CHAPTER 3: AFFECTED ENVIRONMENT

3.1 Introduction

3.1.1 SCOPING AND ISSUE IDENTIFICATION

In accordance with NEPA, this document has been prepared with input from interested agencies, organizations, and individuals within the region (Chapter 5). Potentially affected agencies and the tribes were contacted to solicit concerns to guide the development of the EA and the alternatives. The BLM's interdisciplinary team, as well as specialists from the Navy and BOR, was consulted for specific resource concerns and information at a site visit on May 31, 2007, in a meeting held on September 24, 2007, and through various telephone conversations. Refer to Chapter 5 for a list of persons consulted in preparation of this EA. A public scoping meeting was held on October 17, 2007 at the Churchill County Commissioners meeting.

All issues raised during scoping were considered in the development of this EA.

3.1.2 REGIONAL SETTING

The project would be located on lands managed by the United States (US) Department of Interior (DOI) Bureau of Reclamation (BOR), and U.S. Department of Defense (DOD). Two of the proposed well pads are located on lands within the DOD Naval Air Station (NAS) Fallon.

The area to be explored, the Carson Lake Project Area, is comprised of lands managed by NAS Fallon and BOR managed lands on which Ormat holds geothermal leases from the BLM (federal geothermal leases NVN-079104 and NVN-079105), pursuant to the Geothermal Steam Act of 1970. The leases include approximately 13 sections in Townships T17N R29E, T17N R30E, and T18N R30E, Mount Diablo Base and Meridian (MDB&M) (see Figure 1.1-1).

The project area falls within the lakebed and shoreline of Pleistocene Lake Lahontan. Ancient Lake Lahontan was a large lake that existed during the ice age, covering much of northwestern Nevada and extending into northeastern California and southern Oregon. At its peak approximately 12,700 years ago, the lake had a surface area of over 8,500 square miles, with its largest component centered at the location of the present Carson Sink.

Climate change around the end of the Pleistocene epoch led to a gradual desiccation of ancient Lake Lahontan. The lake had largely disappeared in its extended form by approximately 9,000 years ago. As the surface elevation dropped, the lake broke up into a series of smaller lakes, most of which rapidly dried up leaving only a playa. These playas include the Black Rock Desert, the Carson Sink, and the Humboldt Sink. The only modern day remnants of Lahontan Lake existing as true lakes are Pyramid Lake and Walker Lake. The existence of the lake coincided roughly with the first appearance of humans in that region of North America. Archaeological evidence exists along the ancient lake shore of early human habitation.

The project region is now arid desert, but has agricultural land supported by irrigation canals and systems. BOR managed lands are leased for cattle grazing.

Vegetation in the area is typical of lowland and foothill areas of the Great Basin, with sparse vegetation and saline soils. Air quality is most affected by dust storms, as there is little development in the immediate area.

The nearest city is the City of Fallon, located 7 miles northwest of the project area. Three well pads lie on the southeastern edge of the NAS Fallon Main Station. NAS Fallon is a tactical airfare weapons training center with four bombing ranges, an electronic warfare range and many other training facilities. The Main Station has a14,000-foot runway used for training of the Navy's carrier air wing. The project area is located southeast of the runway.

3.1.3 CRITICAL ELEMENTS OF THE HUMAN ENVIRONMENT

Appendix 5 of BLM's NEPA Handbook (H-1740-1) identifies Critical Elements of the Human Environment that are subject to requirements specified by statute or executive order and must be considered in all BLM environmental documents. Table 3.1-1 below lists the Critical Elements and their status in the project area.

Resources Present but Not Affected (Other than Critical Elements)

The following resources, which are not Critical Elements of the Human Environment as defined by BLM's Handbook H-1740-1, are present in the area. BLM has evaluated the potential impact of the Proposed Action on these resources and has determined that although the resources are present, they would not be affected by the Proposed Action. Rational for dismissing these resources from further discussion in the document are as follows:

Livestock Grazing. Well pad construction, well drilling, and increased traffic could cause a temporary disruption of grazing activities in the vicinity of each well pad, but once construction is complete, the only area that would be off-limits to grazing would be the small fenced-in portion of each well pad. If wells prove to be unproductive, wells would be recapped and reclaimed. Roads constructed for the proposed project would be closed and left to re-vegetated.

Recreation. Well pad construction, well drilling, and increased traffic could cause a temporary disruption to dispersed recreational users in the area. However, these potential impacts are considered temporary, minor, and less than significant. If the wells prove to be unproductive, any roads constructed for the proposed project would be closed and left to re-vegetate. This would prevent a continued increase in disruptive traffic.

Noise. Existing noise sources in the area are primarily associated with aircraft operations at the Fallon Naval Air Station and can reach levels from 60 to 80 dBA. The project-generated noise would be minimal compared with the existing background noise from overhead military operations.

Table 3.1-1: Critical Elements Pertinent to the Project

Critical Element	Not Present *	Present/Not Affected *	Present/May Be Affected**
Air Quality			X
Areas of Critical Environmental Concern	X		
Cultural Resources			X
Environmental Justice			X
Farm Lands (prime or unique)	X		
Floodplains	X		
Invasive, Nonnative Species			X
Native American Concerns			X
Threatened or Endangered Species	X		
Wastes, Hazardous or Solid			X
Water Resources			X
Wetlands/Riparian Zones	X		
Wild and Scenic Rivers	X		
Wilderness	X		

NOTE: *Critical Elements determined to be Not Present or Present/Not Affected need not be carried forward or discussed further in the document.

**Critical Elements determined to be Present/May Be Affected must be carried forward in the document.

Resources Present and Brought Forward for Analysis (Critical and Non-Critical Elements)

The following resources are present in the area, may be affected by the Proposed Action and Alternatives, and are carried forward for analysis.

3.2 Air Quality
3.3 Biological Resources
3.4 Geology and Soils
3.5 Water Resources
3.6 Cultural Resources and Native American Concerns
3.7 Land Use
3.8 Wastes, Hazardous or Solid
3.9 Visual Resources
3.10 Socioeconomics and Environmental Justice

3.2 Air Quality

3.2.1 CLIMATE

The proposed project is located in the intermountain west, which tends to be dominated meteorologically by recurring high and low pressure systems. Churchill County experiences a high

desert climate with hot summers and cold winters. Average temperatures are: 85 degrees in the summer; 39 degrees in the winter; and an average diurnal temperature variation of about 35 degrees (Churchill County 2007). Summer is often marked by stationary high-pressure systems that develop over the region. These systems augment clear-sky conditions but also can result in large-scale stagnation of underlying air when light wind conditions persist.

Winter weather is characterized by transient storm systems that are fairly unpredictable. The project area is part of the Carson Desert, which lies in the precipitation shadow of the Sierra Nevada Mountain Range; precipitation is therefore limited in the project area. The precipitation shadow results when moist air masses rise over the range. The air is cooled until it reaches the dew point, where the water vapor condenses as rain or snow and falls on the windward side or top of the mountain range. The effect is the creation, on the leeward side, of an area of descending dry and warming air, and a region that is quite arid. The precipitation that does occur in the project region occurs mostly from December through March. Winter precipitation is typically rain and snow from large weather systems. Summer precipitation is rain, which is often the result of localized activity caused by solar heating, rising air, and associated thunderstorms. The average annual precipitation in Churchill County is 2 to 3 inches (Churchill County 2007).

3.2.2 AIR QUALITY

The State of Nevada is required to identify geographic areas that are not in compliance with federal and/or state air quality standards. The Nevada Division of Environmental Protection (NDEP), Bureau of Air Quality Planning (BAQP), operates an ambient air quality monitoring network of gaseous and particulate pollutant monitors throughout rural Nevada. The state has nine air quality monitoring stations, the closest of which is located in Fallon, Nevada; the station is approximately 15 miles northwest of the proposed project area. This area is located in Churchill County, which is in compliance with air quality standards and has no non-attainment criteria pollutants (BAQP 2003). Appendix B lists the ambient air quality standards applicable in Nevada.

The unique climate affects the dispersion of emissions from the project area. The arid nature of the local climate makes the project area prone to sudden dust storms on windy days, particularly in the spring (Desert Research Institute 2007). Dust storms are produced by the interaction of strong winds blowing over relatively unobstructed expanses covered with fine-grained dry surface material (USGS 2004). Portions of the project area that fall within the historic lakebed of Pliestocene Lake Lahontan are fine grained and generate considerable dust during storms. Thunderstorms that develop in the afternoons, most often in summer, also generate dust. While substantial dust storms are not common over NAS Fallon, dust “devils”[1] are frequent (Navy 2004). These dust storms can cause substantial decreases in air quality, to the point of severely reducing visibility. Levels of particulate matter in the air are elevated during and following dust storms.

The U.S. Environmental Protection Agency (EPA) released a report on emissions in Churchill County, Nevada in 2001. The report finds carbon monoxide and fine particulate matter (PM_{10}) to be the emissions with the highest concentrations in the county, although none are in non-attainment. Table 3.2-1 provides a summary of the information from the EPA report. Emissions in this table are listed by source category.

The highest carbon dioxide (CO_2) emission is from highway vehicles, likely due to the fact that several highways intersect in Fallon. CO_2 emissions also occur from jet aircrafts at NAS Fallon. The highest contributor to PM_{10} is fugitive dust from unpaved roads.

[1] A dust “devil” is a swirling mass of dust triggered by intense solar heating of dry surface areas (American Meteorological Society 1999).

Table 3.2-1: 2001 EPA Emissions Report, Churchill County, Nevada

Source Category	Annual (tpy)					OSD (tpd)	
	VOC	NO_x	CO	SO_2	PM_{10}	VOC	NO_x
Industrial Fuel Combustion	2	98	19	52	40	0	0
Other Fuel Combustion	94	56	503	15	60	0	0
Petroleum and Related Industries	2	0	0	0	0	0	0
Other Industrial Processes	0	0	0	0	300	0	0
Solvent Utilization	371	0	0	0	0	1	0
Storage and Transport	158	0	0	0	0	0	0
Waste Disposal and Recycling	325	32	3,784	9	228	1	0
Highway Vehicles	960	1,687	9,755	60	69	3	5
Off-Highway	1,008	726	2,765	77	270	3	3
Natural Sources	0	0	0	0	0	0	0
Miscellaneous	0	0	2	0	6,817	0	0
Total Emissions	**2,920**	**2,599**	**16,828**	**213**	**7,785**	**9**	**8**

Notes: OSD: Ozone season day
Tpy: Tons per year
Tpd: Tons per day
VOC: Volatile organic compounds
NO_x: Oxides of nitrogen
CO: Carbon monoxide
SO_2: Sulfur dioxide
PM_{10}: Particulate matter $\leq$ ten micrometers

SOURCE: EPA 2001

3.3 Biological Resources

3.3.1 OVERVIEW

This description of the biological setting of the project area has been determined through literature review, evaluation of aerial photography, and a site visit performed on June 28, and June 29, 2007. Additional information on biological resources at the proposed well pad sites is included in Appendix A: Biological Resources Report (Brookhart 2007).

3.3.2 VEGETATION

The general setting of the project site is typical of the lowland and foothill areas of the Great Basin, with sparse vegetation and saline soils. Vegetation communities in the project area are all of low or moderate quality and are a mix of native and non-native vegetation. The eastern portion of the project area is almost devoid of vegetation in some areas, as there has been no irrigation of these lands and a thick crust of alkaline salts covers the ground. The western portion of the project area has a more significant vegetation component. Several canals pass through the western portion as

part of the Newlands Reclamation Project and this water is or has been used to irrigate crops or to increase the yield of grasses for cattle grazing. The increased soil moisture has resulted in a thicker topsoil layer and denser vegetation, with a considerable number of non-native forb and grass species represented.

Five terrestrial vegetation communities are found in the project area (Figure 3.3-1). The majority of the project is covered by Intermountain Basins Greasewood Flat shrubland. This community includes all areas east of the L12 Canal (see Figure 3.3-1). Vegetation communities west of the canal include shadscale (*Atriplex confertifolia*) shrubland, agricultural/pasture, emergent wetland/riparian, and ruderal areas. Several canals can be found in the area, which were developed in the early 1900's with the Newlands Reclamation Project. The canals are small, channelized conveyance systems. Roads line the banks and obstructions, such as downed tress, are removed from the canals. The waterways are fairly featureless; however the banks of the canals do provide a small strip of vegetation that resembles emergent wetland communities.

Much of the agricultural areas are no longer farmed but are still used as grazing land. Native species, including salt grass, greasewood, and shadscale, are reestablishing in these areas since active farming has ceased.

3.3.3 WILDLIFE

Wildlife

Key Game Species

Nevada has several important mammalian and avian game species associated with the Great Basin desert and mountain habitats. Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation signed August 16, 2007 requires that these species be considered on federally managed lands.

Game species that may visit the project site include mule deer, elk, pronghorn antelope, and California quail. Several other game species would not be found in the project area, including bighorn sheep, black bear, wild turkey, sage grouse, mountain lions, and mountain quail. A narrative of each of these important game species potential for occurrence is included in Table 3.3-1.

Wildlife Habitat

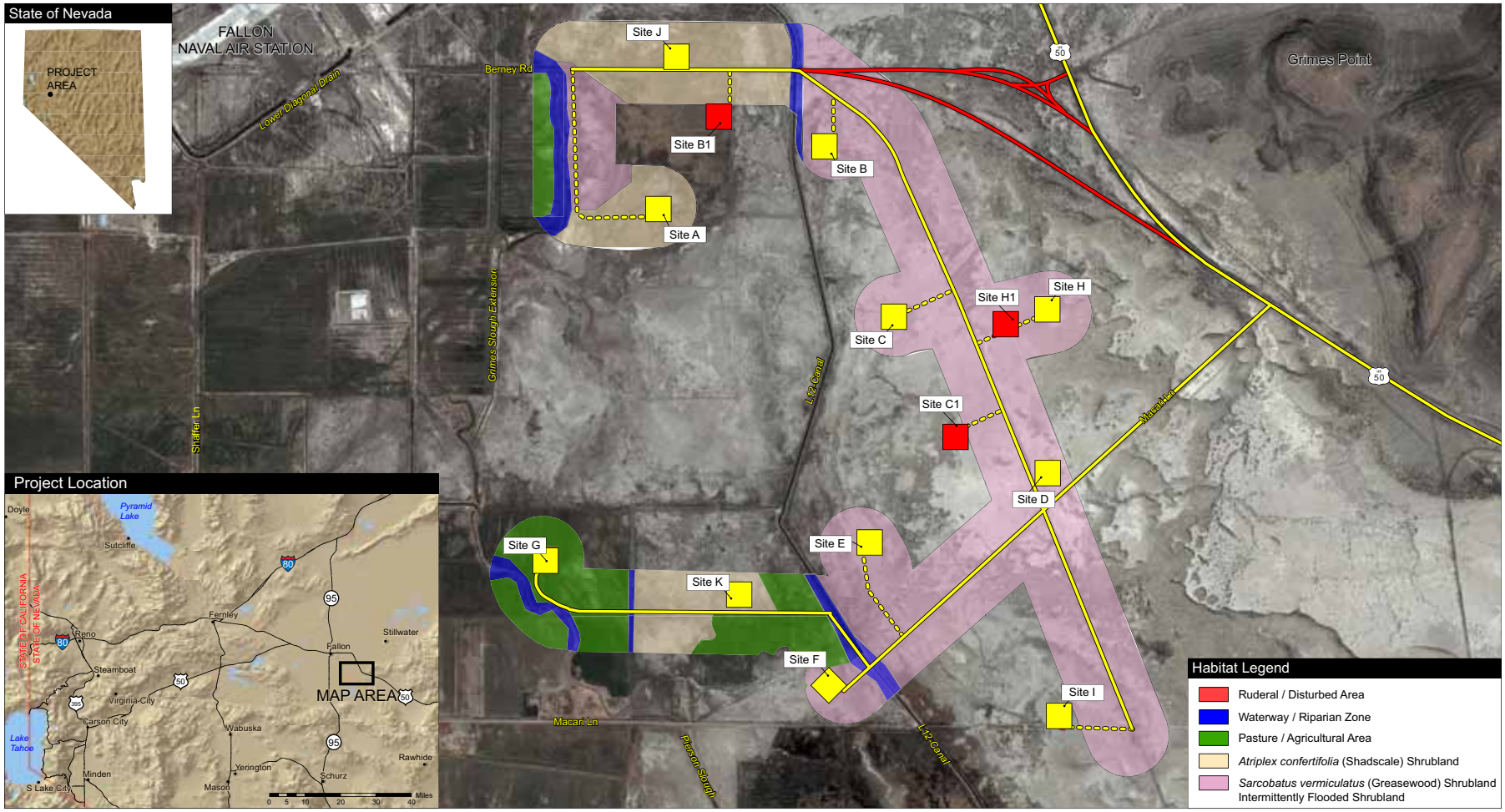
The predominant vegetative community in the project area is greasewood, which provides limited habitat for many Great Basin wildlife species and does not maintain a high diversity or density of wildlife species. The western portion of the project area near the canals and former agricultural land supports a wider variety of species, including some amphibians and waterfowl. Rodents, voles, and lagomorphs are common all over the project area, as are lizards and snakes.

The project area is a mix of native and non-native vegetation, with the eastern portion showing fewer disturbances from agricultural and military uses. The eastern portion is almost devoid of vegetation in some areas, as there has been no irrigation of these lands and a thick crust of alkaline salts covers the ground. The western portion of the project area has a more significant vegetation component. Several canals pass through the western portion as part of the Newlands Reclamation Project and this water is or has been used to irrigate crops or to increase the yield of grasses for cattle grazing. The increased soil moisture has resulted in a thicker topsoil layer and denser vegetation, with a considerable number of non-native forb and grass species represented.

Several terrestrial wildlife habitats are found in the project area as described in the Nevada Wildlife Action Plan (Nevada Wildlife Action Plan Team 2006). The major wildlife habitat types include:

- Intermountain Cold Desert Scrub: comprised of Intermountain Basins Greasewood Flat and Intermountain Basins Mixed Salt Desert Scrub

Figure 3.3-1: Terrestrial Vegetation Communities in the Project Area



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

LEGEND

- Proposed Wellsite
- Alternative Wellsite
- Approved Roadway
- Proposed Roadway
- Restricted Roadway
- U.S. Highway
- Interstate Highway

N W E S

Feet: 0 500 1000 1500 2000 2500 5000

Mile: 0 0.1 0.2 0.3 0.4 0.5 1

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Table 3.3-1: Potential for Occurrence of Key Great Basin Games Species

Common Name	Scientific Name	Description of Habitat/Occurrence	Potential for Occurrence On-site
Mammals			
Bighorn sheep	*Ovis canadensis*	Bighorn sheep prefer open habitats with adjacent steep rocky areas for escape and safety.	Would not occur Lack of habitat
Black bear	*Ursus americanus*	Black bears do occur in shrublands, but close to waters abundant in fish. The canals within the project area do not support fish.	Would not occur Lack of habitat
Elk	*Cervus canadensis*	Elk are common to the mountains and valleys of Nevada. They feed on grasses and forbs.	Would not occur Lack of habitat
Mountain lion	*Puma concolor browni*	Mountain lions prefer dense cover or rocky, rugged terrain, but also occur in desert areas. In Nevada, lion habitat is commonly associated with pinyon pine, juniper, and mountain mahogany. Two of the most important components of lion habitat are a source of meat and cover for hunting.	Would not occur Lack of habitat
Mule deer	*Odocoileus hemionus*	Mule deer graze on grasses and forbs.	Could occur Mule deer may graze on the grasses and forbs in the area; however, the lack of vegetation of the majority of the property precludes much deer use
Pronghorn antelope	*Antilocapra americana*	Pronghorn antelope typically need open spaces with good forb and shrub availability. Over 150 different species of grasses, forbs, and browse plants are eaten by antelope, which allows them to occupy a variety of habitat types. Succulent plants and sprouts are preferred. Some of the main components of pronghorn diet in many locations include sagebrush, antelope bitterbrush, saltbrush, rabbitbrush, cheatgrass, indian rice grass, crested wheat grass, lambsquarter and shadscale.	Could occur Foraging habitat present. May migrate through area.
Avian Species			
California quail	*Callipepla californica*	California quail can tolerate dry habitats and feed on flowers, new growth on shrubs, and insects found in shrub lands.	Could occur
Mountain quail	*Oreortyx pictus*	Mountain quail live in high altitudes where they can be found in grasslands, brush and in open country. They prefer steep slopes with trees and brush for cover.	Would not occur Lack of habitat
Sage grouse	*Centrocercus urophasianus*	Sage grouse are found in foothills, plains and mountain slopes where sagebrush is present, or in mixture of sagebrush, meadows, and aspen in close proximity.	Would not occur Lack of habitat
Wild turkey	*Meleagris gallopavo*	Wild turkey occurs within woodlands and riparian habitats.	Would not occur Lack of habitat

SOURCE: Nevada Department of Wildlife 2007; Brookhart 2007

- Developed Landscapes
- Agricultural Land

Each of these wildlife habitats and the typical wildlife that they could support are detailed below.

Intermountain Cold Desert Scrub

Intermountain Basins Greasewood Flat

Black greasewood (*Sarcobatus vermiculatus*) is found in the majority of the project area. The vegetation is typically composed of a sparse coverage of shrubs, often with little or no groundcover. When groundcover does occur it is often non-native annual forbs. The greasewood flat provides limited habitat for many Great Basin wildlife species, and does not maintain a high diversity or density of wildlife species. Limited wildlife use is especially the case in greasewood habitats that maintain very sparse shrub cover as found in the project area. The habitat provides limited cover for large animals and the high alkalinity makes it unsuitable for amphibian species.

Typical avian species in this habitat could include horned lark (*Erempphilia alpestris*), western king bird (*Tyrannus verticalis*), sage sparrow (A*mphispiza belli*), western meadowlark (*Sturnella neglecta*), and killdeer (*Charadrius vociferous*). Raptors such as the red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), and the Swainson's hawk (*Buteo swainsonii*) would also be expected to pass through the greasewood flat while foraging.

Reptilian species could include side blotched lizard (U*ta stansburiana*), western whiptail (*Cnemidophorus tigris tigris*), long-nosed leopard lizard (*Gambelia wislizenii wislizenii*), and desert collared lizard (C*rotaphytus insularis bicinctores*). Larger lizards would be expected infrequently as they typically prefer habitats with more cover when available. Snakes would not often be found in this habitat because of the lack of prey and abundant cover. Coachwhip (*Masticophis flagellum piceus*), racer (*Coluber constrictor mormon*), gopher snake (*Pituophis melanoleucus deserticola*), and western rattlesnake (*Crotalus virdis lutosus*) are still expected to be found in the Carson Desert area in relatively low abundance.

There were very few rodent burrows in the greasewood flat community. Insects were also relatively absent from the greasewood area, likely a result of the lack of vegetation and water. Representative mammalian species could include black-tailed jackrabbit (*Lepus californicus*), coyote (*Canis latrans*) and many small rodent species, including kangaroo rats (*Dipodomyds spp.*), mice, and voles.

Intermountain Basins Mixed Salt Desert Scrub

Shadscale has generally been interpreted as the regional dominant shrub of the Great Basin Desert. Shadscale forms more associations than does black greasewood (14 versus 10, respectively (NNHP 2003)) and shadscale shrublands can vary widely. Mixed salt desert scrub is typically associated with range and grazing lands, and the community is closely associated with areas of heavy cattle grazing. Bailey greasewood (*Sarcobatus vermiculatus bailey),* spiny hop sage (*Grayia spinosa),* rubber rabbitbrush (*Chrusothamnus nauseosus),* and winterfat (*Ceratoides lanata* var. *lanata*) were present all present in this community. Some exotic plant species include Russian thistle (*Salsola kali)* and cheatgrass.

The mixed salt desert scrub provides better cover and foraging habitat for wildlife than the greasewood flat. Avian species could include sage sparrow, western king bird, western meadowlark (*Sturnella neglecta*), mourning dove (*Nedaida macroura*), and California quail (*Callipepla californica*). Several raptor species could use this community for foraging. These include the American kestrel, red-tailed hawk, and Swainson's hawk (*Buteo swainsoni*).

Representative reptiles include the long-nosed leopard lizard, side blotched lizard, and western whiptail. Rattlesnake (*Crotalus viridis lutosus*) and other snakes are also common to this habitat, including, coachwhip, racer, common kingsnake (*Lampropeltis californiae*), and gopher snake. Common garter snake (*Thamnophis sirtalis*) and western terrestrial garter snake (*Thamnophis elegans*) could also be found on site given the relative proximity to several canals and emergent wetland areas, such as Grimes Slough.

Mammalian species in the area may include coyote, black-tailed jackrabbit and other lagomorphs, raccoon (*Procyon lotor*) and possibly American badger (*Taxidea taxus*). Many small rodents inhabit this community, as indicated by the large numbers of small burrows and tracks.

Developed Landscapes

Developed, Open Space-Low Density

Several canals can be found in the project area. They were developed in the early 1900's as part of the Newlands Reclamation Project. The canals are small, channelized conveyance systems. The waterways are fairly featureless; however, the banks of the canals do provide a small strip of plant species that resembles emergent wetland vegetation. Peach leaf (*Salix amygdaloides*) and sandbar willows (*Salix exigua.*), as well as wetland species such as cattail (*Typha spp.*), bulrush (*Scirpus spp.*), knotweeds (*Polygonum spp.*) and aster (*Machaeranthera spp.*) were observed on the edge of the canal. Several large cottonwoods (Populus fremonti) are found along the L12 Canal at the northern end of the project.

Representative species in developed habitat include red-winged (*Agelaius phoeniceus*) and yellow-headed (*Xanthocephalus xanthocephalus*) blackbird, great blue heron (*Ardea Herodias*), white-faced ibis (*Plegadis chihi)*, and several waterfowl species such as mallard (*Anas platyrhnchos*) and cinnamon teal (A. cyanoptera). The waters could also support northern leopard frog (*Rana pipiens*), and bullfrog (*Rana catesbeiana*). Several snakes would also be expected including gopher snake, western terrestrial garter snake, common garter snake, and western aquatic garter snake (*Thamnopis couchi couchi*). Wildlife would visit this community often, as it is a source for water, food, and cover. The canals also provide corridors for movement across through the area, as willows, other vegetation, and the banks of the canals provide cover for migration wildlife. Reptiles may use the edges of the open area at the existing well pad at site G to sun themselves in the early morning and late afternoon. Mourning doves would also visit the area to pick at gravel and sand to aid in digestion.

Agricultural Lands

The western portion of the project is primarily agricultural lands, or is strongly influenced by this habitat. This area was dominated by sweet clover (*Melitotus spp*), alfalfa (*Medicago sativa*), red-stemmed filaree (*Erodium cicutarium*), chicory (*Cichorium*), knotweed (*Polygonum aviculare*), cocklebur (*Xanthium strumarium*), and peppergrass (*Lepidium sp.*). Much of the agricultural areas are no longer actively farmed, but are still in use as grazing lands. Several native species are also found in this community and reestablishing since active farming has ceased. They include salt grass, greasewood, and shadscale.

The areas designated as agricultural lands support many of the same species found in the mixed salt desert scrub communities. The moist soil is favorable for several plant species, which results in more insects in habiting the area. Predatory bird species such as western kingbird, blackbirds, ibis, herons, American kestrel, red-tailed hawk, and Swainson's hawk would therefore all be expected in the area. Several other birds were seen in the area such as sage sparrow, western meadowlark, mourning dove, and California quail.

Lizards were less abundant in the project area. The thicker grass and forb cover makes movement difficult for these ground dwelling rodents. Snakes would be better suited for this habitat and coachwhip, racer, common kingsnake, western rattlesnake, gopher snake, common garter snake, and western terrestrial garter snake all would be expected in this habitat.

Small mammals were also common in the area. Many burrow holes were observed and several black-tailed jackrabbits were seen. This high density of small mammals would attract predatory species such as coyotes, long tailed weasel (*Mustela frenata*), and American badger.

Table 3.3-2 lists the habitats associated with each proposed well pad.

3.3.4 THREATENED, ENDANGERED, PROPOSED FOR LISTING, AND CANDIDATE SPECIES

Federal Status Species

Federal status species are addressed as a portion of the proposed project is located on Navy lands. The USFWS electronic listing of federally listed threatened, endangered, proposed for listing, and candidate species was reviewed in September 2007 to determine what species may be found in the project area (USFWS 2007). None of these species can be found in the project area. The bald eagle (*Haliaeetus leucocephalus)* can be found in the project area, but was delisted from the USFWS list of endangered and threatened species on June 28, 2007 (USFWS 2007).

3.3.5 SPECIAL STATUS SPECIES

BLM Sensitive Species

Overview

The BLM maintains a list of special status species that it considers when making management decisions and assessing environmental impacts. BLM Manual 6840 defines sensitive species as "… those species not already included as BLM Special Status Species under (1) federal listed, proposed or candidate species; or (2) State of Nevada listed species.

Native species may be listed as "sensitive" if it: (1) could become endangered or extirpated from a state or significant portion of its range; (2) is under review by the FWS/NMFS; or (3) its numbers or habitat capability are declining so rapidly that Federal listing may become necessary, or (4) has typically small and widely dispersed populations; (5) inhabits ecological refugia, specialized or unique habitats; (6) is state-listed, but is better conserved through application of the BLM sensitive species status." It is BLM policy to provide sensitive species with the same level of protection that is given to federal candidate species. The major objective of this protection is to preclude the need for federal listing (BLM 2003). These species are presented in Table 3.3-3.

Plants

Three sensitive plant species were identified as having potential to occur on the project locations (either on access roads and/or well pad sites), as shown in Table 3.3-3.The species are described in greater detail in Appendix A: Biological Resource Report (Brookhart 2007). None of the sensitive plant species were identified during the survey.

Animals

Four bird species, three mammal species, and one invertebrate species were identified as potentially occurring in the project area, as shown in Table 3.3-3. These species are described in greater detail in Appendix A. The only sensitive species observed in the project area during the survey was the white-faced ibis.

Table 3.3-2: Well Pads* and Associated Habitat Type

Well Pad*	Major Habitat Type	Well Pad*	Major Habitat Type
A	Intermountain Cold Desert Scrub	G	Agricultural Lands, Developed Landscapes, Intermountain Cold Desert Scrub
B and B1	Intermountain Cold Desert Scrub	H and H1	Intermountain Cold Desert Scrub
C and C1	Intermountain Cold Desert Scrub	I	Intermountain Cold Desert Scrub
D	Intermountain Cold Desert Scrub	J	Intermountain Cold Desert Scrub
E	Intermountain Cold Desert Scrub	K	Agricultural Lands, Intermountain Cold Desert Scrub
F	Intermountain Cold Desert Scrub		
* Includes access road where appropriate			

SOURCE: Brookhart 2007

Table 3.3-3: Special Status Species with Potential to Occur in the Project Region

Common Name	Scientific Name	Potential to Occur on Site
SPECIAL STATUS SPECIES		
Plants		
Nevada Oryctes	*Oryctes nevadensis*	Low
Nevada dune beardtongue	*Penstemon arenarius*	High
Lahontan beardtongue	*Penstemon palmeri var macranthus*	Low
Invertebrates		
Nevada viceroy	Limenitis archippus lahontani	High
Birds		
Swainson's Hawk	*Buteo Swainsoni*	Low
White-faced Ibis	*Plegadis chihi*	Low
Black tern	*Chlidonias niger*	Low
Long-billed curlew	Numenius americanus	Low
Mammals		
Western Small Footed Myotis	*Myotis ciliolabrum*	Low
Western pipistrelle bat	*Pipistrellus hesperus*	Low
Pallid bat	*Antrozous pallidus*	Low

SOURCE: USFWS 2007; NNHP 2003; NNHP 2007; BLM 2006, NatureServe 2007

Pygmy rabbit (*Brachylagus idahoensis*) is a species of concern in the area, but is not expected to occur within the project area. The species burrows in dense sagebrush with deep loose soils, which are not present on the project site. Burrowing owls (*Athene cunicularia*) are another special status species common in Nevada but not expected at the project area. Burrowing owl is not known to be present within the Carson Desert watershed and they prefer larger burrows (such as fox, badger, prairie dogs) than what is present in the project area, which is primarily rat and vole (NatureServe 2007). Great Basin small blue butterfly and Hardys aegialian scarab do not have potential to occur on the project site due to a lack of appropriate habitat (Kramer pers comm. 2007).

USFWS Species of Concern

The USFWS maintains a list of species of concern. This is not a formal listing under the Endangered Species Act and commonly refers to species that are declining or appear to be in need of conservation. This listing does not impart any particular protection to the species; however, can be used as a planning tool when considering impacts of a project.

Nevada Native Plant Society Species

The Nevada Native Plant Society (NNPS) tracks rare and potentially vulnerable native plant species in Nevada under several categories of conservation concern. The NNPS category assignments for these taxa are reviewed at least annually at the Nevada Rare Plant Workshop, and are updated as necessary. Because these assignments represent the consensus of dozens of botanical experts and resource professionals throughout Nevada and surrounding states, they are maintained in the databases of the Nevada Natural Heritage Program (NNHP), and are considered by NNHP in making its own status assignments and recommendations.

In general, most or all of the taxa on the NNPS Watch List are tracked on NNHP's Watch Lists. Only taxa of conservation concern to NNPS have been assigned to a NNPS category. The species listed as “watch list” species are species that NNPS has determined are potentially vulnerable to becoming threatened or endangered (NNHP 2007).

3.3.6 MIGRATORY BIRDS

Overview

On January 11, 2001, President Clinton signed Executive Order 13186, Land Bird Strategic Allotment, placing emphasis on conservation and management of migratory birds. Migratory birds, in general, are not protected under the Endangered Species Act, but most are protected under the Migratory Bird Treaty Act of 1918. No BLM, BOR, or Navy policies have been developed to provide guidance on how to incorporate migratory birds into NEPA analysis. However, advice based on past USFWS Memorandums of Understanding (MOUs) list items the USFWS believes are fundamental for the analysis of impacts to and planning for these birds. These items are (1) effects to highest priority birds listed by Partners in Flight; (2) effects to important bird areas (IBA’s); (3) effects to important over wintering areas.

Avifaunal biomes that are found on the allotment are described by Partners in Flight (PIF) (Beidleman 2000), PIF-Nevada (Neel 1999) and Nevada Wildlife Action Plan (Nevada Wildlife Action Plan Team 2006). The intermountain west is the center of distribution for many western birds. Over half of the biome’s Species of Continental Importance have 75 percent or more of their population here. Many breeding species from this biome migrate to winter in central and western Mexico or in the Southwestern biome (Beidleman 2000). The species of concern listed by PIF that could occur in the project area are discussed below by biome.

Salt Desert Scrub

This biome experiences harsh climactic variation and is often dominated by salt-tolerant shrubs. Species of concern associated with this habitat type include the loggerhead shrike (*Lanius ludovicianus*) and the burrowing owl (*Athene cunicularia*). Issues related to this habitat type include physical destruction of salt desert shrubs, habitat conversion and use of rangeland pesticides (Neel 1999).

Loggerhead shrike is not expected to occur in the project area due to a lack of small trees to nest in and due to it not being known to occur in the Carson Desert watershed within Churchill Valley (NatureServe 2007). Burrowing owl is also not expected. The species has not been observed in the

project area and no records occur for the area. The area contains only small burrows that would not be suitable for the burrowing owl.

Western Shrublands

Shrubsteppe was identified as the highest priority habitat for conservation for breeding birds. This habitat type supports the largest nesting-bird species list of any upland vegetation type in the West (Beidleman 2000). Species of concern associated with this habitat type in the plan area are the sage grouse (*Centrocercus urophasianus*), Brewer's sparrow (*Spizella breweri*), sage sparrow (*Amphispiza belli*), and the sage thrasher (*Oreoscoptes montanus).* (Neel 1999, Beidleman 2000, Nevada Wildlife Action Plan 2006). Issues related to this habitat type include fragmentation from man-caused activities. Threats to this habitat type include overgrazing of grasses and forbs that alter community structure, invasion of non-native grasses and fire suppression / crown-killing wildfire (Beidleman 2000). Loss of shrub understory, increasing human infrastructure which fragments and degrades habitat, and increases in soil erosion were also identified (Nevada Wildlife Action Plan 2006).

The project area includes intermountain cold desert scrub, comprised of intermountain basins greasewood flat, and intermountain basins mixed salt desert scrub. Sage grouse, Brewer's sparrow, and sage thrasher are not expected; however, because of the low quality of the biome habitat. Sage sparrow could occur in the project area (Brookhart 2007).

3.3.7 INVASIVE, NONNATIVE SPECIES

The predominant non-native species in the project region are Russian thistle (*Salsola kali*) and cheatgrass (BLM 2006). Another non-native species in the project area is exotic salt cedar (*Tamarisk spp*), which has established in Grimes Slough and is also found around some of the other waterways in the area. The genus is fast growing and typically out-competes native vegetation, such as cottonwoods *(Populus fremonti*).

In the former agricultural areas along the western portion of the project site are several non native plant species, including sweet clover (*Melitotus spp*), alfalfa (*Medicago sativa*), red-stemmed filaree (*Erodium cicutarium*), chicory (*Cichorium sp*), knotweed (P*olygonum aviculare*), cocklebur (*Xanthium strumarium*), and peppergrass (*Lepidium sp.*). Native species are beginning to displace these species.

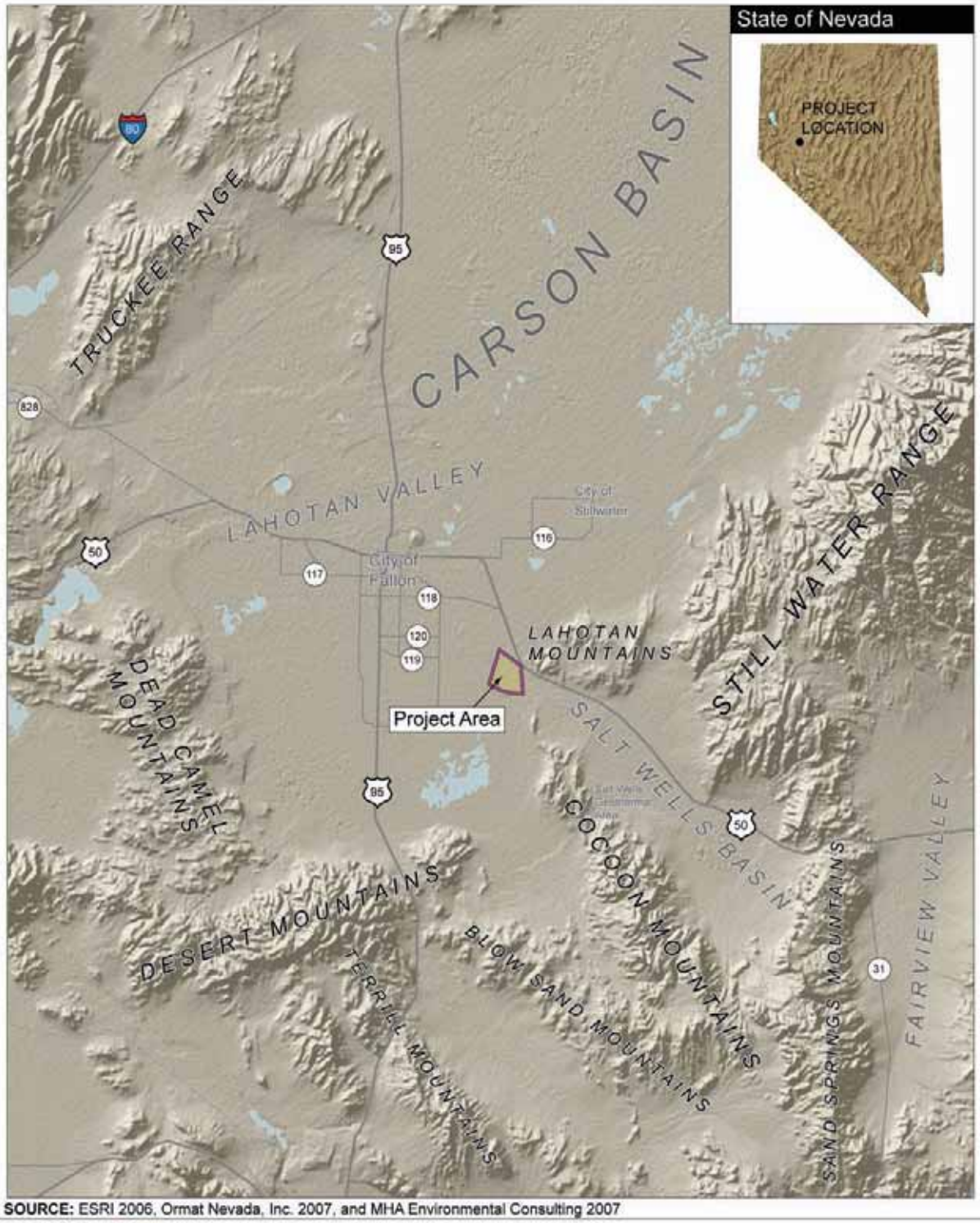
3.4 Geology and Soils

3.4.1 PHYSIOGRAPHY AND TOPOGRAPHY

The Fallon area is within the western portion of the Basin and Range Province. The Basin and Range Province is a particular type of topography that covers much of the southwestern United States and northwestern Mexico. The Basin and Range is typified by elongate north-south trending arid valleys bounded by mountain ranges that also bound adjacent valleys.The valleys tend to be internally draining closed basins with playas. Pleistocene lakes, including the ancient Lake Lahontan, covered much of the northwestern Great Basin from 1.2 million to 10,000 years ago.

The project area is located on the southeast margin of the Carson Desert (Figure 3.4-1), at an elevation of approximately 3,900 feet above mean sea level (amsl). The Carson Desert is a broad, flat, northeastward trending intermontane basin approximately 60 miles long and ranging from 8 to 30 miles wide. The Carson Desert is bounded on the east by the Lahontan and Stillwater Mountains, on the west by Hot Springs and the West Humboldt Ranges, and on the south by the Dead Camel, Desert, Blow Sand, and Cocoon Mountains (Katzenstein and Danti 1982).

Figure 3.4-1: The Carson Desert



SOURCE: ESRI 2006, Ormat Nevada, Inc. 2007, and MHA Environmental Consulting 2007

LEGEND

Project Area | U.S. Highway | Interstate Highway | State Route

0 2.5 5 10 15 20 Miles

The well pad sites in the western part of the project area (closest to NAS Fallon) are located within the former lakebed of Lake Lahontan, while the well pads to the east are located near the ancient low lake terrace/shoreline of Lake Lahontan. Local topography is characterized as relatively flat with some small undulating hills rising no more than about 10 feet in most areas.

Immediately to the east of the project area is a small mountain known as Grimes Point. Grimes Point is approximately 4,159 feet in elevation and is an archaeologically rich location that was frequented by Native Americans 9,000 or more years ago.

3.4.2 GEOLOGY

The Carson Desert is underlain by Quaternary sand dunes and stream sediments, interbedded lake deposits of Pleistocene Lake Lahontan, and volcanic rocks that are about 1,000 feet thick. Lake Lahontan, which covered a large portion of Churchill and Mineral Counties, rose and receded in a number of episodes in response to glacial cycles. Basins alternately filled with water and then dried out, causing lakes to merge and separate. During wet periods deposits tended to be dominated by silts and clays, but during dry periods sand dunes and coarser alluvium would dominate. Volcanic eruptions continued throughout this period. Some of the volcanic material was deposited in the water and some when the water had receded. A wide range of sedimentary deposits is complexly interbedded in the basin. The basin fill deposits are in turn underlain by Tertiary and older igneous and sedimentary rocks.

The major uplift and block faulting that formed the surrounding mountain ranges occurred during the late Tertiary and continued until as recently as about one million years ago (Morgan 1982). The most recent major episode of faulting occurred in the late Pleistocene. The intersections of older and younger faults are thought to be zones of high fracture permeability that may be conducive to formation of a geothermal reservoir (Morgan 1982).

An existing well is located within the western portion of the proposed project area. This well is known as Fallon Observation Hole-1 (FOH-1) and was previously drilled to 8,900 feet. The stratigraphy of the well included:

- Alluvium to about 2,250 feet in depth
- Tertiary basalts beneath the alluvium to about 2,400 feet in depth
- Silicious volcaniclastic tuffs beneath the tertiary basalt with mafic flows to total well depth
- Some granodiorite encountered at 6,800 feet, but this unit may be a fault contact or intrusion

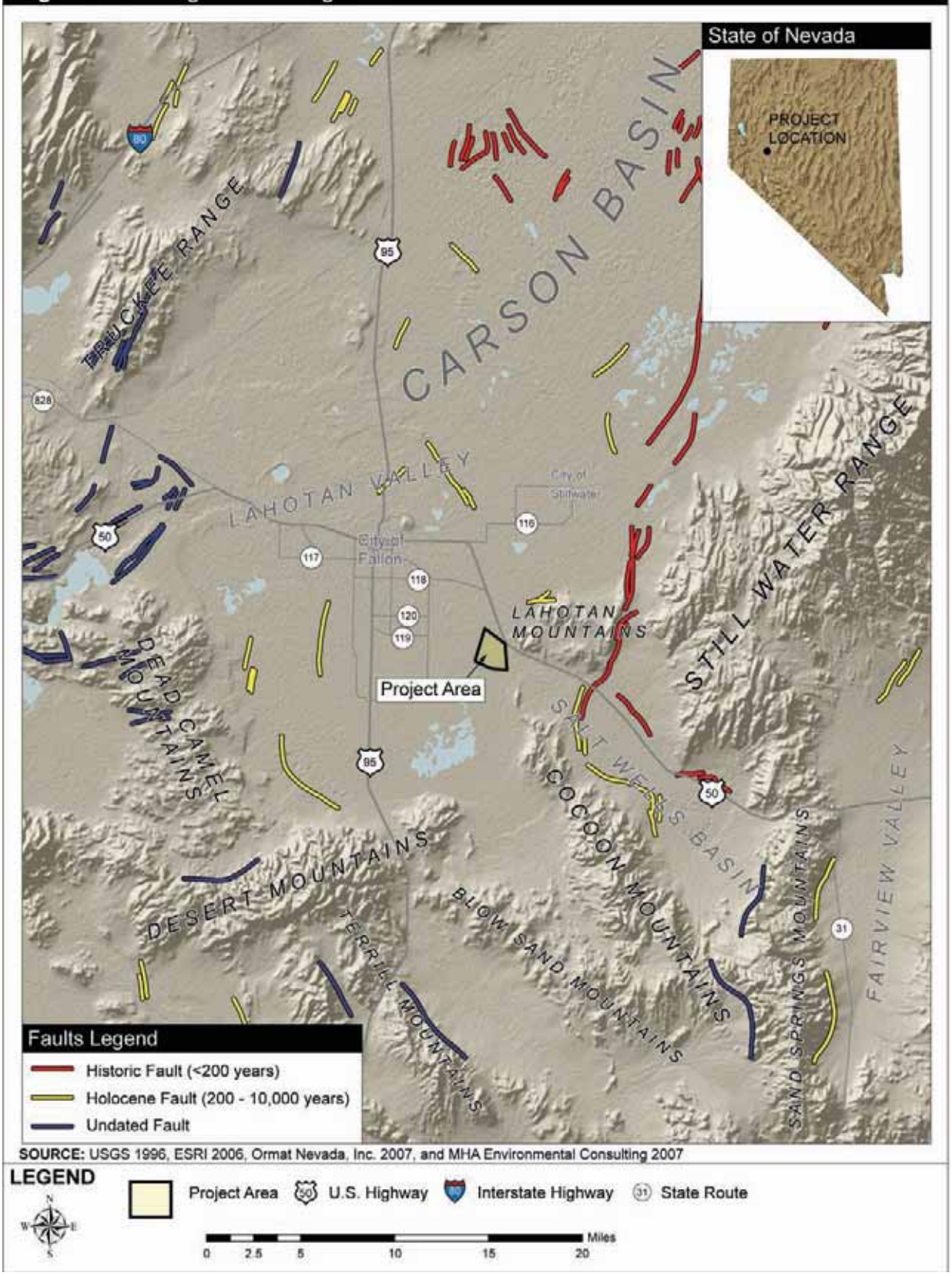
Much of Nevada is seismically active, with substantial movement occurring in the region of the Stillwater Range and the Clan Alpine Mountains in central Churchill County (Stewart 1980). Churchill County is in Zone 4, the highest level zone of seismic hazard. The last significant earthquakes in the region occurred at the foot of the Stillwater Range in the Dixie Valley in July and December 1954. These four earthquakes were of magnitudes ranging from 6.6 to 7.2 (Cottle 2001).

Faults in the project area are shown in Figure 3.4-2. The known active fault closest to a proposed well site is approximately 2 miles away.

3.4.3 SOILS

Most of the soils within the project area are classified as playa, a typical soil of the Carson Sink (NRCS 1986). The soil consists primarily of clayey surface material but varies in particle size from sand to clay. Natural drainage is very poor and internal drainage is very slow; therefore, ponding is common (US Navy 1997). Soils in the project area are shown in Figure 3.4-3. Table 3.4-1 contains a listing of soil types in the vicinity of each drill pad location.

Figure 3.4-2: Regional Faulting



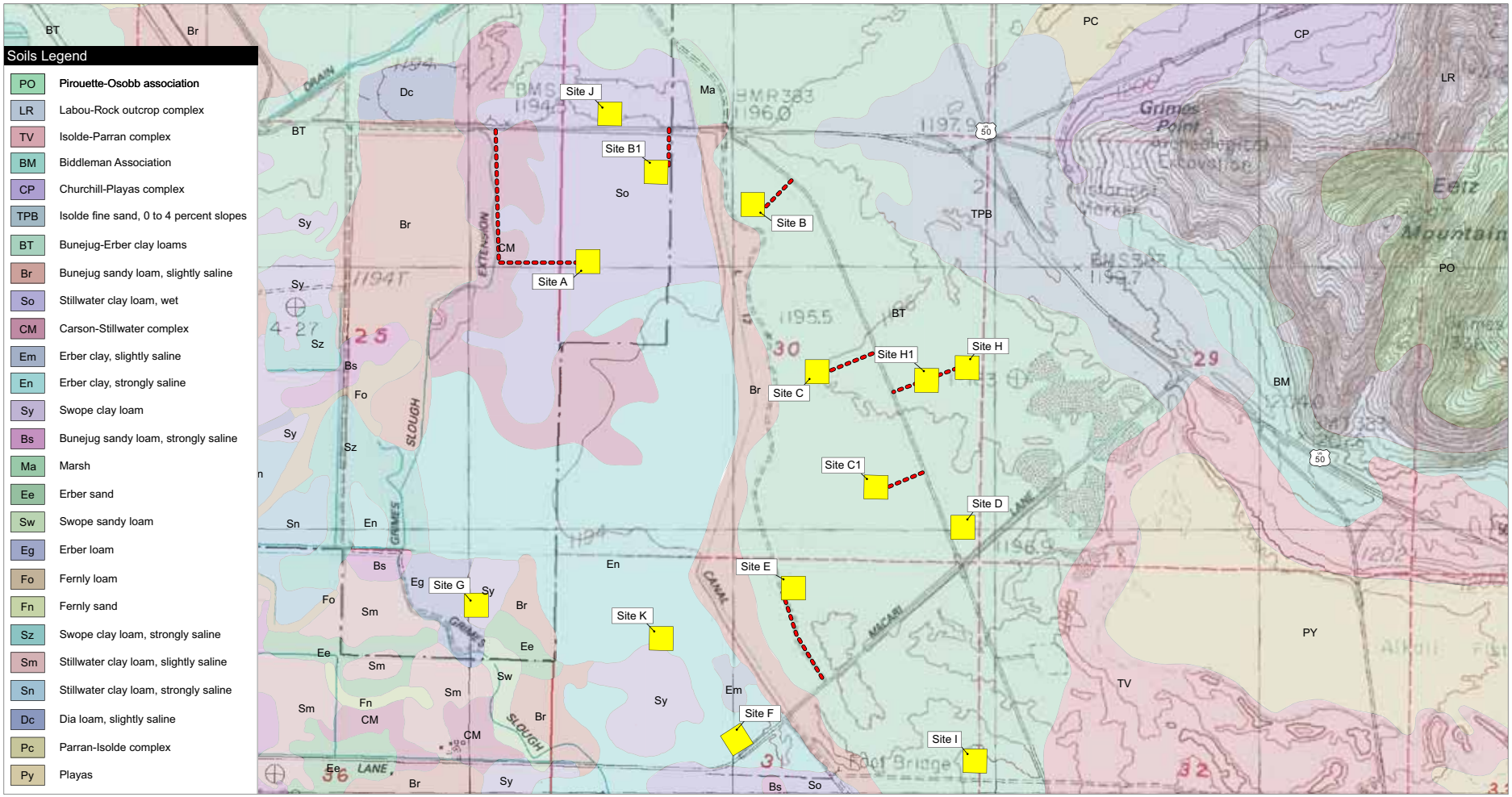
SOURCE: USGS 1996, ESRI 2006, Ormat Nevada, Inc. 2007, and MHA Environmental Consulting 2007

LEGEND

Project Area | U.S. Highway | Interstate Highway | State Route

0 2.5 5 10 15 20 Miles

Figure 3.4-3: Soils in the Project Area



SOURCE: U.S. Geological Survey 1985, U.S. Department of Agriculture, Natural Resources Conservation Service 2006, Ormat Nevada, Inc. 2007, and MHA Environmental Consulting 2008

LEGEND

Proposed Wellsite

Proposed Roadway

U.S. Highway

Feet: 0, 500, 1000, 1500, 2000, 2500, 5000

Mile: 0, 0.1, 0.2, 0.3, 0.4, 0.5, 1

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Table 3.4-1: Soil Types at Drill Pad Locations

Drill Pad Location	Soil Types
A	So: Stillwater Clay Loam, Wet
B	BT: Bunejug-Erber Clay Loams
C	BT: Bunejug-Erber Clay Loams
D	BT: Bunejug-Erber Clay Loams
E	BT: Bunejug-Erber Clay Loams
F	Em: Erber Clay, Slightly Saline
G	Sy: Swope Clay Loam, Slightly Saline
H	BT: Bunejug-Erber Clay Loams
I	BT: Bunejug-Erber Clay Loams
J	So: Stillwater Clay Loam, Wet
K	Sy: Swope Clay Loam, Slightly Saline, and En: Erber clay, Strongly Saline

Series Descriptions:

The **Stillwater series** of soil consists of very deep, poorly drained soils that formed in alluvium from mixed sources. These soils are found on flood plains and delta plains. Slopes range from 0 to 2 percent. The mean annual precipitation is approximately 5 inches and the mean annual soil temperature is approximately 54 degrees Fahrenheit (NRCS 1986).

The B**unejug series** of soil has subangular block, granular dark gray and gray clay loam A1 horizons. The Bunejug series of soil also has subangular blocky and massively finely stratified, dominantly pale olive C horizons with an average texture of fine sandy loam (NRCS 1986).

The **Erber series** of soil consists of very deep, poorly drained soils that formed in mixed alluvium, on flood plains. These soils have very dark grayish brown and very dark gray loam, and silt loam, over dark grayish brown sand at about 16-inches in depth. These soils also have prominent mottles below 12-inches in depth (NRCS 1986).

The **Swope series** of soil consists of very deep, somewhat poorly drained soils that formed in alluvium on flood plains. These soils typically have gray, subangular blocky clay loam and silty clay loam A horizons. These soils also have mottled light brownish gray stratified 2C horizons (NRCS 1986).

SOURCE: USDA 2006; NRCS 1986

3.5 Water Resources

3.5.1 SURFACE WATER

Climate

The proposed project is in the Carson Desert. It is one of the warmest and driest areas of northern Nevada, with wide seasonal and daily variations in temperature and large variations in annual precipitation across the area. The Carson Desert is the largest intermountain basin in northern Nevada. Average annual rainfall in the Carson Desert ranges from less than four inches in the Carson Sink to more than 16 inches in the Stillwater Range which is approximately ten miles east of the proposed project area.

The proposed project area lies within Churchill County, which has an average annual precipitation of two to three inches (Churchill County 2007). Most precipitation falls between December and May, but there are short intense storms at other times of the year. Evaporation far exceeds rainfall, averaging nearly six feet per year (Morgan 1982).

Surface Waters

The primary water features in the project area are irrigation and drainage canals associated with the Newlands Reclamation Project, a project that draws water from the Lahontan Reservoir (which is fed by the Carson River) and by water diverted from the Truckee River. The Newlands Reclamation Project irrigates approximately 60,000 acres, including thousands of acres of agricultural land in the Fallon area. Return-flow and shallow groundwater seepage are directed to the Carson River and wetlands at the Stillwater National Wildlife Refuge and Carson Lake.

Two canals run through the project area, as shown in Figure 3.5-1. Grimes Slough Extension Canal is approximately 0.25 miles west of the proposed Site A. L12 Canal runs north-south through the center of the project area. Several of the proposed drill pads are within 0.25 miles of this canal. Site B is 650 feet from this canal. Site G (which is on Navy land and not part of the BLM leases) is about 400 feet from an unnamed waterway. Wetlands are located several hundred feet south of Site F. Site F is located 650 feet from the L-12 canal, but on private land and would only be developed with permission of the private landowner.

There are no other permanent natural bodies of surface water in the project areas. Carson Lake is approximately five miles south of where the project lies. Carson Lake is an intermittent desert lake that supports wetlands. Most of the runoff is from the east slope of the Bunejug Mountains that is approximately five miles southeast of the proposed site drains to into Carson Lake Basin. Precipitation falling in the Grimes Point area just east of the proposed project drains into the Salt Wells Basin (to the southeast of the project are). Very little runoff is carried into the project area as no slopes exist nearby and no prominent washes pass through the site. Precipitation falling on the site would typically infiltrate into the groundwater, or evaporate.

The fine clays associated with lakebed sediment in the project area retard the infiltration and percolation of heavy rainwater resulting in “mucky” soil conditions during rainstorms. Soils dry quickly due to the arid climate.

3.5.2 GROUNDWATER

Groundwater Sources

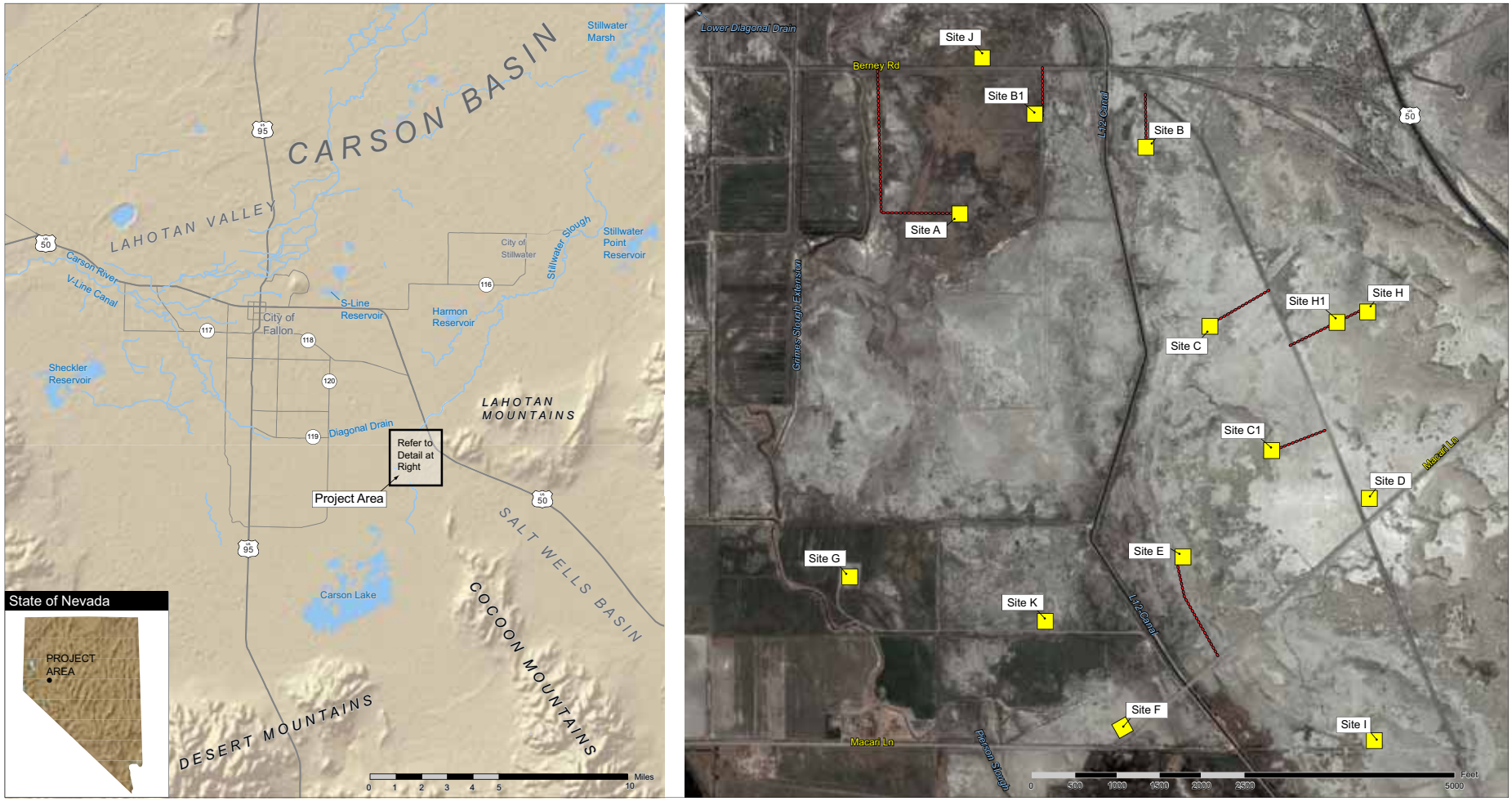
Principal groundwater aquifers in Nevada are basin-fill aquifers, carbonate-rock aquifers, volcanic rock aquifers, and sedimentary rock aquifers. The most common are basin-fill aquifers, which are composed primarily of alluvial, colluvial, and lacustrine deposits. Virtually all major groundwater development in the state has been in the upper 500 feet of basin-fill aquifers. Aquifer recharge is provided by precipitation in the mountain ranges. Water infiltrates alluvial slopes and underflows in poorly sorted, unconsolidated sediments (Glancy and Katzer 1975).

The Fallon area (including the proposed project area) has been grouped into the following general hydrologic systems (Glancy 1986):

- Shallow alluvial aquifer from the surface to 50 feet below ground surface (bgs)
- Intermediate alluvial aquifer from 50 feet to 500-1,000 feet bgs
- Deep alluvial aquifer from greater than 500 feet to 1000 feet bgs
- Basalt aquifer from 200 feet to 1,000 feet bgs, that has intruded into the sediments of the alluvial aquifers

The Nevada Division of Water Resources conserves, protects, manages and enhances the State's water resources through the appropriation and reallocation of the public waters. The proposed project falls within the Carson Desert Hydrographic area. This region encompasses an area of 2022 miles. There is not a current pumpage inventory for the basin (Nevada Division of Water Resources 2008b).

Figure 3.5-1: Surface Waters in the Project Area



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

LEGEND

Project Area | Proposed Wellsite | Proposed Roadway | U.S. Highway | State Route

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The aquifers and aquifer levels in the project area are evidenced in well logs for domestic use in the area. Table 3.5-1 lists the wells that fall within the same Townships, Ranges, and Sections as the proposed geothermal wells. Some deeper wells (in the range of about 100 feet deep) had artesian flows. Most wells encountered a static water level (the shallow aquifer) at depths less than 12 feet. Water quality was unknown except in one shallow well, where it was deemed “good” in the well drillers logs (Nevada Division of Water Resources 2008a).

Groundwater Use

Domestic water demands for the City of Fallon and the Naval Air Station are met through individual domestic wells. Most domestic wells in the project area tap into the shallow and intermediate aquifers, while NAS Fallon taps into the basaltic aquifer (Glancy and Katzer 1975). The nearest domestic wells are listed in Table 3.5-1 and are located about 1 mile from the project area.

The Nevada State Engineer designates the perennial yield that can be withdrawn from the hydrologic basin. The yield for the Carson Desert is 2,500 acre-feet/year.

3.5.3 SURFACE WATER AND GROUNDWATER QUALITY

Regulations

The US EPA has delegated to the state of Nevada the responsibility for regulating the quality of water within its borders. In Nevada, the State Environmental Commission (SEC) and the Nevada Division of Environmental Protection (NDEP) regulate water quality. The state also has antidegradation policies that stipulate that water bodies having quality that is better than the standards must generally maintain its higher quality.

Section 303(d) of the Clean Water Act directs states to compile a list of those waters that need additional measures beyond existing controls to achieve or maintain water quality to the standards (NDEP 2002).

Surface Water Quality

The project area lies within the Carson Desert Watershed. Impaired waters are reported within this watershed. Table 3.5-2 identifies the impaired waters and types of impairment within the Carson Desert Watershed. Sources of contamination were not reported. The nearest contaminated waterbodies include Diagonal Drain, approximately 2 miles from the project location and Rattlesnake Reservoir (also known as S-Line Reservoir) approximately 6 miles from the project location.

Groundwater Quality

The Carson Desert Groundwater Basin is the final discharge area for the Carson River hydrologic system and has become the final receiving area for soluble chemicals transported by the water (Glancy and Katzer 1975). The basin has an abundance of water but most of the water is of poor to very poor quality. Groundwater contamination has also occurred at the Main Station of Fallon Naval Air Station. This contamination is monitored and confined within the Main Station boundaries (US Navy 2001). Groundwater flow in the southern part of the Main Station is upward into a shallow aquifer. In the northern part, flow is downwards through the shallow aquifer (US Navy 2001).

Table 3.5-1: Groundwater Depths in Project Area

Location	Purpose	Date Drilled	Depth of Well feet (blow ground surface (bgs))	Depth to Groundwater (bgs)	Water Quality
T18N R30E Section 30	Monitoring	1992	24 feet	12 feet	Unknown
	Monitoring	1992	30 feet	10 feet	Unknown
T18N R30E Section 31	Domestic	1996	28 feet	8 feet	Unknown
T18N R29E Section 36	Domestic	1992	110 feet	Artesian flow at 10 gpm	Unknown
	Domestic	1998	33 feet	3 feet	Unknown
	Domestic	1998	130 feet	Artesian flow at 5 gpm	Unknown
	Domestic	1998	33 feet	3 feet	Unknown
	Domestic	1998	138 feet	4 feet	Good
T18N R30E Section 19	Domestic	1989	102 feet	6 feet	Unknown

SOURCE: Nevada Division of Water Resources 2008a

Table 3.5-2: Carson Desert Watershed Impaired Waters

Waterbody Name	Impaired Location	Impairment Type(s)
Carson River	Lahontan Reservoir to Carson Sink	Mercury
Diagonal Drain	Entire length	Mercury
Harmon Reservoir	Entire reservoir	Iron, Mercury, and Zinc
Rattlesnake Reservoir (S-Line Reservoir)	Entire reservoir	Iron, Mercury, and Zinc
South Carson lake	Entire lake	Iron, Mercury, and Zinc
Stillwater Marsh	East of Westside Road and north of Stillwater	Arsenic, Boron, Iron, Mercury, and Zinc
Stillwater Marsh	All area not designated Class C	Mercury
Stillwater Point Reservoir	Entire reservoir	Iron
Stillwater Slough	Entire length	Iron, Mercury, and Zinc
V-Line Canal	Carson River Diversion Dam to diversion into the S- and L-Canals	Iron, Mercury, and Zinc

SOURCE: USEPA 2004

3.6 Cultural Resources and Native American Concerns

3.6.1 CULTURAL RESOURCES

Introduction

Cultural resources include landscapes and places, archaeological sites and objects, and historical buildings and structures. Examples of cultural resources are, but not limited to the following:

- Rock art
- Refuse deposits
- Houses
- Tailings
- Railroads
- Roads
- Homesteads
- Quarry sites
- Lithic scatters
- Foundations
- Rock walls
- Waste rock and other mining features
- Rails

A cultural resource generally must be more than 50 years old. This timeframe does not apply in the same manner to TCPs and other sensitive landscapes important to Native Americans.

Cultural Resources Setting

Contemporary Environment

The project area is located within the Carson Desert, a major intermontane basin, located east of Fallon, Nevada and spanning approximately 2,800 square km (Kelly and Hattori 1985). The Carson Desert is one of several adjacent basins that were once a part of a much larger basin containing pluvial Lake Lahontan. It is rimmed by the Hot Spring Mountains and the West Humboldt Range to the west, and the Cocoon Mountains, Lahontan Mountains, and Stillwater Range to the east. Three subbasins present within the region include (from north to south) the Carson Sink, Stillwater Marsh, and Carson Lake (divided by Kelly [2001] into North [Lower] and South [Upper] Carson lakes). The basin is fed by two major drainages: the Humboldt River from the north (which is active only in times of excessive flow) and the Carson River from the west. The latter is the primary water source for the Carson Desert, initiating in the Sierra Nevada and currently emptying into the Stillwater Marsh and Carson Lake (Raven and Elston 1989).

The project area occurs in a broad valley composed of friable, quaternary alluvium and playa deposits. Much of the alluvium filling the valley may have been deposited during the Tertiary Period, dating from 43 to 6 million years ago (Stewart and Carlson 1977), while playa matrix is composed of reworked alluvial and lacustrine sediments derived from aeolian deposits and underlying Lahontan strata. To the east, Grimes Point is composed primarily of Upper Volcanic Rocks (17-6 million years ago), a conglomerate of basalt, andesite, rhyolite, silicic tuff, and related rocks with sparse tuffaceous sedimentary rocks and gravel (US Navy 2007).

Paleoenvironment of the Carson Desert

During the terminal Pleistocene, around 16,000 before present (B.P)., the Carson Desert was submerged under pluvial Lake Lahontan following a climatic shift that caused northern glaciers to melt. Lake margins spread as far north as the Nevada/Idaho border and south to Walker Lake (US Navy 2007). Shortly thereafter, Lake Lahontan began to desiccate. The lake may have stabilized into a single lake, or possibly three to four lakes (Davis 1985). By 9500 B.P., Carson Lake may have been reduced to a series of low lakes and marshlands (Davis 1985; US Navy 2007).

At sometime during this series of recessive and infilling events, caves and overhangs developed at Grimes Point due to repeated wave action that eventually cut into the jutting landform (Kelly 2001). The environment of the Carson Desert during the early Holocene was quite different than it is today. Though warmer and drier than preceding times, conditions were on average cooler and wetter than at present. Artemesia steppe vegetation remained dominant in the area until at least 6,900 B.P., implying the persistence of a relatively moist climate (Zeanah et al. 1995).

The gradual warming trend continued into the middle Holocene, and from about 7,000 to 4,500 or 4,000 years ago, the Great Basin grew increasingly arid. Between 4000 and 2000 B.P, mesic conditions returned and a winter-based precipitation pattern emerged; snowpack from the Sierra Nevada Mountains provided water to the wetlands and lakes in the Carson Desert and increased runoff from a re-routed Walker River might have sent additional water into the area from 2800 B.P. to 2000 B.P. (Benson and Thompson 1987).This may have helped wetland habitats to stabilize, mature, and generate a greater abundance of plant and animal life. Warmer, drier conditions followed from 2000 to 1000 B.P as a spring/summer precipitation mode returned to support a habitat of grasses and desert scrub.

A drier period yet, referred to as the “Medieval Climatic Anomaly”, occurred between 1150 and 600 B.P.; winter precipitation was more common and lake levels increased after having dropped for at least 1,400 years. This may have been a result of increased stream flow from the Carson River. However, there is evidence of several fluctuations between severe but brief droughts and short mesic intervals between ca. 1000 B.P. and 600 B.P. (Lindstrom 1990; Stine 1990, 1994). Periods of extreme aridity would have likely transformed wetland habitats in the Carson Desert into pockets of arid zones with even greater sodicity in the soil. After 300 B.P., the climate in the Carson Desert again became wetter, with essentially modern conditions prevailing over the last 50 to 100 years.

Pre-Contact Setting

Terminal Pleistocene-Early Holocene/Pre-Archaic (11,500-7500 B.P.)

Prehistoric adaptive strategies in the Great Basin remain largely undefined prior to 10,000 B.P., though there is ample evidence that the archaeological record extends to 11,500 years ago. The general settlement strategy of early Holocene or “Pre-Archaic” cultures in the Great Basin is regarded as highly adaptive and regionally variable. Groups in the Lahontan Basin, for instance, were highly mobile and relied on gathering, small-game hunting, and seed processing in various mountain, desert, and lacustrine environments. According to Elston (1986), the typical lithic assemblage of the pre-Archaic groups in the western Great Basin consists of large bifacial knives, stemmed and concave base projectile points (with ground lateral edges), crescent-shaped tools, punches, choppers, gravers, and several forms of scrapers. Some tools, like projectile points, were used for single tasks; others, like bifaces, gravers, and scrapers, appear to have been utilized for multiple tasks.

Middle Holocene/Early Archaic (7500-3200 B.P.)

Changes in the archaeological record of the northern Great Basin prior to 5000 B.P. signal the beginning of the transition from Pre-Archaic to Early Archaic adaptive strategies. The timing of this event, however, is not well defined. Radiocarbon dates from Early Archaic sites at Winnemucca Lake range from about 7300 to 5200 B.P. (Elston 1986). At Shinners Site I in Falcon Hill, a grass layer found over a cache pit dates to 4,780 B.C. (ca. 6780 B.P.); organic debris from Guano Cave dates to 4,550 B.C. (ca. 6550 B.P.); and a cedar bark cloth from a burial in Cowbone Cave dates to 3,720 B.C. or roughly 5720 B.P. (Elston 1986; Heizer and Hester 1978; Hattori 1982). In general, archaeologists recognize the onset of the Early Archaic by about 7000 to 6000 B.P. in the northern and central Great Basin (Elston 1986). Human groups began to regularly occupy and utilize rockshelters and caves in lowland areas, using them primarily for short-term shelter and long-term storage. By about 5000 B.P., Early Archaic occupations in the Lahontan Basin were common, judging by the numerous sites known in the Winnemucca Basin and Carson Sink. Some of these sites demonstrate the regular use of cache caves, most evident during periods when lacustrine resources along the shorelines were abundant.

Archaeological assemblages dating to this period in western Great Basin prehistory are typified by varieties of projectile points bearing weak shoulders and indented or split-stem bases. Historically,

gracile split-stem points termed Little Lake (Harrington 1957; Bettinger and Taylor 1974), Gatecliff Split-Stem (Thomas 1981), and Bare-Creek Eared (O'Connell 1971) have been associated with this time period. Milling equipment is clearly an important part of mid-Holocene assemblages with its morphology reflecting the importance of portability and less concern for intensive shaping.

Early Late Holocene/Middle Archaic (3200-1400 B.P.)

Dramatic changes in Great Basin subsistence adaptations during the early portion of the Late Holocene produced a wide variety of temporal and spatial differences in archaeological patterning. The number of archaeological sites dating to this period increases markedly over the previous interval, while attendant material remains diversify considerably in terms of functional specialization and stylistic/cultural affinity. Three main themes punctuate discussions of this period in the western Great Basin. The first involves the replacement of the atlatl-and dart with the bow-and-arrow; the second relates to an intensification of adaptive strategies that included or related to environmental shifts, population growth, and technological innovation; and the third pertains to a supposed expansion of Numic populations (and cultural tradition) across the west toward the end of the Late Holocene.

Until about 1,500 years ago, projectile technology in the western Great Basin was centered on the use of a throwing stick (atlatl) and a large, bifacial point (dart). Typical dart points of the early Late Holocene in western Nevada and eastern California include those of the Elko series (Corner-notched, Side-notched, Contracting-stem, and Eared variants), the Gatecliff series (primarily Split-stem and Contracting-stem forms), and the Humboldt series (Basal-notched, Concave-base). These points flourished in use between about 3500 and 1500 B.P., with some regional styles being a bit younger or older than others. However, sometime around 1500 B.P. or shortly thereafter, the bow-and-arrow appeared in the Great Basin and brought with it a change in projectile technology. Larger, heavier dart points gave way to smaller arrow points. Popular regional styles now called Rose Spring and Eastgate points, were replaced more recently (about 600 B.P.) by even smaller arrow points (Desert Side-notched and Cottonwood series). It is not known exactly how the emergence of the bow-and-arrow affected other aspects of prehistoric technologies, but a decline in the reliance on bifacial manufacturing is clearly implied (Basgall and Giambastiani 1995; Giambastiani 2004).

Distinctive changes in settlement and subsistence patterns and assemblage complexity are evident during the interval referred to as the Middle Archaic (4000 to 1500 B.P.) in the western and central Great Basin. Seasonal campsites were inhabited for increasing duration and on a more frequent, regular basis within localized territories. Winter camps often feature pit houses, which demonstrate multiple interior features such as hearths, storage and cache pits, and sometimes inhumations. A wider range of resources was more intensively exploited within distinct ecozones, signifying a broadening of diet bread and an "intensification" of subsistence resource use. Groups also utilized more local raw material in manufacturing stone tools, though exotic obsidian and marine shell artifacts also appear in the archaeological record. The presence of these non-local materials suggests outside contact for trading purposes (Jennings 1986).

In the Lahontan Basin between 3500 and 1500 B.P., human groups practiced a slightly more sedentary settlement pattern, often shifting from upland to lowland camps during certain seasons. Lowland residential camps were fairly large, village-like sites established at the mouths of large rivers such as the Humboldt and Truckee (Jennings 1986); presumably, the preference of such locations implies that Middle Archaic groups in the Lahontan Basin relied on riverine and lacustrine subsistence resources for much of the year. In the Carson Desert, little evidence of prehistoric occupation appears prior to 4,000 B.P (Kelly 2001). According to Zeanah et al. (1995), women's foraging strategies were focused on wetland habitats especially from 4500 B.P. to 2000 B.P., when intervals of mesic climate, shifts in seasonal temperatures and precipitation, and fluctuations in stream flow into the Carson Desert were common. Since foraging locations often reflect where

residential camps were based, these would have occurred in marsh communities as well (Kelly 2001).

Terminal Late Holocene/Late Archaic (1400-170 B.P. [Euro-American Contact])

In many parts of the western Great Basin, there are clear archaeological examples of shifts in subsistence organization that relate to the increased use of plant resources after about 1500 B.P. (Basgall 1987; Basgall and Giambastiani 1995; Basgall and McGuire 1988; Bettinger 1989, 1990, 1991; Delacorte 1990). These shifts were typified by a diversification of diet breadth to include more low-return or labor-intensive foodstuffs (both faunal and floral), and were accomplished through the development of new technology (use of water in leaching acorns; seedbeater, specialized baskets, and extensive milling features for bulk seed procurement; use of bow-and-arrow instead of atlatl-and-dart; pottery for cooking and storage) or by the adjustment of plant collection and processing techniques in an effort to extend plant harvests (green-cone collection and roasting pine nuts, green-seed collection and flash-burning; dry storage). Population pressure, in combination with small-scale environmental changes, has been given much of the credit for increasing resource competition among Great Basin huntergatherers, thus necessitating some alteration of subsistence strategies. In addition to changes in material technology and extractive methods, increased trade during the Late Holocene was another mechanism that allowed human groups access to resources that may have been unavailable because of geographic population circumscription.

Contact Period (170-70 B.P.)

At the time of Euro-American contact, the western Great Basin was inhabited primarily by the Northern Pauite such as the Sawawaktödö, Makuhadökadö, and Küpadökadö along the Humboldt River, the Wadadökadö near Honey Lake, the Huyuidokado at Pyramid Lake, the Aga'idökadö and Pakwidökadö around Walker Lake, and, in Carson Sink, the Toedökadö (Fowler 1989, 2002; Gilmore 1953; Heizer 1960, 1970a, 1970b; Kelly 2001; Loud 1929; Park 1938; Steward 1937, 1938, 1939; Stewart 1937, 1938, 1941; Wheat 1967).

The territory of the Toedökadö (or Toidįkadį), or "Cattail-eaters," (Fowler 2002) had been modified to encompass "all of the Carson Sink, some distance up the Carson River, Fairview Valley to the southeast of Carson Lake, Dixie Valley, and into the Clan Alpine Range" (Shimkin and Reid 1970). Stewart (1939) extended the territorial boundary farther east, across the Desatoya Mountains and near the Reese River Valley. Ethnographic and archaeological data suggest that the groups mostly relied on wetland communities as residential bases but adopted a mobile lifeway to utilize more distant upland and lowland resources outside of the Carson Desert given fish, large game, seeds and piñon appear to have all been important in their diet (Kelly 2001).

The Toedökadö practiced a seasonally semi-nomadic lifeway, hunting, gathering, and fishing in the wetlands, the surrounding desert, and uplands. Fowler (2002) describes the plant geography of the Toedökadö where resources were seasonally acquired (or stored) for their seeds, berries, pollen, roots, and stems or leaves. Little greasewood-shadscale shrubs are dominant in lowlands, where numerous edible perennial grasses, and other annual and perennial plants were sought. A larger array of plants in wetland habitats present in Stillwater Marsh, Stillwater Slough, along the Carson River, in the Carson Sink, and on the margins of the Carson Lakes, include Indian ricegrass, needlegrass, bluegrass, saltgrass, meadow barley, squirreltail, and mat barley; these were available during early to midsummer. Wildrye, bulrush, wheatgrass, sand dropseed, and alkali sacaton were available during mid to late summer while cattail was available in the fall (Kelly 2001). Tubers of chufa fatsedge and sego lily were also available (Kelly 2001). Tule, willow, sagebrush, and cattail were heavily utilized to make clothing, personal adornment, basketry, tools, and a variety of other woven materials including matted covers for domed houses or boats (Bengston 2003; Fowler 2002). Resources from upland zones, such as summer seeds, fall berries, and pine nuts, were also sought.

The first Euro-American explorers to visit the Lahontan Basin, around 1830, noted the relatively large Native American (Toedökadö) population in the area (Bidwell 1890; Dodge 1860; Leonard 1904; Simpson 1876). Relations between the Toedökadö and the earliest explorers in the area were peaceful. Once the gold rush in California commenced in 1848, however, tens of thousands of Euro-Americans passed through the Carson Desert each year on their way to try to strike it rich; other waves of emigrations followed. The emigrants brought with them disease and left behind abandoned wagons and dead livestock, which likely provided the Toedökadö with new sources of food and material goods as their natural habitat was altered (Fowler 2002).

The first permanent Euro-American settlers in the area appeared in the mid-1850s, and Mormon settlement in the Carson Valley required a new route connecting Salt Lake City to the region, which passed through Toedökadö territory. The settlers soon began to displace local people from the wetter meadow areas and into less desirable areas; some native peoples soon began to work for the settlers as ranch hands and laborers, while others retreated to upland areas. Hostile encounters between the settlers and the Toedökadö appear to have been minimal until around 1860, and shortly thereafter, Fort Churchill was established approximately 25 miles west of present-day Fallon (Fowler 2002). In 1861, a Virginia City journalist by the name of William Wright (a.k.a. Dan DeQuille) visited the area and wrote a very detailed ethnographic account of the Toedökadö. DeQuille reported that though they were adapting some cultural elements from the white settlers, the native people were still living at traditional sites and were following traditional subsistence patterns (DeQuille 1963). As settlement and cultivation of the land increased, the Toedökadö people more intensively adopted Euro-American culture. In 1893, the Bureau of Indian Affairs distributed 30,000 acres of land to the Churchill County Indians; however, this allotment excluded the prime lands already owned by white settlers. As much of their land lacked water and proved too alkaline to cultivate, native peoples continued to work as ranchers and in other capacities for Euro-American settlers (Fowler 2002).

Historical Setting

The project area is located near an historical crossroads that contains transportation corridors, a major federally sponsored irrigation project, mining, agriculture, a Native American reservation, and one of the region's most important rivers.

Exploration

The exploration of Nevada by Euro-Americans started as early as 1826. Fur trappers Jedediah Smith (Rocky Mountain Fur Company) and Peter Skene Ogden (Hudson's Bay Company) were the first known individuals to explore the American West. Both were in search of furs and explored the "Unknown Territory" (what was then a part of Mexico) by trapping beaver along the many rivers and tributaries of this unexplored region (McBride 2002).

In 1833, after Ogden and Smith established that the rivers of Nevada were not bountiful sources of beaver pelts, another expedition took place. The Walker-Bonneville Expedition, commanded by Joseph R. Walker, entered Nevada near Pilot's Peak and then followed the Humboldt River to the Humboldt Sink, about 25 miles north of the project area. Here, tensions with the Native Americans resulted in Walker's men killing 30 to 40 Native Americans. In the spring of 1834, Walker returned to the Great Basin from the San Joaquin Valley. This route, again led Walker and his men to the Humboldt Sink. Like before, Walker encountered a group of Northern Paiutes. The encounter resulted in Walker and his men killing 14 of the Northern Paiutes (McBride 2002:3-5). Violent run-ins with the native populations resulted in overall distrust by Indians of Euro-Americans and feelings of contempt for Walker (McBride 2002).

In December of 1843, John C. Fremont entered into northwestern Nevada in present-day Washoe County and trekked south to a large desert lake with a pyramid-shaped island. Fremont named the impressive body of water Pyramid Lake, then followed the Truckee River, which he named the

Salmon Trout River, south to present-day Wadsworth. From Wadsworth he continued south to the Carson River, followed it to its sink, then turned back along the Carson River, and crossed the Sierra Nevada near Carson Pass, ending at Sutter's Fort in March of 1844 (Elliott 1987; McBride 2002).

In 1845, Fremont led another exploration party into Nevada. At Mound Springs near the Pequop Mountains his party split into two groups. Theodore Talbot and Joseph Walker led their party northwest along the Humboldt River. Fremont led his southwest to Ruby Valley and eventually to Walker Lake where the two groups met up again (Elliot 1987). At Walker Lake they split once more. Fremont took his group north to the Truckee River, then through the Truckee Meadows, and over Donner Pass, while the other group went south to Owens Valley. Fremont more accurately mapped the Humboldt, Truckee, Carson, and Walker river basins, giving him a clearer understanding of the nature of the region as an interior drainage and inspiring the name Great Basin (McBride 2002).

Emigration

The many explorers of the early- to mid-nineteenth century paved the way for numerous emigrants that would follow in their footsteps into California shortly after. The Donner Party crossed the Forty Mile Desert and then followed the Truckee River to the Truckee Meadows late in 1846, only to push further into the Sierra Nevada during a devastating snowstorm. The news of their disaster frightened numerous would-be emigrants, keeping traffic on the Humboldt-Carson Emigrant Trail low for the next couple of years (Hulse 1991). The pinnacle of this westward movement was in 1849 with the California Gold Rush. It is estimated that between 15,000 and 25,000 people immigrated to California in 1849 alone (McBride 2002). When the Gold Rush broke out, the Humboldt-Carson Trail became the most popular trail to California. The trail entered Nevada north of Pilot Peak, then aimed straight for the headwaters of the Humboldt River, leading the travelers across Nevada as far as the Humboldt Sink. From there they crossed the Forty Mile Desert to the Carson River or the Truckee River. They then followed each of these rivers to the Sierra Nevada and climbed the daunting mountain range into California (Hulse 1991).

Mining

Three mining districts are situated near the CLGE, including Sand Springs Marsh to the southeast, Sand Springs to the southeast, and Mountain Wells to the east. The Sand Springs Marsh Mining District was discovered in 1863 and was utilized for its salt deposit until 1870. In 1870, borax was discovered at the mine, and borax works were active at the site for several years. The district encompasses a fairly large area, beginning at Salt Wells about 15 miles southeast of the town of Fallon, and ending at Sand Springs, approximately 30 miles southeast of Fallon (Lincoln 1982). The Sand Springs Mining District includes most of the Sand Springs Range and was discovered around 1866. The district appears to have been rediscovered in 1905. It was a source of silver, gold, tungsten, mercury, and titanium (Tingley 1998). Last, the Mountain Wells Mining District sits on the eastern slope of the Stillwater Mountains. A silver deposit was discovered here and the town of La Plata founded in 1862. The district was used until the ore supply was exhausted in about 1868, and La Plata became a ghost town soon after the decline of the mining district. Prospectors shipped a small amount of silver ore from the district in 1919 and 1920 (Lincoln 1982).

Though mining has played a relatively minor role in the immediate vicinity of the project area, it was this activity that spurred the construction of railroads all around the state and initiated settlement in a region considered by many in the nineteenth century to be worthless and barren.

The Central Pacific Railroad

In 1869, only 20 years after 49ers trekked their way across Nevada with oxen and wagons, the Central Pacific Railroad was completed, connecting California to New York. In the vicinity of the study area, the historic railroad followed the Truckee River. From the railroad town of Wadsworth

(established in the spring of 1868), The Central Pacific Railroad continued northeast to Lovelock across the Forty Mile Desert. In 1899, the Railroad bought out the local facilities of the Southern Pacific Railroad (Myrick 1962). Immediately, plans for improvements were under way. The end result was a series of line improvements including 221 miles of track that were rebuilt between Sparks and the Utah state line (Myrick 1962).

U.S. Highway 50 – The Lincoln Highway

The Lincoln Highway began as a dream of entrepreneur Carl Fisher in 1912. He envisioned a coast-to-coast paved highway, which would be the first of its kind and one of the few paved roads in the United States at the time. After much lobbying and commotion over what the official route would be, federal funds were secured in the early 1920s, a federally-approved route was chosen, and construction began. Some parts of the highway were quickly completed, but the entire route wasn't finished until 1937 when the last section in Nebraska was done (Franzwa and Petersen 2004). The eventual demise of the Lincoln Highway as a major coast-to-coast route occurred in part as a result of the movement in the mid-1920s toward a numbered, federal highway system. Named roads were ignored in the planning of the numbered highway system, and the Lincoln Highway was broken up into a series of different numbers throughout the United States. In Nevada, the highway would be known as U.S. 50. With this change, and the removal of all highway markers along the road referring to the Lincoln Highway, public interest in the road dropped considerably, and use of the road dwindled once Interstate 80 became the main east-west route for cross-country travelers.

The Lincoln Highway roughly follows US Route 50 from from Ely, Nevada to west of Fallon, Nevada in the project area. Portions of the highway are considered historical where unique historical or engineering features remain.

Agriculture and the Newlands Project

After the discovery of the Comstock Lode in 1859, agriculture in Carson Valley along the Carson River grew with the needs and demands of the thousands of miners, families, and entrepreneurs on the slopes of Mount Davidson to the north. Ever since this initial boom, agriculture has managed to have some staying power in Nevada, despite fluctuating mining boomtown markets. The area around Fallon did not develop as an agricultural center until the Newlands Project was under way beginning in 1903, because of its alkaline soils and the lack of water in the area.

As the Nevada mining industry began to experience a major decline at the end of the nineteenth century, and agricultural efforts were hampered by a long drought during the 1880s and 1890s, Nevada politicians began looking to diversify the economy and improve the odds for agriculture through the development of large-scale irrigation projects. As early as 1888, Senator William Morris Stewart was advocating such projects in the U.S. Senate, though he ultimately proved to be unsuccessful. Francis G. Newlands, who was elected to the U.S. House of Representatives in 1892, proved to be a much more effective advocate for irrigation. During Newlands' fifth term, President Theodore Roosevelt entered office as a strong supporter of national policies that would aid in the development of agriculture in the arid American West. Newlands saw his chance and sponsored the Newlands Reclamations Act of 1902(Hulse 1991).

The Truckee-Carson Project (later renamed the Newlands Project) began construction on the Derby Dam immediately after the Reclamation Service authorized the work in 1903 (Hardesty and Buhr 2001). The U.S. Reclamation Service split the route of the canal into three 10-mile segments with construction camps and staging areas located at convenient points along the way (Townley 1998). By 1905, the 30-mile-long Truckee Canal was completed and was providing water to irrigate farmlands in the newly founded towns of Fallon and Fernley. The Truckee Canal diverted approximately half of the flow of the Truckee River from the Truckee River Basin to the Newlands irrigation system and the Carson River Basin. Between 1911 and 1913, the Lahontan Reservoir was

under construction on the Carson River. By 1914, the towns of Fernley and Fallon had grown into fairly orderly and reasonably prosperous communities (Hulse 1991). But with time, existing irrigation systems were in desperate need of repair. In the 1930s, the Civilian Conservation Corps (CCC) undertook the work of enlarging and upgrading existing irrigation systems, much to the relief of farmers who had fallen on hard times (Kolvet and Ford 2006).

The plan was that 400,000 acres would be irrigated by a system of canals and ditches fed by the Truckee Canal and the Carson River. In the end it was determined that only 87,500 acres of land could be irrigated by the irrigation project. Ultimately, the Newlands project dramatically changed the landscape of the Carson and Truckee river basins with the birth of a new agricultural center located on formerly uncultivable land, dams built up and down both rivers affecting the flow of water and the spawning of fish, and the diversion of water away from Pyramid Lake and the Pyramid Lake Indian Reservation. Many problems arose from the Newlands project. The irrigation of the alkaline soils increased their alkalinity, and the soils had poor drainage, making many areas a swampy, alkaline mess. This problem was addressed by creating drainage systems to remove excess water. Another problem that arose from the Newlands project was a dispute over water storage rights at Lake Tahoe, which led to prolonged lawsuits (Hulse 1991). Other litigation revolved around the water rights to the Truckee River and Pyramid Lake (Hardesty and Buhr 2001).

The canals in the project area are associated with the Newlands Project. Certain Newlands Project facilities (including canals, pipelines, dams, and other irrigation features) have been determined eligible for inclusion in the National Register of Historic Places as a part of the Newlands Project Multiple Property Listing (Deschler personal communication 2007).

Naval Air Station Fallon (NAS Fallon)

A portion of the project area lies within lands managed by NAS Fallon. Initially established by the Army Air Forces (predecessor to the modern Air Force) in 1942 in response to fears that Japan would attack military airfields in California, NAS Fallon was soon abandoned by the Air Force in 1943 following naval victories in the Pacific. Shortly thereafter, the Navy took the site over to train Navy pilots assigned to aircraft carriers until the end of World War II. The facility reopened following the outbreak of the Korean War to train Navy pilots in the use of jet aircraft (NAS Fallon ICRMP 2007).

Construction work at the air station in the 1950s involved renovation of some of the original buildings at the station and significantly expanding the size of the built environment at NAS Fallon. Additionally, the use of jet aircraft required that a larger series of runways be built at the station. In fact, a 14,000-foot runway was built in the mid-1950s; at the time of its construction, this was the largest Navy runway (US Navy 2007). Remaining World War II-era buildings were evaluated at NAS Fallon as part of the 1993 Cultural Resources Management Plan (Woodward-Clyde Consultants 1993); one aircraft beacon (designated Building 95) was deemed potentially eligible for the NRHP. An inventory and evaluation of Cold War-era buildings at the Main Station was conducted by the Navy in 1998 (JRP Historical Consulting 1998), though this study is considered to not meet current standards by NAS Fallon and the State Historic Preservation Office (SHPO).

Currently, the mission of NAS Fallon emphasizes final training of entire Navy squadrons immediately prior to their deployment aboard aircraft carriers. The principal tenant at NAS Fallon is the Naval Strike and Air Warfare Center (NSAWC), which include training functions in addition to the Navy Fighter Weapons School (“Top Gun”) and the Carrier Airborne Early Warning Weapons School (“Top Dome”). The Aviation Intermediate Maintenance Department is located at the base, and a Seabee unit, Construction Battalion Unit 416, is permanently stationed at the base as well. The station is also used by Naval Reserve Units for their routine training.

Cultural Resource Investigations

Project Area

The project area is located approximately 7 miles southeast of the town of Fallon, Nevada.The proposed well pad sites can be accessed by a series of unpaved access roads from Highway 50 (which lies to the east of the project) or Highway 95 (to the west of the project). Both improved and unimproved access roads are present in the area. Unpaved roadways that are maintained in the area include Macari Lane, Berney Road, and Schaffer Lane. A map of the project location is shown in Figure 2.1-1. For the purposes of this EA, the “project area” is the general region in which the project occurs. The Area of Potential Effect (APE) for this project is defined as the 500 by 500 foot well pad sites and the 20 foot wide access road corridors leading up to the well pads. The “study area” refers to the cultural resources survey area and includes a 500 foot radius from the center point of each proposed well pad for well pads J, A, G, K, F, E, and a larger area surrounding pads B, C, D, H, F, and I. The larger area was surveyed in order to relocate the 300 by 300 foot pad sites to avoid resources. The total area inventoried for cultural resources encompasses 304 acres, including 10 acres of private land, 44 acres of NAS Fallon lands, and 250 acres of Reclamation lands.

Previous Cultural Resource Investigations

Prior to initiating fieldwork, ASM conducted archival review at the Nevada State Museum in Carson City, the NVCRIS Map Service website, at NAS Fallon, public land records on file with the Nevada State BLM, and at the Carson City BLM Field Office; additionally, property and structure maps were obtained from the Truckee-Carson Irrigation District (TCID).

A number of cultural resource inventories have been conducted within one mile of the proposed APE of the project; however, the vast majority of reports and site records obtained were outdated. Grimes Point has witnessed archaeological work since the late 1920s, and much of the South Carson Lake area has been punctuated by small-scale cultural resources management efforts since the 1970s. Many of the earliest studies never produced reports, and those completed in the 1970s and 1980s often lack adequate site records and have poor locational data. A limited number of recent data sets prove more applicable (such as Young and Wriston 2005; Kelly 2001). Others locally that are helpful include (Kelly 2001; Obermayr and Branch 2007; and Zeanah et al. 1995).

A cluster of substantial, well-studied archaeological sites are known around Grimes Point, located less than a mile east of the Ormat project area. At Grimes Point, a major petroglyph site overlooks the study area from the east atop a low promontory at the margin of South Carson Lake. Farther back from the lake, within a group of hills that juts out from the main body of the Stillwater Range, are a number of caves and rockshelters that have been the focus of archaeological study since the 1940s, including Spirit Cave (Dansie 1997; Kirner et al. 1996), Fish Cave (Wheeler and Wheeler 1969), Hanging Rock Cave (Tuohy 1969), Burnt Cave, Picnic Cave, Goblin Cave, High Cave, Fallen-in Cave, and Hidden Cave (Thomas 1985). All in all, landscapes surrounding Grimes Point, and including the current project area, contain more than 100 known pre-contact and ethnohistoric archaeological sites.

While several studies are associated with Grimes Point, only three previous studies covered portions of the current project area (Hardesty and Buhr 2001; and Young and Wriston 2005). A total of 27 sites have been identified within a one mile radius of the project area, these including lithic scatters, lithic scatters with historic debris, petroglyphs, temporary camps, mixed pre-contact and ethnohistoric deposits, ground stone scatters, and historic irrigation features. Three of these sites lie within the originally proposed APE for this project, but none fall within the Alternative 1 APE (discussed in Chapter 4 of this EA). Details of previous research and recorded sites are provided in a technical cultural resources inventory report for the current study area (Sprengeler et al. 2008).

Inventory Methods

Fieldwork for the project was completed in two phases, the first between July 19-20 and 23, 2007 and the second from September 4-7, 2007. The first session concentrated on inventorying a 500-foot (150-meter) radius from the center point of each proposed drill pad and on completing inventories of all proposed access roads. Several alternative locations for drill sites were selected for additional survey in order to avoid placing drill pads at or near potentially NRHP-eligible resources and to decrease the proximity of certain drill pad sites to the “Designated No Surface Occupancy Area”. Ultimately, the acreage added near drill sites B, C, H, and I was inventoried during the second field session; in the end, the survey totaled approximately 304 acres (approximately 121 hectares) of land, including eleven proposed geothermal drill pads, proposed access roads, and larger tracts surrounding the drill pad sites noted above.

Coverage was achieved by traversing parallel transect lines generally oriented to cardinal directions with surveyors spaced intervals no more than 30 meters apart (per BLM and State guidelines). Isolated artifacts and features were noted, recorded with a Trimble GPS receiver, and measured and illustrated as appropriate.

All newly identified sites were thoroughly examined to demarcate boundaries regardless of whether or not they were fully contained within the current project APE. Each site was recorded on an Intermountain Antiquities Computer System (IMACS) site form and mapped using a Trimble GPS Receiver. A wooden datum stake with an aluminum tag inscribed with a temporary site number was placed at every site. Digital photographs were taken of each site and any associated features or diagnostic artifacts. No artifacts or archaeological samples were collected and no subsurface testing or probes were excavated during the inventory.

ASM archaeologists also attempted to relocate and re-examine any previously identified sites plotted within any portion of the project APE. Any relocated sites that were previously recorded more than 15 years ago were fully updated by ASM personnel. Only two of the previously recorded sites within the project APE were eventually relocated. One site had additional components necessitating a dramatic expansion of its boundaries. ASM field personnel generated new IMACS forms for the site that include the added components of the site and mapped the new site boundary and components using a Trimble GPS receiver. The second site was a segment of the Lincoln Highway/Old U.S. 50, which was photographed and examined to document its current condition, and the site record was updated. The third site suspected to be present in the project APE was not relocated.

Regulatory Background

Cultural resources are protected primarily through the National Historic Preservation Act (NHPA) of 1966 and the regulations implementing Section 106 of that Act (36 CFR § 800), the Archaeological and Historic Preservation Act of 1974, and the Archaeological Resources Protection Act of 1979. Section 106 of the NHPA requires federal agencies to consider the effects of their actions on cultural resources that meet the criteria and are considered eligible for inclusion in the NRHP. These cultural resources are known as “historic properties.”

Criteria for inclusion on the NRHP are provided in 36 CFR § 60.4. Section 101(d)(6)(A) of the NHPA allows properties of traditional religious and cultural importance to a tribe to be determined eligible for inclusion on the NRHP.

The American Indian Religious Freedom Act of 1978 also allows for access to sites of religious importance to Native Americans. The Native American Graves Protection and Repatriation Act of 1990 provides for the repatriation of human remains and funerary items to identified Native American descendants.

Inventory Results

Twenty-eight sites and 22 isolated finds were identified and recorded as a result of the cultural resources inventory. Additionally, one previously identified site was re-examined and its boundaries expanded, and a site record update was completed to document a segment of the Lincoln Highway that passes through the project area. Three potentially eligible sites fall within the proposed APE. The eligible aspects of these sites include ethnohistoric components and pre-contact components. Nine additional sites that are recommended as ineligible for listing in the NRHP also fall within the APE of the proposed project.

Under Alternative 1, six sites fall within the project APE, either within the 500 by 500 foot radii for proposed well pad sites or along the routes of proposed access roads. All are recommended as ineligible for NRHP listing as historic properties except for one, which is considered unevaluated for NRHP eligibility. All are historical refuse deposits except for one historic road and one site with pre-contact and historical components.

Other than several roads, canals, and some graded areas, inventoried lands are relatively free of modern impacts. Still, some of the roads and canals have led to an increase in ponding, while others have bisected archaeological sites; there is some evidence of recent (1960s-1980s) episodes of trash dumping; and relic collector's artifact piles were identified at several locations. These impacts have caused some adverse effects, but it is natural forces, particularly a combination of flooding, erosion, and deflation, that have taken a heavy toll on almost all of the archaeological sites identified during the survey. Ground surfaces in many areas have been stripped bare of loose sediment, leaving archaeological features like middens and hearths as thin, carbon-stained patches on playa-like exposures and artifact deposits as sparse, discontinuous scatters. Ultimately, the lack of preservation and poor overall physical integrity of most project sites affect their eligibility for NRHP listing.

3.6.2 NATIVE AMERICAN CONCERNS

Native American Resources

Native American resources are sites, areas, and materials important to Native Americans for religious, spiritual, or traditional reasons. These resources may include villages, burials, petroglyphs, rock features, or spring locations. Fundamental to Native American religions is the belief in the sacred character of physical places, such as mountain peaks, springs, or burials. Traditional rituals often prescribe the use of particular native plants, animals, or minerals. Activities that may affect sacred areas, their accessibility, or the availability of materials or natural resources used in traditional practices are also considered when evaluating these areas.

Ethnographic information indicates that the Northern Paiute occupied the study area, and their way of life is characterized by the concept of living in harmony with the natural environment. Rituals and ceremonies address the need to ensure that plants, animals, and physical elements flourish. The continued welfare of the people depends on these rituals and ceremonies being performed properly. The manner of performing the rituals and ceremonies, the places at which they are performed, and perhaps even the time of their performance are often prescribed.

Religious expression takes several primary forms including ceremonies, individual prayer, and use of power spots for vision questing, curing, and doctoring. The most frequent form of expression is the individual prayer. Prayers are made to the spirits and were especially important in connection with places where spirits may live or places regarded as power spots.

Sensitive areas having religious or cultural importance have been previously identified in the area by the Fallon Paiute-Shoshone Tribe. The Grimes Point area is of great importance to the Tribe. The

archaeological area encompasses approximately 1,160 acres and is recognized as one of the most significant archaeological sites in the Great Basin.

Tribal Consultation

Consultation is being conducted with the Fallon Paiute-Shoshone Tribe located in Fallon, Nevada. Consultation was initiated on August 8, 2007 to visit the proposed exploration well pads. On October 25, 2007 correspondence was sent to the Tribe with additional information concerning the proposed exploration, maps of the locations, drilling process, webpage with similated drilling photos, preliminary results of the cultural resource survey and a map with alternative locations based upon the findings of the cultural resource survey. Correspondence was received by the BLM from the Tribe on August 13, 2007 identifying the significant cultural value of the area to the Tribe. Concerns were expressed for locations identified during the previous field trip (well pads B, C, H and a portion of D). The proposed exploration pads are sensitive due to their position on the landform, the sandy shore of Carson Lake. Ormat responded to the area of sensitivity and the alternative sites were sent to the Tribe on October 25, 2007.

A second field trip was conducted on February 29, 2008. Specific site locations were examined in reference to the alternative pads locations, access roads and evaluation process for cultural resources identified during the cultural resource inventory. Subsequent to the site visit, a request was made for an archaeological monitor for all exploration activities and a tribal monitor for specific locations as discussed.

Consultation with the Fallon Paiute-Shoshone Tribe will be ongoing throughout the exploration process.

3.7 Land Use

3.7.1 LAND USE

Regional Setting

The proposed project is located in the west-central portion of Nevada in Churchill County. Churchill County encompasses approximately 5,000 square miles, of which approximately 91 percent is publicly owned. Land management and ownership percentages are shown in Table 3.7-1.

Table 3.7-1: Land Ownership/Management in Churchill County

Land Owner/Manager	Percentage of Ownership/Management
Bureau of Land Management (BLM)	71%
Bureau of Reclamation (BOR)	13%
United States Navy	4%
State of Nevada and Churchill County	1%
Fallon and Walker River Reservations	1.5%
Southern Pacific Railroad	8%
Privately-owned farm land	1.5%

SOURCE: Churchill County 2005

There is one population center near the project area, the City of Fallon in Churchill County. The City of Fallon is located approximately seven miles northwest of the project area, and has a population of approximately 8,304 people. Churchill County is a lightly urbanized area with approximately 25,036 residents (US Census Bureau 2007).

The project area is within an area of approximately 2.25 square miles, or 1,440 acres. Lands within and adjacent to the lease areas are managed by the BOR, the BLM, and the Department of Defense (DOD) at the Naval Air Station Fallon (NAS Fallon). One site, Site F, is located on private land and would require permission of the private land owner for development. Land management in and around the lease area is shown in Figure 1.1-2. The private land in the project vicinity is zoned by Churchill County for agricultural uses.

BOR managed lands in the project area are all part of the Newlands Project, one of the first projects built by the BOR. The Newlands Project is operated by the Truckee-Carson Irrigation District (TCID) through a contract with the BOR. The Lahontan Basin Area Office of the BOR administers the operation of the Newlands Project in consultation with TCID, Pyramid Lake Pauite Tribe, the U.S. Fish and Wildlife Service, the Fallon Pauite-Shoshone Tribe, and the Federal Water Master.

The Geothermal Steam Act gave BLM the responsibility and authority for leasing geothermal rights for geothermal development and for reviewing and authorizing the development. The BOR managed lands in the project area were leased for geothermal development to Ormat in 2006. The effects of leasing were analyzed in an EA prepared by the BLM (BLM 2006). The geothermal leases are shown in Figure 1.1-2.

The DOD manages the lands on NAS Fallon. In addition to the runways, barracks, and other uses typical of a Naval air station, the DOD also allows livestock grazing on portions of its land, as described above. Bureau of Land Management and Navy Resource Management Plan for Certain Federal Lands in Churchill County, Nevada (September 2001) outlines how resources on the Naval lands in the project vicinity are to be managed by the DOD.

The Pony Express National Historic Trail is within the vicinity of the lease area but does not cross it. The Grimes Point Archaeological Area and the Fallon Indian Reservation are also in the vicinity of the lease area. The Stillwater NWR is adjacent to and to the north of the lease area.

Policies and Plans

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of Federal Land Policy Management Act (FLPMA), to encourage the development of mineral resources, including geothermal resources, on federally managed lands. A geothermal lease is an authorization to possess and use public land for a fixed period of time. A geothermal lease is issued when there is going to be substantial construction, development, and improvement and there is an investment of large amounts of capital that would be amortized over time. Geothermal leasing is proposed only on public lands administered by the BLM or on other lands where the BLM has the express legal authority to lease with the concurrence of the other agency.

The leasing of geothermal resources on the BOR managed lands is managed by the BLM. BLM does not issue leases on DOD managed lands. The Consolidated Resource Management Plan (CRMP) (BLM 2001) guides management of the BLM managed public lands under the jurisdiction of the Carson City Field Office. The CRMP provides the BLM with the authority to issue geothermal leases on these lands.

The BLM has designated the eastern portion of the project area as “no surface disturbance” to protect cultural and natural resources. Several of the proposed well pad sites are located very near these areas, but are not actually located within this designated area.

The CRMP also states in its standard operating procedures that no surface occupancy, including the construction and operation of well pads, be constructed within 500 feet from canals and other water features.

3.7.2 TRAFFIC AND TRANSPORTATION

Highway transportation within the Fallon area is provided by US Highways 50 and 95. US Highway 50 is used by tourists traveling to and from Reno. US Highway 95 connects Yerington with Fernley and Fallon, and runs south from Fallon to Las Vegas (see Figure 2.1-2).

The Lincoln Highway or the "old" Highway 50 is considered a historical roadway, and segments of the roadway are subject to certain use regulations, including the maintenance and restoration of the roadway if it is damaged during construction and operation of any development project. Two sections of the highway exist in the project area, connecting Highway 50 to Berney Road. The southern section has been structurally altered and does not require restoration and maintenance if used (see Figure 2.1-2).

Local arterials in the project area include Berney Road, Macari Lane, and Shaffer Lane. Various unimproved, graded roads also provide access within the proposed project area.

Annual average daily traffic (AADT) figures for highways and arterials in the project area were obtained from the Nevada Department of Transportation Annual Traffic Report (NDT 2006) (see Table 3.7-2). The year 2002 showed the highest rates of traffic in the vicinity in the past 10 years, with subsequent years showing a marked decline in traffic counts. The Churchill County Road Department does not have any designated roadway capacities, so for purposes of this analysis, typical daily roadway capacity volumes (OCEMA) were used to analyze existing traffic capacity in the project vicinity. Level of service (LOS) can range from A (little or no delay) to F (failure/extreme congestion). The roadways shown in Table 3.7-2 operate at LOS A or better at 5,000 annual average daily traffic trips or less. Therefore, all roads in the project vicinity are currently operating at the optimal level of service. The traffic would have to increase to 15,000 before any of these roadways would reach LOS F.

Table 3.7-2: Annual Average Daily Traffic (AADT) Counts in the Project Vicinity

Name of Road	2002 AADT	2006 AADT
U.S. Highway 50, 2.6 miles east of Harmon Road	1,350	960
U.S. Highway 50, 1.5 miles east of Macari Lane	1,300	840
Berney Road, 0.1 miles east of Pasture Road	690	610

SOURCE: NDT 2006

3.8 Wastes, Hazardous or Solid

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a federal fund to clean up uncontrolled or abandoned hazardous waste sites and certain other releases of pollutants and contaminants into the environment. Section 120(h) of CERCLA requires that property contaminated by the federal government be restored before being conveyed outside the federal government (USEPA 2002).

The Resource Conservation and Recovery Act (RCRA) gave the EPA the authority to control hazardous waste from when it was created to its disposal and includes the generation, transportation, treatment, storage, and disposal of hazardous waste. Drilling fluids, produced water,

and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy are exempt from RCRA Subtitle C (USEPA 1993).

The project area is undeveloped and no hazardous materials are known to be present. There is no evidence to suggest that hazardous material was stored for one or more years, disposed of, or released on the project area or the eastern portion of the Navy managed lands (where well pads A, J, and G occur) (BLM 2002; Deverin, personal communication 2007).

3.9 Visual Resources

3.9.1 REGIONAL VISUAL SETTING

The project would be located on public lands in Churchill County, Nevada, that are currently leased and or under contract to Ormat for geothermal resource development. The proposed project area is approximately seven miles southeast of Fallon, Nevada (Figure 2.1-1).

The project area is characteristic of the Great Basin environment; desolate landscapes of sun-saturated, brush-strewn valley floors interspersed with barren, bleached alkali playas, bordered by often barren, but frequently colorful, elongated and steep mountain ranges (BLM 1974). Higher elevations support sagebrush, juniper, and pinyon pine providing visual diversity and contrasting darker color along ridgelines in the distant background. Vegetation on the valley floor grows low and evenly and primarily consists of monochromatic desert brush (US Navy 2000). Although these areas are sparsely populated, fences, utility lines, roads (paved and dirt), historic trails, houses on private lands, mines, and road signs are present (BLM 1974).

The form, line, color, and texture of the Great Basin landscape are influenced by the arid climate. The hills are gold and brown, and the blue sky can be dotted with fluffy clouds and thunder clouds at times. Sunlight is a dominating element in the area, and winds create dust funnels (US Navy 2000; BLM 1974).

3.9.2 LOCAL VISUAL SETTING

NAS Fallon

NAS Fallon lies to the northwest of the project area, and three of the proposed well pads are located on the NAS Fallon property. NAS Fallon Main Station includes a few buildings visible in the distance from the project site. The 14,000-foot-long runway is located approximately 0.5 miles to the northwest of the project area. Aircraft take off and land on the runways occurs several times per day and are often visible overhead.

Grimes Point

The Grimes Point Petroglyph Trail (Grimes Point) is adjacent to the project site. Grimes Point is one of the largest and most accessible petroglyph (rock art) sites in the US. Grimes Point rises to a height of 250 feet above the project area. A mile-long, self-guided interpretive trail exists for visitors. Picnic pavilions are visible in the parking lot of Grimes Point.

3.9.3 SENSITIVE RECEPTORS

Sensitive receptors in the project area include drivers looking west from Highway 50, recreational visitors (particularly at Grimes Point), and local residents. Recreational activities in the area include hiking, picnicking, wildlife viewing, viewing local petroglyphs, and the Valley Off Road Racing Association's (VORRA's) special recreation permit races. The closest sensitive receptors are two ranch properties located approximately 1,742 feet and 2,428 feet south of Site G, on Macari Lane.

3.9.4 VISUAL RESOURCE MANAGEMENT CLASSIFICATION

The BLM has not established visual resource management (VRM) classes for this area (BLM 2001). Although no BLM VRM classes have been established yet for this area, projects of this nature are generally required to meet the VRM Class III objective in such a situation. The VRM Class III objective is to partially retain the existing character of the landscape, limiting the level of change to the character of the landscape to a moderate level. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

The Navy and BOR do not have any visual management requirements for the project area (Kurtz, personal communication 2007).

3.10 Socioeconomics and Environmental Justice

3.10.1 POPULATION

The population of the State of Nevada is increasing, as is the population in Churchill County. The source of much of the population growth in Churchill County has been from in-migration. Approximately a third of the County's population resides in the City of Fallon. Population statistics for the region are shown in Table 3.10-1.

NAS Fallon is also located in Churchill County, and has a population of approximately 3,000 personnel, most of who live in the City of Fallon (NAS Fallon 2007).

Demographics

Racial and ethnic data for Churchill County for the years 1990 and 2000 are illustrated in Table 3.10-2. According to US Census Bureau data, the white population increased by 33 percent, and it remained the dominant race in Churchill County. The largest minority within the County is Hispanic/Latino, followed by American Indian/Alaska Native.

The Fallon Paiute-Shoshone Tribe of the Fallon Reservation and Colony consists of 60 acres two miles northeast of Fallon, and the reservation covers 8,000 acres 12 miles to the northeast of Fallon.

3.10.2 HOUSING

Churchill County has a total of approximately 9,732 housing units, while the City of Fallon has a total of approximately 3,336 housing units (US Census Bureau 2007). The Fallon NAS has 360 on-base family dwelling units, and 2,334 bachelor quarters/barracks (Globalsecurity.org 2007).

Table 3.10-1: Population in the Project Area

	1990	2000	2006
State of Nevada	1,201,833	1,998,257	2,495,529
Churchill County	17,938	23,982	25,036
City of Fallon	6,438	7,536	8,403

SOURCE: US Census Bureau 2007

Table 3.10-2: Demographic Changes in Churchill County (1990-2000)

	1990	2000	Percentage (2000)	Percent Change
Total Population	17,938	23,982	N/A	33.7
White	16,216	20,192	84.2	24.5
Black/African American	251	384	1.6	53.0
American Indian/ Alaska Native	968	1,151	4.8	18.9
Asian	502	648	2.7	29.1
Pacific Islander*	N/A	48	0.2	N/A
Other	N/A	767	3.2	N/A
Two or more*	N/A	791	3.3	N/A
Hispanic/Latino**	1,184	2,086	8.7	76.2

Notes: * These categories did not exist in the 1990 census: Asians and Pacific Islanders were grouped together, and the option to choose multiple races did not exist.

** In combination with other races. The categorical figures/percentages may add up to more than the total population (100 percent) because individuals may report more than one race.

SOURCE: US Census Bureau 2007

3.10.3 SCHOOLS

The Churchill Unified School District serves Churchill County, with one preschool, five elementary schools, a junior high school, and two high schools, with a total enrollment in the 2007-2008 school year of approximately 4,500 students (Churchill County School District 2007). All of the schools within this district are within the City of Fallon.

3.10.4 EMPLOYMENT AND ECONOMY

The most recent employment figures for Churchill County show that the county has a labor force of 12,415 people and an unemployment rate of 4.2 percent. Churchill County experienced a large growth in total employment between 2001 and 2004 of 18.3 percent. The largest increase in employment in Churchill County was associated with mining (271.1 percent). There were also large increases in employment in the construction sector in Churchill County (55.7 percent). Between 2001 and 2004, the employment in the agriculture sector decreased, while the largest decrease in employment was in the manufacturing sector (18.2 percent).

Income and Earnings by Industry

Per capita personal income in 2004 for Churchill County was $32,171, an increase of 22.6 since 2001, while earnings by persons employed in Churchill County increased by 26.3 percent (BEA 2006). Table 3.10-3 includes a list of earnings by industry and the percent change.

Household Income

The US Census Bureau uses a set of income thresholds that vary by family size and composition to determine which families are considered poor. If a family's total income is less than its threshold, then that family, and every individual in it, is considered poor. The poverty thresholds do not vary geographically, but they are updated annually for inflation using the Consumer Price Index. For example, in 2006 the average estimated poverty threshold for an individual was an annual income of $10,294, and for a four-person household it was $20,614 (US Census Bureau 2007).

Table 3.10-3: Earnings by Industry (in Thousands of Dollars)

	Agriculture	Mining and Extractive Industries	Construction	Manufacturing	Transportation/ Communication/ Utilities	Wholesale and Retail Trade	Finance/ Insurance/ Real Estate	Services	Government	Total Earnings
2001	12,553	1,033	22,188	27,418	24,443	39,964	27,519	81,927	158,359	436,000
2004	12,614	942	35,142	23,783	34,023	51,396	41,896	101,307	196,585	550,837
% Change	0.5	-8.8	58.4	-13.3	39.2	28.6	52.2	23.7	24.1	26.3

SOURCE: US Bureau of Economic Analysis 2001

Table 3.10-4 provides income statistics for Churchill County and Nevada. Churchill County has a median household income slightly lower than the Nevada average, and a poverty rate slightly lower than the statewide level.

Table 3.10-4: Income and Poverty Statistics (2004)

	Churchill County	Nevada
Median Household Income (2004)	$45,720	$47,231
Percentage of Population Living in Poverty (2004)	10.2%	11.1%

SOURCE: US Census Bureau 2007

3.10.5 ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton signed EO 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. This order requires that “each federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities, on minority populations and low-income populations” (EO 12898, 59 FR 7629 [Section 1-101]).

Protection of Children from Environmental Health Risks and Safety Risks (62 FR 19885), states that each federal agency must make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. Environmental health risks and safety risks mean risks to health or to safety that are attributable to products or substances that the child is likely to come into contact with or to ingest. Approximately 28.9 percent of Churchill County is made up of children (under 18 years of age) (US Census 2007).