and implemented during long-term flow-testing

² Values based on the assumption that a maximum of 1000 gallons of low sulfur (0.02%) diesel oil fuel will be used, and that the average heating value of the fuel is 19,300 BTU per pound of fuel with a density of 7.1 pounds per gallon.

³ Source: U.S. EPA 1996.

if it becomes apparent during drilling operations that H₂S abatement is necessary to mitigate potential nuisance odors.

With monitoring and abatement, H₂S emissions would not cause adverse impacts.

Air Conformity

The project is not located within any non-attainment areas and would not exceed any conformity requirements as dictated in the Environmental Protection Agency's (EPA) rule "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (40 CFR 93, Subpart B). The project is not expected to contribute to any violation of federal ambient air quality standards.

Mitigation Measures

Mitigation Measure Air Quality-1: H₂S emissions shall be monitored during all phases of drilling and testing and the results reported to the BLM regularly. If the monitoring reveals emissions exceeding the Nevada ambient air quality standard, an H₂S abatement plan shall be developed and implemented. The abatement plan shall include additional control measures to ensure compliance with the emission limitation. Additional control measures could include, but would not be limited to, the following:

- Reduce the number of wells venting simultaneously, as applicable
- Implement additional wellhead abatement measures, such as caustic injection between the flash tank and the portable silencer

Mitigation Measure Air Quality-2: Vehicle speeds shall be minimized on exposed soils to 15 miles per hour (mph) to reduce fugitive dust generation from vehicle travel.

Mitigation Measure Air Quality-3: Diesel generators over 37 kW (50 horse power) shall be diesel-fired units manufactured after January 1996 that are certified to meet EPA Tier 1 Emission Standards and are equipped with an exhaust particulate filter system.

4.2.2 ALTERNATIVE 1

Alternative 1 includes alternative well pad locations for B, C, and H. These well pads are within the same localized area as the proposed action and would be constructed and wells would be drilled in the same manner. Air Quality impacts would be the same as for the proposed action.

Mitigation measures required for Alternative 1 would be the same as for the proposed action.

4.2.3 NO ACTION ALTERNATIVE

The No Action Alternative would result in no action being taken. There would be no impacts to air quality in the area from this project because the project would not commence. The No Action Alternative; however, could preclude the possibility of geothermal power generation at the site, which is a cleaner alternative to coal and fossil fuel burning. Loss of potential alternative energy sources has a negative impact on air quality. The No Action Alternative could result in additional fossil fuel combustion emissions at another location.

4.3 Biological Resources

4.3.1 PROPOSED ACTION

Vegetation

Most pad and access road construction would have temporary impacts to vegetation. Constructing well pads and access roads would remove an average of 2.3 acres of vegetation per site for the period of construction, drilling, and testing (about 2.06 acres per pad and 0.22 acres per access road). The vegetation that would be cleared does not provide high quality habitat for wildlife. Much of the area has a history of disturbance or is being used as grazing lands and is therefore highly disturbed.

Each pad would be reclaimed after drilling and testing if no commercially viable resource is found. Reclamation would include restoring grade, and placing the stockpiled topsoil (if any was salvaged during construction) back over the well pad. A diverse perennial seed mix certified as being free of noxious weed materials would be used to seed the areas, if the well pad and access road needs to be re-vegetated. Reclamation would have a beneficial impact on vegetation.

Well pads found commercially viable or viable as an injection well would not be reclaimed; however, due to the low quality of the dominant vegetative community affected and its abundance in surrounding areas, impacts to vegetation from the proposed project would not be adverse.

The best habitat found in the project area is the riparian areas found in association with the canals and Grimes Slough. None of these riparian or wetland communities would be affected by the proposed project.

Wildlife

The project area supports limited habitat for many Great Basin wildlife species. The project area has a low diversity and low density of wildlife species, limited primarily to rodents, voles, lagomorphs, lizards, and snakes. Some important game species, including mule deer and pronghorn antelope, could visit the project site periodically to forage or to migrate through the area.

Removal of vegetation for well pad and access road construction would likely displace common small mammals and reptiles; however, the surrounding habitat is plentiful and adequate to support these common Great Basin animals. Game species like mule deer, pronghorn sheep, and California quail would not be impacted by project activities due to the large availability of migrating habitat and similar foraging habitat in surrounding areas.

Several large pieces of equipment, as well as trucks, and worker vehicles would access the well pads. Vehicles could crush or injure terrestrial wildlife. Keeping vehicles at low speeds, as proposed by Ormat in the Plan of Exploration, would reduce the potential for vehicle-caused wildlife mortality. Some mortality of common species such as lizards and voles would not be considered a significant adverse impact due to the abundance of these species. Vehicles would not travel off-road.

Noise from construction, drilling, and testing would not cause impacts to wildlife as wildlife in the area is acclimated to loud noise. The project area is directly adjacent to the Fallon NAS runway (0.8 miles) and jet and plane noise reaches levels upwards of 90 decibels in the area (US Navy 1991).

The project would not result in adverse impacts to wildlife. No additional mitigation is necessary

Threatened, Endangered, Proposed for Listing, and Candidate Species

Federal Status Species

There are no federally listed threatened or endangered species that could occur in the project area. No mitigation is necessary.

Special Status Species

BLM Sensitive Species

Plants

Three special status plant species have a potential to occur in the project area. Nevada oryctes and Lahontan beardtongue have a low potential to occur and Nevada dune beardtongue has a higher potential. Constructing well pads and access roads would destroy any of these plants if they were present. Mitigation Measure Biology-1 requires performing surveys prior to ground disturbance to assure that these species are not present and avoiding the species if they are present. Mitigation Measures Biology-1 would reduce potential adverse impacts to less than significant levels.

Animals

Birds

The white-faced ibis would not be affected by the project. None of the proposed well pads or roadways is appropriate habitat for white-faced ibis. Suitable habitat for the ibis does occur both north and south of the project at the Stillwater Wildlife Refuge and in the wetland area surrounding Carson Lake; however, no activities would occur in these areas.

Long-billed curlew is not expected to nest within the project area, but may forage for insects onsite. This bird species is known to occur within the Carson Desert watershed. Project activities would not occur within nesting areas. Some foraging habitat may temporarily be removed through construction of pads; however, similar habitat surrounds the area and the species would likely forage elsewhere. Well pads would be approximately 2.06 acres in size, which represents only a small amount of foraging habitat. Adverse impacts to long-billed curlew would not occur.

Black tern may nest in the riparian vegetation surrounding the canals near some well pads and may forage at well pads. The closest pad to potential habitat is about 300 feet from Site G; however, Site G is already graded and doesn't provide much foraging habitat. This pad is also far enough away that noise should not impact any nesting birds. Temporary removal of some foraging habitat for pad construction would not be considered an adverse impact. Surrounding habitat is similar.

Swainson's hawk would not nest in the project area. There are no nesting trees within 1,000 feet of any well pads. Swainson's hawk may forage over project pads; however, temporary removal of some foraging habitat would not be adverse since similar habitat surrounds the project area.

Mammals

Western small-footed myotis, pallid bat, and western pipistrelle bat may forage in the area, but there are no roosts available for habitation. Foraging habitat would be only slightly altered, as very little vegetation would be removed in relation to the available foraging habitat in the region. Bats would not be adversely impacted by project activities. Bats would not likely roost in equipment as the equipment would be running 24 hours a day and would have constant occupancy. This disturbance would discourage roosting.

Invertebrates

The Nevada viceroy is likely to occur alongside the canals in the lease area. They may fly through the area but are not expected to be directly affected by project activities. Impacts would be less than significant.

Migratory Birds

Raptors would lose the cleared area of the project site as foraging habitat; however, this area represents only a small amount of available foraging habitat in the region. Raptors are very mobile predators that forage over several square miles in a day. The surrounding area provides ample foraging habitat for raptors in the area.

The project would not impact nesting birds either through direct disturbance or noise disturbance. There are no roosting or nesting trees within 1,000 feet of any of the proposed well pads. Ground nesting birds in the area are not known to nest on well pads, and effects related to nesting on well pads are not expected to occur (Kramer pers comm. 2007).

The proposed project-generated construction and drilling noise (estimated at an average 83 decibels (dBA) at a distance of 50 feet) could also keep some migratory birds away from areas with activities generating this noise (typically areas of new surface disturbance). Other indirect effects could result from general human activity, which could displace individuals or reduce breeding success of species that are sensitive to human activity. The indirect effects would be temporary and short-term, given the approximately one year life of the proposed project. In addition, migratory birds would be able to re-occupy the disturbed areas upon completion of these short-term operations, which would prevent residual impacts. Most well pads are at least 650 feet from existing water sources. The exception is for well pads on Navy managed lands. Site G is located about 300 feet from an unnamed waterway and Site A includes an access road about 250 feet from Grimes Slough Extension. Construction noise could displace raptors; however, there is no raptor nesting habitat in these waterways. Raptors would move to surrounding areas during the short construction period, if disturbed. Adverse impacts are expected to be less than significant.

Invasive, Non-Native Species

Project activities could contribute to the spread of invasive, nonnative species within the project area through surface disturbing activities and the number of construction and drilling vehicles involved. Ormat has committed to comply with special lease stipulations which require that seed mixtures used to re-vegetate disturbed areas be “weed free;” that an invasive, nonnative species control program consisting of monitoring and eradication for species listed on the Nevada Designated Noxious Weed List be implemented; and that all vehicles, heavy equipment, and the boots of operators and other persons working in the areas be cleaned by water before entering public lands to do work. Mitigation Measure Biology-2 requires continued monitoring and treatment of the well pads and access roads. The measure would reduce any adverse impacts to less than significant levels.

Mitigation Measures

Mitigation Measure Biology-1: A certified biologist shall do a site assessment prior to any project activities. If Nevada oryctes, Lahontan beardtongue, or Nevada dune beardtongue are found to be present, they shall be marked with fencing and flags and be avoided. If avoidance is not possible, the plant(s) shall be transplanted by a qualified biologist to an area adjacent to the area of construction, and marked with fencing and flags.

Mitigation Measure Biology-2: Monitoring and treatment of the well pads and access roads for invasive, non-native species shall be required for the duration of exploration. Any

weeds found in the roads or well pads would be removed completely and discarded in an appropriate manner.

4.3.2 ALTERNATIVE 1

Alternative 1 includes alternative well pads for sites B, C, and H. These well pads are within the same localized area as the proposed action and would be constructed and drilled in the same manner. The alternative sites have the same general habitat as the proposed action and there are no trees or wetlands in these areas.

Implementation of Alternative 1 would not result in significant adverse impacts to biological resources with the implementation of Mitigation Measures Biology-1.

4.3.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, the project would not be implemented. There would be no impacts to biological resources at the project site.

4.4 Geology and Soils

4.4.1 PROPOSED ACTION

Physiography and Topography

The existing topography in the areas of the proposed project is relatively flat with a few rolling hills that may present up to 10 feet of elevation change. Well pads would require cut and fill to level the pads, which would result in slight changes in topography. Well pads are roughly 2 acres in size. Changes would not be significant considering the relatively flat nature of the valley in which the project would occur. Access roads may also require some cut and fill but would not dramatically alter the existing topography.

Well pads and roads would be restored to natural conditions if the exploration wells do not demonstrate commercial value as geothermal production or injection wells. Reclamation would restore general grade; however, micro-topographic relief (i.e., small hills and mounds) may not be restored. The alteration would be unperceivable within the relatively flat topography of the area and no adverse impact is expected.

Geology

Slope Stability

The proposed well pads are all located within a generally flat area with only small topographic relief (small undulations of approximately 10 feet). Well pad construction, access, and well drilling would have no adverse effects on and would not be adversely affected by slope stability issues.

Subsidence

Land subsidence would not be expected to increase as a result of the proposed geothermal exploration activities. The limited volume of geothermal fluids produced during flow-testing, and the presence of competent volcanic bedrock overlaying the geothermal reservoir in the project vicinity preclude the likelihood of subsidence resulting from flow testing.

Well water withdrawal from a shallow aquifer would not cause land subsidence because only small quantities of water are needed relative to the overall aquifer size and pressure. NAS Fallon is permitted to withdraw 2 million gallons per day and has not experienced any subsidence.

No other action related to the project could cause subsidence; therefore, the project would not cause adverse impacts related to subsidence.

Seismicity

There are no mapped faults within the proposed project area. Numerous active faults are situated within the project region (see Figure 3.4-2). Churchill County is in Zone 4, the highest level zone of seismic hazard. The roads and pads would be compacted to minimize ground shaking impacts in the event of an earthquake during the exploration program. Some facilities such as portable equipment and outhouses may fall over but can be cleaned up easily after any such event. Hazardous materials are stored with 110 percent or greater containment in case of a spill during a seismic event. The well casing would not likely be affected by seismic ground shaking; however, if it were damaged in the unlikely event of an earthquake, it would be repaired and the well redrilled, as necessary. The likelihood of a large regional earthquake during the drilling program is very minimal. Adverse impacts are unlikely.

Microseismic events have been reported to be induced by the subsurface injection of large volumes of fluid under high pressure (Evans 1966). The proposed project would include the production of geothermal fluid from wells, but only short injectivity test are proposed. Given the relatively small amount of withdrawal for well testing, and the small amount of injection proposed, induction of microseismic events is unlikely.

Soils

Erosion

On-site soils at the proposed well pads and access roads have the highest potential for erosion from wind. The removal of groundcover during construction of each pad and access road would increase the potential for erosion by wind through exposure of denuded surfaces. The project includes best management practices to minimize driving speeds on access roads and to water sites to minimize wind erosion of denuded surfaces. Mitigation has been included to require covering top soil piles to minimize wind erosion and to further reduce traffic speeds on new access roads.

Low precipitation minimizes run-off erosion potential; however, mitigation measures have been included to require new roads to have appropriate drainage in conformance with BOR standards. Well pads would be constructed to prevent run-on, and run-off from drill pads would be directed to the on-site reserve pits. Adverse impacts are expected to be less than significant.

Mitigation Measures

Mitigation Measure Geology-1: A site drainage and runoff management plan shall be prepared. All new access roads will comply with the plan order to minimize erosion and off-site sedimentation.

Mitigation Measure Geology-2: Topsoil piles shall be covered to minimize wind erosion of dust during wind storms.

4.4.2 ALTERNATIVE 1

Alternative 1 includes alternative well pads for sites B, C, and H. These well pads are within the same localized area as the proposed action and would be constructed and wells would be drilled in the same manner. Geology impacts would be the same as for the proposed action.

Implementation of Alternative 1 would not result in significant adverse impacts to geology and soils with the implementation of Mitigation Measures Geology-1 and Geology-2.,

4.4.3. NO ACTION ALTERNATIVE

Under the No Action Alternative, the project would not be implemented. There would be no impacts to geology and soils.

4.5 Water Resources

4.5.1 PROPOSED ACTION

Water Resources

Geothermal Resource Withdrawal

The objective of the project is to encounter and test a deep geothermal resource at Carson Lake. The wells would be drilled with appropriate drilling procedures including casing, cementing, and mud programs designed to prevent formation damage within the geothermal reservoir as well as the shallower zones above the resource. Proper geothermal drilling practices would minimize the impact to the geothermal resource and geothermal fluid production would be suppressed until the drilling is complete. After the well is completed, geothermal fluids would be produced to the surface through a separator/rock muffler. After the well is completed, flow testing of the geothermal resource (or reservoir) would commence.

The flow tests would not be of sufficient duration or volume to adversely impact the geothermal fluids in the geothermal reservoir. The flow tests would be of short duration and small volume. Flow tests typically last 24 to 72 hours at an average pumping rate of 800 gpm. . If the flow test is successful, then it would only tap into a small fraction of the withdrawal potential of the well.

Groundwater Withdrawal

The principal demand for water would be during exploration well drilling operations. The drilling operation proposed for this project would consume up to 20,000 gallons per day during peak operation. Smaller volumes of water are needed for dust suppression on roads and pads, drilling and testing activities, and ancillary activities. Groundwater impacts from this project are expected to be negligible.

Water would also be used during well pad and road construction. Ormat intends to purchase water from private sources with valid water rights or to drill temporary wells, as approved by the BLM and the Nevada Division of Water Resources. . If water is purchased, it would be transferred to the well pads using water trucks and stored on site in a 10,000 gallon tank/truck. Another water truck would be used to transport water to the site and a third to water roads. No surface water will be used during the course of this project.

Water Quality

Surface Water

Groundwater and surface water quality has the potential to be adversely affected by surface spills of petroleum fuel, oil, or grease from construction vehicles and equipment and from drilling muds and fluids. Surface water runoff would increase slightly at the well pads due to vegetation removal and soil compaction efforts. Off-site transportation of sediments by surface runoff is expected to be minimal due to the hot and dry climate which evaporates runoff before it could reach a surface drainage. Surface water contamination is further minimized as all stormwater, drilling muds and fluids, and storage tanks drain to the reserve pit. The reserve pit is not lined; however, soils in the area are clayey and fairly impermeable. Mitigation measures require the construction of containment berms around all hazardous material or potentially hazardous material storage. Off-pad stormwater is directed away from the well pads.

Blowouts have the potential to release water pollutants. Blowout prevention equipment (BOPE) would minimize the risk of impacts related to uncontrolled production of geothermal fluids. BOPE would be maintained at the wellhead to allow well shutdown if an uncontrolled flow of fluid or gas occurs.

The Carson City Field Office Geothermal Leasing EA (BLM 2006) standard operating procedures and conditions of approval stipulate that there is no surface occupancy or ground disturbance within 650 feet from canals and other water features. Site F has been modified to a triangle shaped area that is at least 650 feet from the L-12 canal and fully on leased land. The development site would have dimensions of 517 by 275 by 425 feet. Only a temperature gradient well would be drilled on this site, per the project description, to avoid impacts to the L-12 canal surface waters.

The access road to site A is about 250 feet from Grimes Slough Extension. Pad G is about 300 feet from an unnamed waterway, while its access road comes within 100 feet of the waterway. These two pads are not on public land managed by the BLM; therefore, the BLM geothermal leases and the CCFO Leasing EA conditions do not apply. Pad G is an existing pad with very little vegetation; so little new ground disturbance is needed at this site. Mitigation has been included to protect the surface water quality of the nearby waterways. Mitigation requiring silt fencing between the new access road and Grimes Slough Extension near well pad Site A and between well pad Site G would minimize any potential contamination into Grimes Slough Extension on Navy managed lands.

Groundwater

Ormat may use groundwater for dust suppression purposes. Water for dust suppression most likely will be purchased from a private source.

Water within the shallow aquifer may be of poor quality and contain soluble chemicals that have percolated through the soils. This water would not be used for any potable purposes. Application to roads and the pads would result in re-percolating of some soluble chemicals back into the shallow aquifer (if it doesn't evaporate first); however, this would not change the baseline condition of the water quality in the aquifer.

The high groundwater table (often just a few feet below ground surface or at surface in the winter) causes the soils to be high in the solutes that are found in the groundwater. Therefore, application of the water over the surface would not provide a new source of polluted dust. Soils would be watered to minimize dust generation.

Use of groundwater would require permits from the Nevada Division of Water Resources and Nevada Department of Environmental Protection (NDEP). Ormat would likely apply for a waiver from a permit from the Nevada Division of Water Resources for temporary use of groundwater for dust suppression during construction. The application of groundwater on the surface would also require a permit from NDEP for non-point source water discharge, which would specify application rates and maximum TDS rates. As long as TDS rates are below that of dust palliatives (50,000 mg/l), application of the groundwater for dust suppression would not negatively impact vegetation in the area. No surface disturbance and therefore no dust suppression would occur within 650 feet of any water bodies within the BLM lease areas. This distance would prevent groundwater from contaminating any existing water bodies. Silt fencing and other protection would be established per Mitigation Measure Water Resources-3 and -4 for Sites within 650 feet of water bodies on Navy land to minimize impacts to surface water quality.

Groundwater quality in the project region could be impacted by release of drilling fluids to groundwater from geothermal zones and mixing of geothermal and groundwater may also affect groundwater as a result of subsurface well leaks. These water quality impacts are minimized by the use of the casing and liner.

Adverse impacts to groundwater quality are not expected.

Mitigation Measures

Mitigation Measure Water Resources-1: A site drainage and runoff management plan shall be prepared. The plan shall identify equipment and procedures used for containment and recovery of accidental spills.

Mitigation Measure Water Resources-2: Containment berms shall be constructed around all hazardous or potentially hazardous materials storage areas, handling areas, loading and unloading zones. Containment shall be 110 percent of storage volume and the berms shall be earthen but lined with plastic or an impermeable material.

Mitigation Measure Water Resources-3: Silt fencing and/or other erosion control devices (straw waddle, etc.) shall be placed between the access road to Site A and Grimes Slough Extension (at the western edge of the proposed road) during construction of the access road. The silt fencing and/or devices shall be removed after road construction.

Mitigation Measure Water Resources-4: Silt fencing and/or other erosion control devices (straw waddle, etc.) shall be placed between well pad G (at the edge of the well pad) and the nearby waterway during construction of the well pad. The silt fencing and/or devices shall be removed after pad construction. If additional aggregate is added to the access road to Site G, then silt fencing or other erosion control devices shall be placed between the road and the waterway, where the road is within 650 feet of the waterway, to prevent erosion of the waterway during placing aggregate on the road. The silt fencing and/or other devices shall be removed after road construction.

4.5.2 ALTERNATIVE 1

Alternative 1 includes alternative well pads for sites B, C, and H. These well pads are within the same localized area as the proposed action and would be constructed and drilled in the same manner. Water resource impacts would be the same as for the proposed action.

Implementation of Alternative 1 would not result in significant adverse impacts to water resources with the implementation of Mitigation Measures Water Resources-1, Water Resources-2, Water Resources-3, and Water Resources-4.

4.5.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, the project would not be implemented. There would be no impacts to water resources.

4.6 Cultural Resources and Native American Concerns

4.6.1 PROPOSED ACTION

Historic Properties

Three historic properties overlap with proposed well pad sites. Construction on these well pad sites could affect the property's NRHP eligibility, which would be considered a significant impact. Compliance with 36 CFR 800.6 would minimize effects to these resources.

Portions of the Newlands Reclamation Project and certain associated facilities (including canals, pipelines, dams, and other irrigation features) have been determined eligible for the NRHP as part of the Multiple Property Listing. The project would not impact the component of the Newlands

Reclamation Project canals that are eligible for the NRHP. Mitigation Measure Traffic-1 (listed below under section 4.7 Land Use) requires that no levee roads are used by heavy equipment and all employees are informed of the restrictions. No impacts to the Newlands Reclamation Project would occur from the proposed action.

The applicant would not use the historic, unaltered section of the Lincoln Highway or old Highway 50 (west of Highway 50, north of Macari Lane) to access the project site (Kessler, personal communication 2007).

The project would occur near the Grimes Point Archaeological District. Visitors to this location engage in hiking, biking, picnicking, wildlife viewing, and viewing the petroglyphs and many other archaeological resources in the area. The installations proposed by Ormat would have an effect on the viewshed west from Grimes Point; however, they would not detract significantly from the various outdoor experiences within the archaeological district because the impact is temporary. Drill rigs would typically be on the project area for about 45-days per exploration well pad site over a 12 month or shorter period.

The Grimes Point petroglyphs are distributed across a series of boulders and are accessed by a footpath. Nearly all of the glyphs visible from the path are at or below gaze level, particularly the gaze of taller people, and several informative signs also draw visitors' attention downward. The openness of the surrounding landscape probably does add to the feeling of solitude, and heightens the perception of antiquity at the site, but the presence of narrow drill rigs and other proposed facilities in the distance to the west may not prove distracting enough to affect the experience of visitors to the Grimes Point petroglyphs. Similarly, the effects of visual impacts from installations would probably be less intrusive to visitors out hiking or biking, as these activities would draw people farther east, around the north and south sides of Grimes Point and away from the project area. Visual simulations of drill rig appearance from Grimes Point are presented in Figure 4.6-1. Further NEPA analysis will be required for any future development beyond exploration.

Undiscovered Cultural Resources

The project has a high potential to affect undiscovered or subsurface resources. The project would involve excavation that could disturb unknown sites. A number of resources were found within the APE. It is important that vehicles and traffic stay within the clearly delineated and flagged APE during all project operations, because undiscovered resources likely exist outside this area. The APE would be clearly flagged and staff would be informed (before project commencement) to stay within the APE and that any effects on, defacement of, or removal and/or disturbance of archaeological, historical, or sacred material is prohibited and subject to disciplinary action.

If subsurface cultural resources are found during project operations, all work in the vicinity of the resource would cease and Ormat would notify the BLM, BOR, and Navy environmental personnel immediately. Ormat would implement those appropriate measures requested by the BLM, BOR, and/or Navy to protect the resource until it could be adequately evaluated by the permitted archaeologist, and the BLM, BOR, and/or Navy archaeologist, if necessary. The risk of damaging or destroying unknown cultural resources is significant. Implementation of mitigation would avoid significant effects. Mitigation includes requiring a professional archaeologist and Native American monitor for all ground disturbing activities.

Native American Concerns

Native Americans identified concerns related to the religious and spiritual significance of Grimes Point and the likelihood of disturbing Native American artifacts and remains during the exploration program, particularly on sites B, C, H, and a small portion of D. In response to these concerns, Ormat has performed additional archaeological resources studies and have provided an alternative

project (Alternative 1, discussed below) including a new location for sites B, C, and H. Ormat would utilize the western portion of Site D where there were no identified concerns and fewer archaeological constraints. Exploration activities would be temporary and mitigation would be implemented in the case of discovery of a previously undiscovered resource or human remains. Impacts would not be adverse with implementation of mitigation measures.

Mitigation Measures:

Mitigation Measure Cultural Resources-1: Well pad sites B, C, and H would require ground disturbance within areas of three historic properties that are potentially eligible for listing on the National Register of Historic Places (NRHP).

The process for resolution of adverse effects shall be followed as defined in 36 CFR 800.6, which includes continued consultation, notifying the Council and determining their participation, developing a programmatic agreement, involving consulting parties, providing documentation, involving the public, etc. One option for resolution could include realizing the data potential of the sites under an appropriate data recovery plan, developed in consultation with SHPO and interested parties.

Mitigation Measure Cultural Resources-2: Well pads shall be fenced and workers shall be trained to not access off-pad areas. Permitted archaeologists shall be responsible for assisting Navy, BLM, and/or BOR with protection, identification, and assessment of any cultural resources discovered during the operations. A Native American monitor and an archaeological monitor shall be present during any ground disturbing activities. The archeologist shall have the authority to halt all earth moving activities in the area of the discovery if prehistoric or historic artifacts are discovered until the find can be assessed.

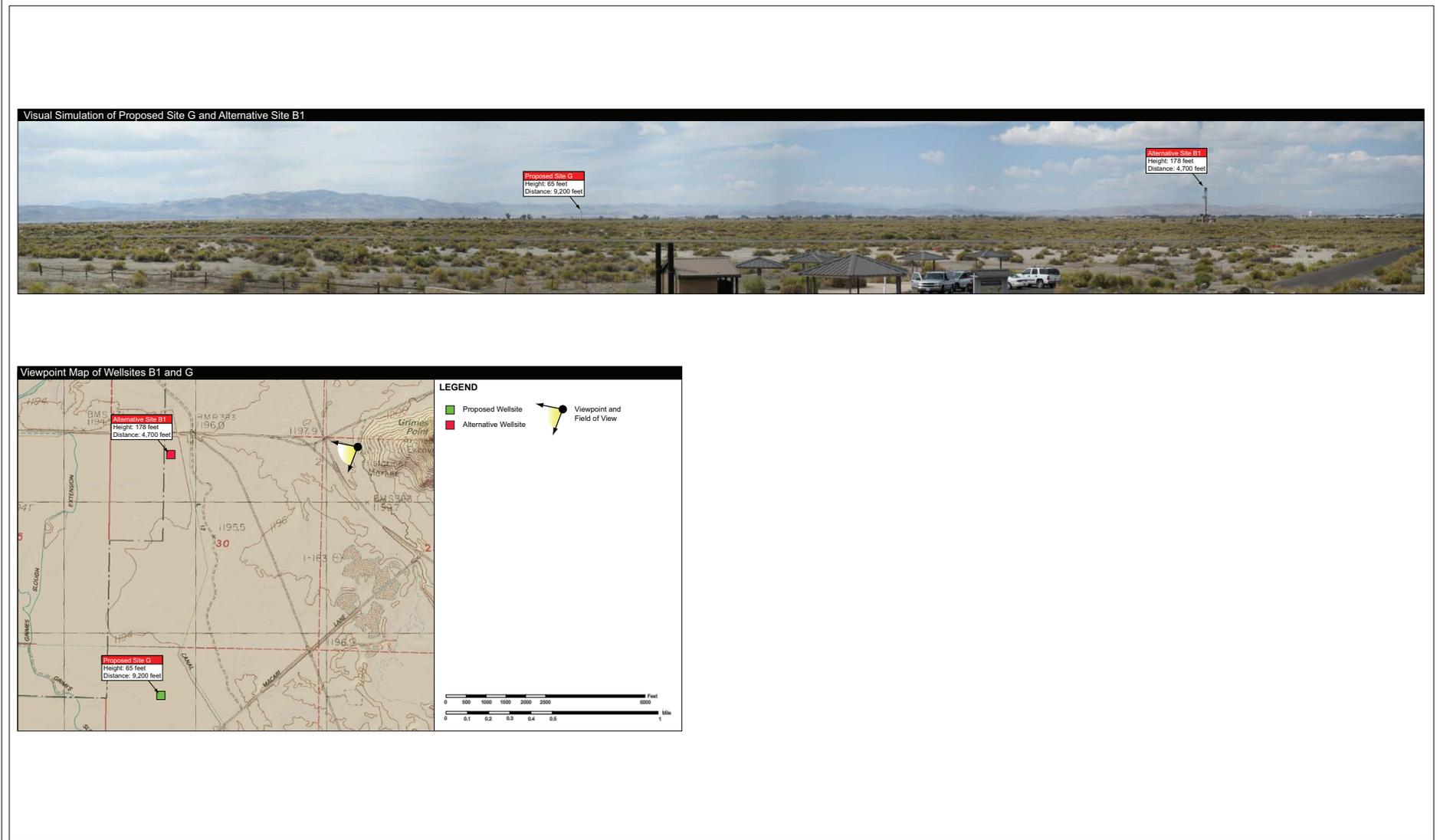
The applicant shall prepare a formal monitoring plan that shall be reviewed and approved by BLM and Nevada SHPO prior to construction fieldwork.

Mitigation Measure Cultural Resources-3: Prior to commencement of each task of operations, Ormat shall conduct employee briefings to inform personnel of critical elements of compliance with the Archaeological Resources Protection Act (ARPA) and the National Historic Preservation Act (NHPA), along with pertinent Navy, BLM, and BOR requirements and expectations concerning the protection of natural, cultural, and current approved land uses.

All Ormat employees and their contractors shall be informed before commencement of project operations that any effects on, defacement of, or removal and/or disturbance of archaeological, historical, or sacred material shall not be permitted. Violation of the laws that protect these resources shall be treated as law enforcement/administrative disciplinary action.

Mitigation Measure Cultural Resources-4: If human remains or artifacts or any other items of cultural significance are encountered during project operations, all work within 300 feet of the remains shall cease and the remains shall be protected from further exposure or damage. The BLM (and Navy if on Navy managed lands; and BOR if on BOR managed lands; or SHPO if on private lands) shall be notified immediately per the monitoring plan for this project. If human remains are found and are Native American, the BLM, Navy, and/or BOR shall follow the procedures set forth in 43 CFR Part 10, Native American Graves Protection and Repatriation Regulations. Procedures for handling the discovery of human remains must also follow the Reclamation Manual Directives and Standards LND 07-01 (Inadvertent Discovery of Human Remains on Reclamation Lands) if remains are located on

Figure 4.6-1: Visual Simulation of Drill Rig Appearance from Grimes Point



SOURCE: Google Earth Pro 2007, ESRI 2006, Ormat Nevada, Inc. 2007, and MHA Environmental Consulting 2008

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BOR managed lands. If remains are found on private land, NRS 383 would be implemented with SHPO as the lead agency.

4.6.2 ALTERNATIVE 1

Alternative 1 includes alternative well pads for sites B, C, and H (alternative sites are known as B1, C1, and H1, refer to Figure 2.3-1). The alternative well pads B1, C1, and H1 are within the same study area as the proposed action. The alternative well pads would be constructed and wells would be drilled in the same manner as the proposed project.

No historic properties are present within the alternative Site B1, Site C1, and Site H1. This alternative would reduce the potential to affect known historic properties. This alternative cites the well pads away from any known surface resources and farther away from the No Surface Occupancy (NSO) area associated with Grimes Point.

The alternative would not further reduce the potential to affect unknown resources in the area. Implementation of Alternative 1 would not result in significant adverse impacts to cultural resources with the implementation of Mitigation Measures Cultural-2, Cultural-3, and Cultural-4. Mitigation Measure Cultural-1 would not be necessary because Alternative 1 would not disturb any known eligible resources.

4.6.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, the project would not be implemented. There would be no impacts to cultural resources.

4.7 Land Use

4.7.1 PROPOSED ACTION

Land Use

BOR Managed Lands

The proposed access roads, well pads, and exploratory wells would be located within the BLM geothermal lease area and would be consistent with the conditions of the BLM geothermal leases. Although the lease area may contain existing valid surface uses (such as easements, rights-of-way, and range improvements), these uses are largely nonexclusive, so compatible rights can be granted. Geothermal exploration in this area would not conflict with multiple use management objectives of the BLM and BOR, which have concurred that development of geothermal resources in this area would not conflict with its management objectives for geothermal leases in the area.

The lease area is currently being used for cattle grazing. The project would not interfere and does not violate cattle grazing rights and leases that state that the US government has the right to conduct prospecting and procurement for mineral, oil, gas and other valuable mineral resources within the lease area. Impacts to cattle from equipment and to equipment from cattle could occur. Mitigation measure Land Use-1 requires installing cattle guards along the main entrance roads to deter cattle from accessing the exploration area and also fencing of well pads to prevent injury and to exploration equipment and facilities to any cattle that may enter the area.

The geothermal leases also require that the "lessee would not interfere with the operations and maintenance of the Newlands Project." Mitigation requires that canal roads are not used by heavy equipment. No new crossings over canals would be created. The lease also states that construction can not occur within 650 feet of surface water features. These stipulations only apply

to the BLM lease areas on BOR managed lands. None of the sites on BLM leased lands would be within 650 feet of a canal or other surface water feature.

The lease and the Carson City Field Office's (CCFO's) 2006 Geothermal Leasing EA require that there the no surface occupancy zones associated with Grimes Point are not violated. Mitigation Measure Cultural Resources-2 requires that employees are trained regarding the no surface occupancy zones and the cultural significance of Grimes Point. Several well pads are close to the no occupancy zone, but are not cited within it. Figure 1.1-1 shows the no surface occupancy zone.

Lands Managed by NAS Fallon

Three of the well pads are located on lands managed by NAS Fallon. The construction of the well pads, drilling, and testing the wells would be consistent with the terms of the Ormat contract with Navy regarding the exploration of the geothermal resources at NAS Fallon.

The portion of the project area to the southeast of NAS Fallon is within the flight zone of the runway. Several proposed well pad locations would be located within this 16,000-foot-long, wedge-shaped flight path area including Site G (approximately 7,500 feet from the edge of the runway), Site E (approximately 9,500 feet from the edge of the runway), Site F (approximately 10,500 feet from the edge of the runway), and Site I (approximately 12,700 feet from the edge of the runway). The maximum height of the drilling equipment would not exceed 178 feet; however, the well drilling and testing may result in the emission of geothermal steam plumes. The height of the steam plume depends on the ambient temperature and humidity. Plumes are smaller on hot, dry days and larger on cold, wet days. Use of the drilling rig could conflict with Naval operations. Mitigation has been included that requires the applicant to provide the Navy with detailed maps and schedules for all drilling operations in the NAS Fallon and BOR leased area and to coordinate with Naval operations and implement their requirements.

Land Use Management Plans

The project does not conflict with any land use management plans for the area, including the CCFO's Geothermal Leasing EA (BLM 2006), the CCFO's Consolidated Resources Management Plan, or the BLM and Navy Resource Management Plan for Certain Federal Lands in Churchill County, Nevada (BLM and Navy 2001).

Traffic and Transportation

Traffic Volume

The project would result in minor short-term increases in average daily travel due to traffic from construction workers from areas beyond Churchill County. The project would generate 4-6 small trucks and 4-6 worker vehicles during slim well drilling. Exploration well drilling may require 25 or more tractor trailer truck trips to bring in equipment and about 18 small trucks and 10 worker vehicles per day during exploration. Up to 10 additional tractor trailer trucks may travel back and forth from well pads on the busiest days during exploration well drilling. To remain at an optimal level of service (LOS), major highways and local arterials would not exceed 5,000 annual average daily trips (AADT). The highest existing AADT occurs on US Highway 50 approximately 2.6 miles east of Harmon Road, and is approximately 960 trips. Assuming an increase of approximately 30 AADT (worst-case scenario including both commuter and construction vehicle traffic), and considering the existing AADT values on local arterials, the increased traffic generated by the project would increase AADT levels to approximately 1,000 during the approximately 12-month construction period. None of the roadways in the project area would exceed 5,000 AADT. The project would have a less than significant impact on local vehicle traffic.

Road Access and Degradation

Individual well pads would be accessed via existing roads, as shown in Figure 2.2-1. The BOR has expressed concern over heavy service vehicles using canal levee roads (Deschler personal communication 2007). Heavy service vehicles using these roadways could create a risk of roadway collapse into the canals. Mitigation requires that levee roads are not accessed by vehicles, especially to sites K and G and that roads would be maintained and access for BOR operations secured at all times. No new crossings over canals associated with the Newlands Reclamation Project would be created.

The project would also require placement of some aggregate on existing roads in the project area. No roads under Churchill County's jurisdiction would be upgraded (Macari Lane and Berney Road).

An adverse impact could result if County roads are damaged by equipment and heavy trucks associated with the project. Mitigation requires that road conditions would be inspected and documented prior to project construction, and that the roads would remain in at least the same condition after work is complete. If roads are in a worse condition as a result of the project, the applicant would repair any road damage associated with the geothermal program.

Mitigation Measures

Mitigation Measure Land Use-1: Cattle guards shall be installed on the roads that provide access to the project area to deter cattle from entering the project area. Additionally, all well pads shall be fenced to prevent accidental damage to equipment from cattle and to prevent injury to cattle. Entrances to the well pads shall be gated or a cattle guard will be used. Fences will be removed after reclamation of the pads.

Mitigation Measure Land Use-2: The applicant shall provide NAS Fallon with all project plans including drilling locations and potential testing times, and the maximum height of equipment that shall be used prior to placing any equipment on any well pads in the project area. The applicant shall only place equipment on the project site after coordinating and receiving approval from NAS Fallon Operations. The applicant shall follow all use restrictions requested by NAS Fallon Operations. That is, the geothermal project shall not interfere with Naval operations.

Mitigation Measure Traffic-1: Employees shall be informed that vehicles are not to be used on any canal levee access roads.

Mitigation Measure Traffic-2: The applicant shall record the condition of all local and BOR maintenance roads that will be accessed during the project implementation. Recordation shall include written descriptions and photo documentation. The applicant shall repair any damage to the roads or road hazards caused by the project to previous conditions. The applicant shall maintain the roads during the course of the project and shall not interfere with any access as required by the BOR.

4.7.2 ALTERNATIVE 1

Alternative 1 would involve relocating Sites B, C, and H farther away from Grimes Point. The impacts of Alternative A would be substantially similar to those described above for the proposed project. Implementation of Alternative 1 would not result in significant adverse impacts to land uses with the implementation of Mitigation Measures Land Use-1, Land Use-2, Traffic-1, and Traffic-2. Alternative 1 moves well pad B from BOR managed lands onto US Navy lands.

4.7.3 NO ACTION ALTERNATIVE

The No Action Alternative would have no impacts to land use or traffic and transportation.

4.8 Wastes, Hazardous or Solid

4.8.1 PROPOSED ACTION

The proposed well pads and access roads would be located primarily on undeveloped land where no hazardous materials occur. It is not expected that workers would be exposed to hazardous materials already present on site.

Development of the well pads and operation of the drill rigs would involve hazardous material use. These materials would include, but would not be limited to, drilling additives and mud, diesel fuel, lubricants, solvents, oil, equipment/vehicle emissions, and geothermal fluids.

The transport, use, or disposal of hazardous materials could affect workers, the public, and the environment through accidental spills or emissions. Ormat would adhere to general geothermal lease stipulations for geothermal developers to address the potential impacts involved with transport, use, and disposal of hazardous materials. Ormat would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes. Mitigation measures from Section 4.5 Water Resources and mitigation requiring preparation of a hazardous material spill and prevention plan would prevent adverse impacts to the environment from hazardous materials.

Drilling mud and fluid would be directed to reserve pits. At the conclusion of drilling and testing, the liquid portions of the containment basin contents would be evaporated, pumped back down the well, or removed and disposed of off-site in a facility authorized to receive such wastes. The remaining contents, typically consisting of non-toxic drilling mud and cuttings, would be tested as required by the Nevada Bureau of Water Quality Planning (BWQP). If non-toxic and as authorized by the BWQP, these materials would be spread and dried on the well site, mixed with soil and buried in the on-site reserve pit in conformance with the applicable requirements of the BWQP and the BLM. Testing results and location of buried waste would be provided to the Navy for well pads on Navy managed lands and to the BOR for well pads on BOR managed lands. Adverse impacts are not expected. Toxic materials would be disposed of in an appropriate facility.

Well blowouts and pipeline failures are rare occurrences during well drilling and can result in the release of toxic drilling additives and fluids, as well as hydrogen sulfide gas (see section 3.2 Air Quality for more information on hydrogen sulfide) from the geothermal resource. Blowouts may also result in the surface release of geothermal fluids and steam containing heavy metals, acids, mineral deposits, and other pollutants (see the discussion above in air quality and hydrology).

Ormat has submitted a detailed blow-out prevention plan as part of the Plan of Exploration. Measures include:

- Perform regular maintenance of wellheads, including corrosion control and inspection; pressure monitoring; and use of blowout prevention equipment such as shutoff valves;
- Prepare an emergency response plan for well blowout, including measures for containment of geothermal fluid spills
- Prepare a contingency plan for hydrogen sulfide release events, including all necessary aspects from evacuation to resumption of normal operations;
- Provide workers with a fact sheet about the potential human health and safety impacts from exposure to liquids and gases from the production well during a blowout.

The implementation of Blowout prevention equipment (BOPE) and the blowout plan would prevent adverse impacts to the environment.

Mitigation Measures

Mitigation Measure Hazards-1: A hazardous material spill and disposal contingency plan shall be developed, which shall describe the methods for cleanup and abatement of any petroleum hydrocarbon spill.

4.8.2 ALTERNATIVE 1

Alternative 1 includes alternative well pads for sites B, C, and H. These well pads are within the same localized area as the proposed action and would be constructed and wells would be drilled in the same manner. Impacts associated with hazardous materials and/or fires would be the same as for the proposed action.

Implementation of Alternative 1 would not result in significant adverse impacts associated with hazards and hazardous materials, with the implementation of Mitigation Measure Hazards-1.

4.8.3 NO ACTION ALTERNATIVE

The No Action Alternative would result in no action being taken. There would be no impacts associated with hazardous materials or for wildfires because the project would not commence.

4.9 Visual Resources

4.9.1 PROPOSED ACTION

Overview

The visual impacts of the proposed action would result from:

- Construction of 11 well pads
- Construction of 2.5 miles of access roads
- Views of construction equipment and facilities
- Views of the 30- to 178-foot-tall drill rig on the well pads for 45 to 60 days of drilling and testing
- Views of steam plumes during well drilling and testing
- Presence of a 30-foot-tall rock muffler

Views and View Sheds

Up to three well pads would be constructed at a time. Each pad would be constructed as needed. The facilities on the pad would include geologists' trailers, drill pipe, diesel generators, small tanks, one or two mufflers (30 feet tall) and the drill rig (see Figure 2.2-1 in Chapter 2: Proposed Action and Alternatives for the well pad layout).

Well pads would generally not be visible from sensitive viewing receptors such as residences, located about 1,742 feet south of Site G on Macari Lane, from Grimes Point, located approximately 0.75 miles from the closest pad (Site B), and from the Pony Express National Historic Trail located about 7.5 miles south of Site F (the southern most site). The tallest structures on well pads, except for the drill rigs, would be the rock mufflers that can be as high as 30 feet tall. Well pads tend to blend into the surrounding desert landscape and no pads would be located on any prominent

ridges or hilltops that would increase visibility. Access roads in the area are infrequently used and the pads would not be visible from any major highways.

Drill rigs used would depend upon the type of well being drilled. Exploration wells require the largest drill rig, which has a 178 foot tall mast painted red and white with an FAA compliant flashing light at the top. Only one 178 foot tall rig would be used at any given time. The drill rig would be moderately visible from surrounding land uses, including recreational uses at Grimes Point.

Figure 4.6-1 presents a visual simulation of how rigs may appear from an observation point at about 100 foot elevation along a recreational trail on Grimes Point. This simulation gives a sense of the potential visual impact; however, it is important to understand that the impact would be temporary.

The level of change to the character of the landscape would be moderate. The pads and access roads would be temporary and therefore compatible with VRM class III objectives. Adverse impacts would be less than significant.

Light and Glare

The drill sites would be illuminated at night when they are erected on site and during drilling and flow testing operations, resulting in a potentially visible glow from the nearest sensitive receptor. To the extent practical, all lights used to illuminate the drill sites would be shielded and directed downward or away from identified sensitive receptors to reduce the visual impacts from lighted drill sites during well drilling and flow-testing activities.

Adverse impacts would be less than significant because the number of lights would be minimal, the duration of use of lights would be temporary, and existing lighting associated with NAS Fallon already contributes to illumination of the night sky.

Mitigation Measures

No mitigation would be required.

4.9.2 ALTERNATIVE 1

Alternative 1 would involve relocating Sites B, C, and H farther away from Grimes Point. The visual resources impacts of Alternative 1 would be slightly reduced compared to the proposed project. Moving these three well pad locations farther away from the Grimes Point area would diminish the visibility of the well pads. However, the drill rigs would remain visible (when at each pad) from the Grimes Point. The visual impacts of Alternative 1 would be less than significant.

No mitigation would be required.

4.9.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, no construction would take place, and there would be no impacts on visual resources in the project area.

4.10 Socioeconomics and Environmental Justice

4.10.1 PROPOSED ACTION

Socioeconomics

Constructing the exploratory wells could have a beneficial effect on the surrounding economy by bringing approximately 18 employees into the area for the one year long construction and drilling efforts. Expenditures for equipment fuel, lodging, food, and other needs would provide a stimulus to the local economy over the duration of the construction, drilling, and testing period.

The project would have only minimal impacts on nearby recreational facilities such as birding, mountain biking, and hiking. The project area is within Navy and BOR managed lands and is not currently used for recreational activities. Minor temporary effects could be expected from the alteration of the viewscape from the Grimes Point Petroglyph Trail; however, a reduction in dispersed visitation would not be expected to result from the construction and operation of the exploratory wells. The proposed exploratory well sites and access roads could cause a minor reduction in the grazing allotment by about 6.18 acres at a time. This reduction would not significantly affect the economic livelihood of ranchers and herders as the overall lease area is about 6,500 acres.

Environmental Justice

No minority populations reside near the project area, and no minority or low income populations would be disproportionately affected by the construction and operation of the proposed project.

The nearest tribal lands are the Walker River Indian Reservation, which is located approximately 10 miles south of the project area, and the Fallon Indian Reservation, which is located approximately 10 miles northeast of the project area. Any potential physical effects of constructing and operating the proposed facility would be unlikely to affect these populations because operations would be temporary and mitigation has been included to appropriately avoid or mitigate for impacts to cultural resources found at specific pad locations (see section 4.6 Cultural Resources). The project would employ one Native American monitor during any ground disturbing activities.

The project would not have adverse impacts associated with socioeconomic resources or environmental justice.

Mitigation Measures

No mitigation would be required.

4.10.2 ALTERNATIVE 1

The socioeconomic and environmental justice impacts of Alternative 1 would be similar to those of the proposed project. Alternative 1 would involve the same number of well pads and well drilling as the proposed project, and the only difference between the two options would be the specific locations of several of the well pads. Impacts to socioeconomics and environmental justice would be same as for the proposed project.

No mitigation is required.

4.10.3 NO ACTION ALTERNATIVE

The No Action Alternative would result in no action being taken. There would be no impacts from the existing baseline condition. Any beneficial impacts to the economy associated with the project would not occur.

4.11 Residual Impacts

Residual impacts are the unavoidable impacts that remain after application of all mitigation measures to those resources where mitigation was defined. This section discusses the effectiveness of identified mitigation measures and the residual impact that the project would still have on the environment. None of the residual effects are considered to be significant after mitigation. Mitigation was defined for the following sections of this EA:

- Air Quality
- Biological Resources
- Geology and Soils
- Water Resources
- Cultural Resources
- Land Use
- Wastes, Hazardous or Solid

4.11.1 AIR QUALITY

The project has the potential to increase PM₁₀ emissions from fugitive dust generated by vehicles (especially support vehicles) traveling at excessive speeds along unpaved paths and through off-road areas. Mitigation Measure Air Quality-2 includes limiting the allowable speed limit to 15 mph on exposed soils, such as access roads. The mitigation measure would be effective in reducing impacts, but even with implementation some dust may be generated that could affect local air quality.

The project also has the potential to cause H₂S levels above Nevada ambient air quality standards. Mitigation Measure Air Quality-1 includes monitoring H₂S levels and would be effective in reducing H₂S levels should they increase above the standard. Some H₂S would be emitted even with mitigation.

The project would generate some combustion emissions, particularly associated with diesel generators. Mitigation Measure Air Quality-3 requires the use of EPA approved diesel generators that emit less pollutants. Even with implementation of this measure, some pollutants (VOCs, CO, CO₂, etc.) would still be generated, just in lesser quantities.

Residual impacts would be less than significant and cease when the project operations are complete.

4.11.2 BIOLOGICAL RESOURCES

Impacts to special status plant species could occur as a result of implementation of the project. Mitigation measures require surveys for special status plant species prior to construction and avoidance or relocation of any species found.

Implementation of these measures would avoid impacts to special status plant species and there would be no residual impacts to biological resources.

4.11.3 GEOLOGY AND SOILS

The project would affect drainage in the area. Mitigation Measure Geology-1 refers to a Site Drainage and Runoff Management Plan that minimizes erosion. Some erosion may still occur, and would remain after the project is complete. Some wind erosion of soil piles is expected. Mitigation Measure Geology-2 involves covering soil piles to eliminated wind erosion. Some impacts may remain; however, the impacts would not be significant.

4.11.4 WATER RESOURCES

The project may cause increased erosion from storm water runoff. Mitigation Measure Water Resources-1 refers to a Site Drainage and Runoff Management Plan that minimizes erosion. Some erosion may still occur, but would be minimal and less than significant. The plan would also address procedures for handling any spills. Mitigation Measure Water Resources-2 states that berms would be constructed around all hazardous containment to protect water resources from seepage. No residual impacts related to spills of hazardous materials are expected after implementation of this mitigation measure.

Other mitigation to protect water resources includes using erosion control devices between the access road to Site A and Grimes Slough Extension and between Site G and its access road and the nearby unnamed waterway. Mitigation requiring erosion control devices would prevent sedimentation of these waterways and there would be no residual impacts.

4.11.5 CULTURAL RESOURCES

The project has the potential for significant impacts on cultural resources. Mitigation Measures Cultural Resources-1 through -4 involve educating employees, preventative measures, and procedures in the event an unknown cultural resource site is identified during construction.

No residual impacts to cultural resources are expected.

4.11.6 LAND USE

The project could have impacts to levee access roads and to the condition of existing roads. Traffic mitigation includes prohibiting heavy vehicle access on levee roads, and photo documenting existing road conditions and repairing any damage during and after completion of the project. Residual impacts related to traffic and transportation are not expected.

The drill rigs could impact flight operations at NAS Fallon. The applicant would provide drilling schedules and coordinate with NAS Fallon Operations. Some impacts to flight patterns may result from the coordination with Ormat, or impacts to the drilling schedule may result. These residual impacts are expected to be less than significant.

4.11.7 WASTES, HAZARDOUS OR SOLID

The project involves the storage and transportation of hazardous materials and may have accidental spills of hazardous material. Mitigation Measures Water Resources-1 and -2 would be implemented. Residual impacts are not expected with implementation of these measures.

4.12 Cumulative Impacts

4.12.1 INTRODUCTION

NEPA Regulations define cumulative impact as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably

foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time” (40 CFR 1508.7).

Impacts of the proposed action and alternatives presented in this EA are assessed for cumulative impacts with other actions conducted in the region. The region of influence for each resource in the cumulative analysis is the same as the area defined for Chapter 3.

This analysis considers the effects of the proposed action when combined with the effects of other past, present, and future actions in the affected region. Current or reasonably foreseeable actions that have been identified are described below. The timeframe considered includes projects that may have started before the proposed project but have ongoing activities that could be impacted by the proposed project, concurrent projects, and projects that may start after the proposed project but within the timeframe that the project could still leave residual impacts. The proposed project is temporary and would not leave residual impacts for more than a few months. Future projects were considered within that timeframe.

4.12.2 PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

Geothermal Development at Fallon

The likely development scenario includes potential development of a power plant at NAS Fallon after completion of the exploration program. Any future power plant would be sited on Navy managed lands; however, productive wells from the lease area would become permanent and pipelines connecting the wells to the plant would need to be built. The exact location and layout of a power plant is not known at this time. The maximum height of the facilities would not likely be more than 30 feet. The power plant development would also require new transmission lines in the area.

Salt Wells and other Geothermal Development

There is a geothermal development project being conducted under geothermal leases near Salt Wells. The lease area is 7.5 miles to the southeast of the Proposed Action area. Wells are currently being drilled and evaluated. If a plant is installed, it would consist of two 10-megawatt binary cycle geothermal power plants, each producing 12 megawatts annually.

Seven geothermal power plants are operating in the Carson City Field Office (CCFO) planning area. There are currently 57 noncompetitive lease applications for geothermal development pending within the CCFO management area. There are also 14 known geothermal resource areas (KGRAs) within Nevada, each of which contains land that may be offered for geothermal leasing. Five of the KGRAs are within the CCFO management area and proposed for lease: Steamboat, Hazen, Soda Lake, Stillwater, and Saltwells. Although no detailed proposals have been developed, geothermal development is being considered on private, tribal, and other federally managed land (US Navy) throughout the CCFO management area (BLM 2002).

Carson Lake and Pasture

Under the Truckee-Carson-Pyramid Lake Water Rights Settlement Act, Pub. L. 101-618, the Secretary of the Interior was authorized to convey Reclamation withdrawn lands in the area referred to as the “Carson Lake and Pasture” (CL&P) to the State of Nevada for use as a State wildlife refuge. While the agreement has not been completed, the State of Nevada and Reclamation regard the conveyance as an active proposal that would be completed at an unspecified date (BLM 2002). The area of the CL&P proposed for wildlife refuge does not overlap with the proposed project area, but is located immediately south of the project area.

4.12.3 CUMULATIVE IMPACTS OF THE PROPOSED PROJECT

All defined mitigation would reduce any potential impacts from the proposed action to less than significant levels. Due to the nature of the other proposed activities that could occur in the project region, several environmental resources would have no potential for aggregation of less than significant impacts to create a significant impact. These resources include:

- Geology and Soils
- Wastes, Hazardous or Solid
- Socioeconomics and Environmental Justice

Resources with the potential for cumulative impacts include:

- Air Quality
- Biological Resources
- Water Resources
- Cultural Resources
- Land Use
- Visual Resources

The proposed project could contribute to some overall cumulative impacts to these resources; however, none of these impacts are expected to be significant.

Resources with No Significant Cumulative Impacts

Geology and Soils

No cumulative effects are expected related to geology, soils, and minerals, provided that construction and operation of geothermal facilities is in compliance with building codes and state and local permits. Other geothermal development is likely in the surrounding areas, but would have to comply with the above limitations. Compounded levels of erosion would not occur to soils because erosion prevention practices are common for all development projects and would be required to comply with NEPA. The development of CL&P into a wildlife refuge would not have any impacts on geology, soils, and minerals. Cumulative impacts are not expected.

Wastes, Hazardous or Solid

Adverse impacts to hazardous materials are not expected with implementation of mitigation measures. Other development may also involve the transport and storage of hazardous materials; however the likelihood is extremely small that major spills would occur at the same time. The development of CL&P into a wildlife refuge would not have any impacts on hazardous materials. Cumulative impacts are not expected to occur.

Socioeconomics and Environmental Justice

The overall economic effect of geothermal development and operation at the project area would be a minor positive stimulus to the economy of the local area, and a less than significant impact on population, housing, businesses, and schools. The proposed project would not contribute to potential environmental justice effects to nearby Native American populations; since the proposed project would not be likely to affect these populations due to their distance from the project area. In combination with other future planned development, potential adverse effects due to the proposed project would be minor and less than significant. The development of CL&P into a wildlife refuge would not have any impacts on socioeconomics and environmental justice. Cumulative impacts are not expected.

Resources with Some Potential for Aggregation of Impacts

Air Quality

The proposed project would result in combustion emissions and H₂S emissions. With the implementation of mitigation measures, emissions are expected to comply with federal and state ambient air quality standards. Other simultaneous geothermal development in the area would also have emissions, but would have to comply with standards as well, and would not be within a distance expected to significantly compound emission levels (i.e the Salt Wells Exploration and Development project is over 7.5 miles away). Fugitive dust in the region has raised fine particulate matter (PM₁₀) levels above standards naturally. The potential for simultaneous excavation work may compound the impacts related to PM₁₀ levels. The proposed project includes several dust suppression measures to minimize the proposed project's potential contribution to air quality impacts. The development of CL&P into a wildlife refuge would not have any impacts on air quality.

Biological Resources

The proposed project would have no adverse effects to biological resources. Some vegetation and habitat would be removed. Invasive and non-native plant species may occur as a result of the proposed project. Other development in the surrounding area may also result in removal of vegetation and habitat and growth of invasive and non-native plant species. The nearest proposed geothermal development is 7.5 miles southeast of the project area. The area is small enough and the location is too far from the proposed project location to have any significant cumulative impacts. The development of CL&P into a wildlife refuge would not have any negative impacts on biological resources. Cumulative impacts are not expected.

Water Resources

The project could require some groundwater withdrawal. The shallow aquifer in the project area is plentiful as not many users have tapped into it; however, water quality is generally not suitable for drinking. Project needs would be temporary and Ormat would receive proper authorization if groundwater is to be used for drilling water and for dust suppression. Water may also be used for nearby geothermal projects; however the distance is great enough that the closest geothermal project is actually within a different drainage basin (Salt Wells). Cumulative impacts associated with groundwater use would not occur. The development of CL&P into a wildlife refuge would not have impacts on water resources.

Exploration for the geothermal resource would only involve some flow testing (at a rate of 800 gallons per minute over a few days) and would therefore not exploit the geothermal reservoir. Future development may result in use of the reservoir. Other geothermal projects (such as in the Salt Wells KGRA) are likely far enough away so as not to result in a cumulative impact to the reservoir since the amount of fluid removal for flow testing is minimal. If private property were to be developed or nearby leases developed, the resource could be impacted. This would be dealt with during environmental review for development. The likely solution to conserve the geothermal resource would be unitization; however, such prospects are only speculative at this time.

Cultural Resources and Native American Concerns

The Proposed Action has the potential to significantly affect cultural resources if a significant site is damaged or destroyed in the Proposed Action area. Other geothermal development in the region is not expected to aggregate this impact, as the potential impact is localized and physically separate from other possible or current development. Cumulative impacts are not expected.

Future commercial development, a reasonably foreseeable consequence of exploration, could result in a more permanent impact to the area. The power plant would likely be sited on Navy managed land or on leased land but to the west of the L12 Canal, farther from Grimes Point. Some

transmission lines would also be installed, which would appear against the remote landscape. These impacts would be addressed a future EA, if they were to occur. Development would not occur at the same time as exploration but could occur right after exploration.

The Fallon Paiute-Shoshone Tribe has identified Grimes Point as an area of concern. Grimes Point is rich in cultural and visual resources, and the Fallon Paiute-Shoshone Tribe is concerned about the peacefulness of the area. Other geothermal development would not occur at the area of concern. No other projects are proposed in the immediate vicinity of Grimes Point. The Churchill County RMPA would not have impacts to Grimes Point. The development of CL&P into a wildlife refuge would not have any impacts on cultural resources and Native American concerns.

Land Use

The Proposed Action would potentially remove some grazing land in the area. Other geothermal development in the region would have the same impact, and a potential for aggregation. Due to the distance between the Proposed Action and the nearest geothermal development (7.5 miles), this aggregation is not expected to be significant. The development of CL&P into a wildlife refuge would not have any negative impacts on land use. Cumulative land use effects are not expected.

Visual Resources

Potential geothermal development in the future would increase the number of visible human-made structures in an area. An increase in geothermal plants being constructed would aggregate visual impacts. The development of CL&P into a wildlife refuge would not have any negative impacts on visual resources.

Potential future geothermal development would increase the developed appearance of the area. Some transmission lines would also be installed, which would appear against the remote landscape. These impacts would be addressed in a future EA, if they were to occur. Development could occur right after exploration, which would compound the visual impacts in the area because of increased and possibly permanent appearance of man made structures. Development is speculative at this time and measures would be taken to minimize the appearance of any man-made structures. A plant would most likely be sited on NAS Fallon lands or at least along the western portions of the public land managed by the BLM, away from Grimes Point. A plant would likely blend in with the existing development at NAS Fallon so that any cumulative impacts would be less than significant.

4.13 Monitoring

Ormat (the applicant) would appoint a field manager to self-monitor project operations for compliance with the terms of the EA and any permit conditions. The field manager would be familiar with environmental compliance, and would prepare weekly monitoring compliance reports to submit to the BLM. The BLM-Carson City Field Office could also conduct a compliance inspection to monitor environmental concerns and adherence to mitigation.

The project includes a hydrologic monitoring plan that would be submitted to the BLM according to lease stipulations prior to drilling activities.

Additional monitoring of resources, beyond that described in the proposed action and mitigation, is not necessary.

