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September 12, 2008
File No.: 04.02.06.02
Project No. 357891

Mr. Che McFarlin, Project Manager
California Energy Commission
Systems Assessment and Facilities Siting Division
1516 9th Street, MS 15
Sacramento, CA 95814-5504

RE: Data Response, Set 1H
Ivanpah Solar Electric Generating System (07-AFC-5)

Dear Mr. McFarlin:

On behalf of Solar Partners I, LLC, Solar Partners II, LLC, Solar Partners IV, LLC, and Solar Partners VIII, LLC, please find attached one original and 12 hard copies of Data Response, Set 1G, which addresses Staff's data requests dated December 12, 2007.

Please call me if you have any questions.

Sincerely,

CH2M HILL

John L. Carrier, J.D.
Program Manager

Enclosure
c: POS List
Project File

Ivanpah Solar Electric Generating System (ISEGS)

(07-AFC-5)

Data Response, Set 1H

(Response to Data Requests for: Biological Resources)

Submitted to the

California Energy Commission

Submitted by

Solar Partners I, LLC; Solar Partners II, LLC; Solar Partners IV, LLC; and Solar Partners VIII, LLC

September 12, 2008

With Assistance from

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2485 Natomas Park Drive
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Introduction

Attached are data responses (Set 1H) by Solar Partners I, LLC; Solar Partners II, LLC; Solar Partners IV, LLC; and Solar Partners VIII, LLC (Applicant) to the California Energy Commission (CEC) Staff's data requests for the Ivanpah Solar Electric Generating System (Ivanpah SEGS) Project (07-AFC-5). The CEC Staff served these data requests on December 12, 2007, as part of the discovery process for Ivanpah SEGS. As with Data Response, Set 1A, the responses are grouped by individual discipline or topic area. Within each discipline area, the responses are presented in the same order as CEC Staff presented them and are keyed to the Data Request numbers (1 through 116). New graphics or tables are numbered in reference to the Data Request number. For example, the first table used in response to Data Request 15 would be numbered Table DR15-1. The first figure used in response to Data Request 15 would be Figure DR15-1, and so on. AFC figures or tables that have been revised have "R1" following the original number, indicating revision 1.

Additional tables, figures, or documents submitted in response to a data request (supporting data, stand-alone documents such as plans, folding graphics, etc.) are found at the end of a discipline-specific section and may not be sequentially page-numbered consistently with the remainder of the document, though they may have their own internal page numbering system.

The Applicant looks forward to working cooperatively with the CEC and Bureau of Land Management (BLM) staff as the Ivanpah SEGS Project proceeds through the siting process. We trust that these responses address the Staff's questions and remain available to have any additional dialogue the Staff may require.

Biological Resources (29)

Background

As noted in the AFC, ravens are known to prey upon juvenile desert tortoise and other wildlife species. However, ravens are a migratory species and federally protected under the Migratory Bird Treaty Act. Perch-deterrent device installation is mentioned in the AFC on page 5.2-67, but the facilities upon which they would be installed are not specified. In addition, CDFG commented in a March 23, 2007 letter on Victorville 2, another desert solar project, regarding the need for a sufficiently detailed raven control plan.

Data Request

29. Please provide a detailed raven control plan that discusses, but is not limited to the following elements:
    a. coordination process with CDFG and USFWS
    b. area to be covered by the plan
    c. use of perch-deterrent devices and locations of installation
    d. circumstances when nest removal would be necessary
    e. remedial actions that would be employed if evidence of raven predation of juvenile desert tortoise is detected and the circumstances that would trigger the implementation of remedial actions
    f. facility/project owner staff expected to implement the raven control plan and their qualifications

Response: It turns out that BLM is still in the process of working with the U.S. Fish and Wildlife Service (USFWS) on the raven plan best management practices. Therefore, BLM has requested that the Applicant submit its Raven Management Plan at this time. Once the BLM/USFWS District-wide plan is available, the management practices will be standardized. Therefore, Applicant's Raven Management Plan is provided as Attachment DR29-1A.

Attachment DR29-1A

Draft Raven Management Plan
Ivanpah Solar Electric Generating System

Prepared for

Solar Partners I, LLC; Solar Partners II, LLC; Solar Partners IV, LLC; and Solar Partners VIII, LLC

September 2008

CH2MHILL
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

Contents

SECTION 1

Introduction

Solar Partners I, LLC; Solar Partners II, LLC; Solar Partners IV, LLC and Solar Partners VIII, LLC (the Applicant), which are subsidiaries of BrightSource Energy, Inc., propose to develop a solar power project consisting of three adjacent solar energy facilities to be located in the Ivanpah Valley near the Interstate 15 (I-15) crossing of the California/Nevada border in San Bernardino County, California (Figure 1, figures are located at the end of each section). The proposed project site is located on land administered by the Bureau of Land Management (BLM) and is less than 2 miles east of the Mojave National Preserve, less than 2 miles west of Ivanpah Dry Lake, less than a mile south of the Stateline Wilderness and Mesquite Wilderness areas of the Clark Mountains; approximately 0.5 miles west of the Primm Valley Golf Club; approximately 0.8 miles northwest of I-15; and approximately 4.5 miles southwest of the Primm Valley casinos. Access to the site is via the Yates Well Road interchange on I-15 and Colosseum Road to the west of the Primm Valley Golf Club.

The project will be built in three phases. Each of the three facilities will be owned by different investors but will be constructed and managed in conjunction with one another. The first 100-megawatt (MW) plant at the south end of the project, known as Ivanpah 1, would be owned by Solar Partners II, LLC. Solar Partners I, LLC, would own the middle 100-MW plant known as Ivanpah 2. The northernmost 200-MW plant, known as Ivanpah 3, would be owned by Solar Partners VIII, LLC. The three proposed facilities and their shared operations (owned by Solar Partners IV) will be collectively known as the "Ivanpah Solar Electric Generating System" or "Ivanpah SEGS" and will be designed, constructed, and operated by Bright Source Energy. The Applicant is seeking a separate ROW grant from the BLM for each of the three facilities and for the shared support and utility operations.

The Applicants have filed SF 299 ROW grant applications for use of the land with the BLM Needles Field Office. The completed project will account for approximately 3,760 acres of permanent disturbance and approximately 300 acres of temporary disturbance that will be subject to restoration efforts. The facilities will be accessed by the existing Colosseum Road and the gas and water utility tie-ins will occur locally within the fenced facilities.

The Ivanpah Valley and the proposed Ivanpah SEGS is occupied by the desert tortoise (*Gopherus agassizii*). This Raven Management Plan has been developed as a measure to minimize the effects of the project construction and operation on the desert tortoise by minimizing the introduction of anthropomorphic subsidies that could attract and benefit the common raven (*Corvus corax*) and result in the increased probability of tortoise predation.

The objective of this Raven Management Plan is to reduce potential direct and cumulative effects of raven predation on desert tortoise and other native wildlife species in the Ivanpah Valley as a result of construction activities, increased human presence, the addition of potential roost and nest site structures, and facility operation. This Raven Management Plan is being submitted to the California Department of Fish and Game (CDFG), the California Energy Commission (CEC), BLM, and the U.S. Fish and Wildlife Service (USFWS) for approval prior to implementation. Raven management plans are a typical component of biological opinions issued for desert tortoise. As stated in the BLM Northern and Eastern Mojave (NEMO) Planning Area Boundary Desert Tortoise Conservation Strategy, the BLM is compelled to review the design and operation features of the proposed Ivanpah SEGS to reduce or eliminate the opportunity for proliferation of ravens (BLM 2001). Once approved, the Applicant will be responsible for implementing the management plan.

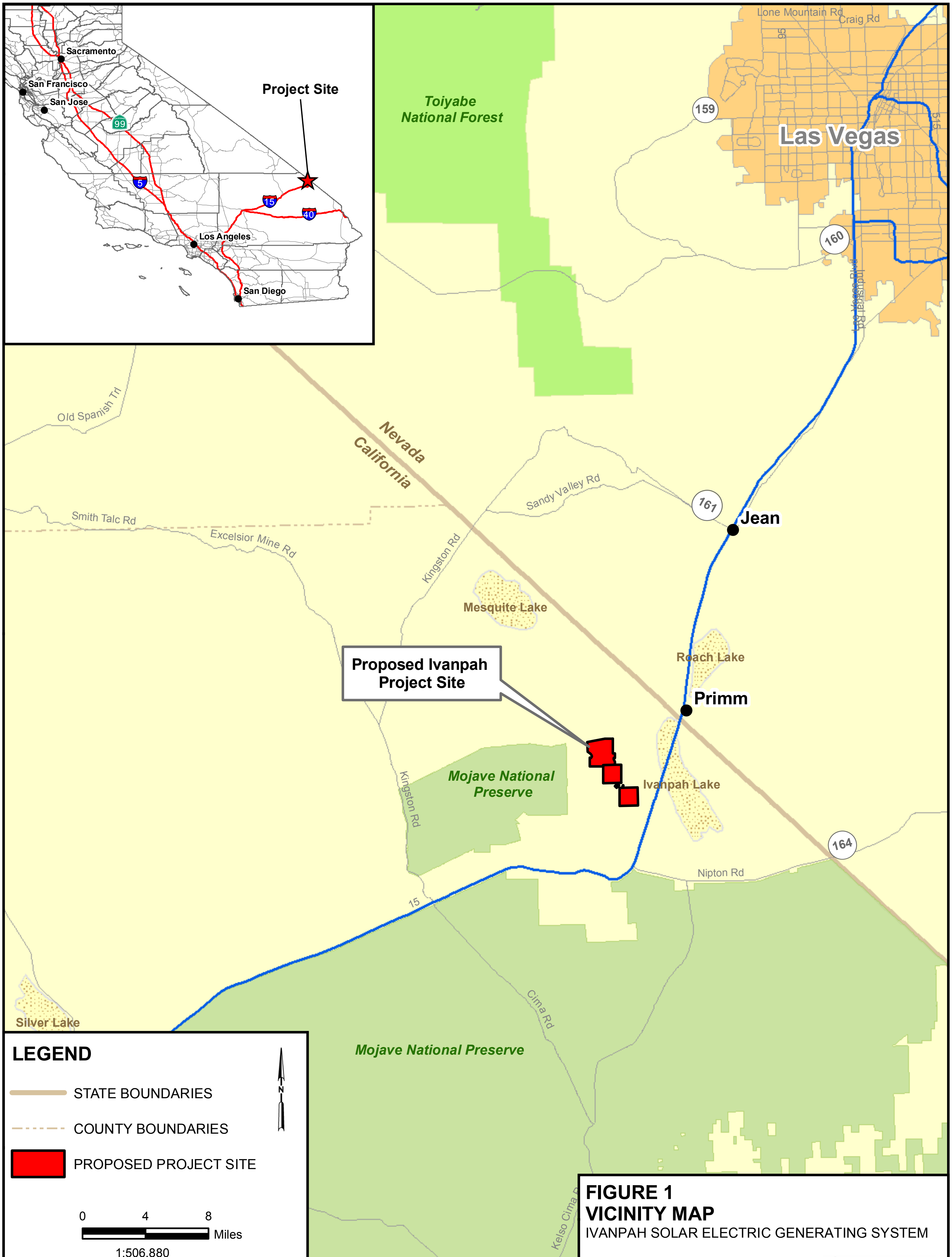

FIGURE 1
VICINITY MAP
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

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SECTION 2

Background

This section describes the Ivanpah Valley natural setting and includes background information regarding desert tortoise and raven biology.

2.1 Environmental Setting of Ivanpah Valley

The Ivanpah Valley is bounded by the Lucy Grey Range and McCullough Mountains to the east, the New York Mountains and the Mid-Hills to the south, the Ivanpah Mountains, Mescal Range, and Clark Mountain to the west, and the Clark Mountain and southernmost Spring Range to the north. The valley-facing slopes of these mountain ranges empty into Ivanpah and Roach dry lakes. From the rugged mountains to the dry lake basins, Ivanpah Valley encompasses a diverse assemblage of landscape features and vegetation communities for such a limited defined geographical area in the eastern Mojave Desert region.

The proposed 3,760-acre (5.9 square mile) solar site is located on an alluvial fan, or bajada, that extends eastward from the Clark Mountains to Ivanpah Dry Lake (Figure 2). The alluvial fan topography slopes gradually (3 to 5 percent grade) to the east and southeast from an elevation of approximately 3,150 feet in the northwest corner to about 2,850 feet in the southeast corner. The alluvial fan is dissected by numerous ephemeral washes. Most are small (active channels 1 to 3 feet wide), but a few are larger, with bank-to-bank widths of more than 50 feet and active channels 5 to 15 feet (or more) wide. Drainage within Ivanpah SEGS flows eastward, ultimately reaching Ivanpah Dry Lake.

Mojave Creosote Bush Scrub, Mojave Yucca-Nevada Ephedra Scrub, and Mojave Wash Scrub were the predominant vegetation types identified in the proposed Ivanpah SEGS construction area during 2007 botanical surveys. Vegetation complexity and density within the proposed Ivanpah SEGS are dependent on elevation. The higher elevations, up against the base of the Clark Mountains, support a higher diversity of vegetation and the greatest density of shrubs, cacti, and Mojave yucca. The vegetation diversity and density decreases with elevation and is more limited to Creosote White Bursage Scrub and a Mixed Saltbush series as the project site extends toward the more alkaline soils of the dry lake.

The diversity of vegetation and landscape features in and around the proposed Ivanpah SEGS provides habitat for a rich variety of Mojave Desert and non-native wildlife. These includes the desert tortoise and other reptiles such as side-blotched lizard (*Uta stansburiana*), desert iguana (*Dipsosaurus dorsalis*), long-nosed leopard lizard (*Gambelia wislizenii*), western whiptail (*Cnemidophorus tigris*), zebra-tailed lizard (*Callisaurus draconoides*), common collared lizard (*Crotaphytus collaris*), sidewinder (*Crotalus cerastes*), and gopher snake (*Pituophis melanoleucus*). Developing knowledge of the banded Gila monster (*Heloderma suspectum cinctum*) distribution in California suggests that this large but seldom seen lizard may occur in the project vicinity.

Although human influences are primarily responsible for the year-round presence of the common raven in the Ivanpah Valley, the Ivanpah SEGS project area provides forage, cover, roosting, and nesting habitat for a variety of bird species. Resident and migratory birds use the resources during the winter, migratory, and breeding seasons. This includes birds such as Say's phoebe (*Sayornis saya*), black-throated sparrow *(Amphispiza bilineata)*, white-crowned sparrow (*Zonotrichia leucophrys*), sage sparrow (*Amphispiza belli*), blue-gray gnatcatcher (*Polioptila caerulea*), cactus wren (*Campylorhynchus brunneicapillus*), Verdin (*Auriparus flaviceps*), western kingbird (*Tyrannus verticalis*), sage thrasher (*Oreoscoptes montanus*), house finch (*Carpodacus mexicanus*), lesser nighthawk (*Chordeiles acutipennis*), common ground-dove (*Columbina passerine*), mourning dove (*Zenaida macroura*), Gambel's quail (*Callipepla gambelii*), American kestrel (*Falco sparverius*), burrowing owl (*Athene cunicularia*), and red-tailed hawk (*Buteo jamaicensis*).

A diverse collection of landscape features, vegetation diversity, forage, and prey availability in the Ivanpah SEGS project area is likely to attract a variety of mammal species such as Audubon's cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), whitetail antelope squirrel (*Ammospermophilus leucurus*), desert kit fox (*Vulpes macrotis*), and coyote (*Canis latrans*). The regional mule deer (*Odocoileus hemionus hemionus*) population is considered low despite efforts in 1948 to reintroduce the species to the New York and Providence mountains, installation of guzzlers, and efforts to control the introduced feral burro (*Equus asinus*) (NPS 2006). Given the proximity of the Clark Mountains, it is likely that deer and desert bighorn sheep (*Ovis canadensis nelsoni*) move down into the upper elevations of the valley, including the Ivanpah SEGS project area to forage. It is also likely that areas of Ivanpah Valley provide important movement corridors for mule deer and this bighorn sheep subspecies. The BLM also issues year-round cattle grazing allotments in the Ivanpah Valley, including areas within the nearby Ivanpah Valley Desert Wildlife Management Areas (DWMA) (BLM 2001).

The biological value of the area has been recognized with the inclusion of portions of the Ivanpah Valley within the Mojave National Preserve (Preserve). The northern extent, or Clark Mountain portion, of the Preserve is less than 2 miles to the east of the Ivanpah SEGS. Significant portions of the valley are also within designated DWMAs, which are focus areas for desert tortoise recovery (USFWS 1994). The Ivanpah DWMA is located approximately 5 miles southeast of the Ivanpah SEGS and the Piute-Eldorado DWMA is approximately 18 miles northeast of Ivanpah SEGS.

The Ivanpah Valley has a human history of occupation and various land uses with early wide range grazing, hunting, mining, rock hounding, recreational shooting, and military training that is now overshadowed by casinos, small residential development (at Primm, Jean, Nipton, and Mountain Pass), commercial facilities, a power plant, utility corridors, golf courses, and other recreation. Interstate 15 (I-15) and a railroad bisect the valley and form the major transportation corridor between southern California and Las Vegas. Proximity to a major traffic corridor makes Ivanpah Valley vulnerable to additional in-fill projects, such as a proposed master plan community, airport, high speed rail, wind farms, and solar power fields. The Nevada portion of the Ivanpah Valley is within the coverage area for the Clark County Multiple Species Habitat Conservation Plan (HCP).

The BLM has transferred 6,500 acres of undeveloped land on the Nevada side of the Ivanpah Valley for the proposed Southern Nevada Supplemental Airport and plans to transfer an additional 16,903 acres to Clark County to serve as a noise compatibility area for the new airport. According to one news report "A land rush is already underway in the

Ivanpah valley" and BLM "says it has been swamped with land requests from developers who are betting that a major boom will accompany the construction of the new airport (Knapp 2008)."

The proposed project site is located in close proximity to golf courses, casinos, and I-15. Utility lines and existing dirt roads run through, and adjacent to, the Ivanpah SEGS project area. There are also nearby wells as well as historic and large-scale active mines (Molycorp Mine). The dirt roads are used for various recreational pursuits and for access to utility lines that have been recently constructed or upgraded. The nearby Ivanpah Dry Lake is a popular land sailing location and has been used for large-scale sanctioned competitions.

Past and ongoing development and intrusion within Ivanpah Valley has resulted in habitat loss, degradation, fragmentation, and the introduction of non-native species. Further development will be a source of cumulative effects to the desert tortoise.

2.2 Desert Tortoise Biology

2.2.1 Status

On August 4, 1989, the USFWS published an emergency rule listing the Mojave Desert population of the desert tortoise as endangered (USFWS 1989). The USFWS final rule, dated April 2, 1990, determined the Mojave population of the desert tortoise to be threatened under the Federal Endangered Species Act (USFWS 1990). The tortoise was listed in response to loss and degradation of habitat caused by numerous human activities including urbanization, agricultural development, military training, recreational use, mining, and livestock grazing. The loss of individual desert tortoises to increased predation by common ravens, collection by humans for pets or consumption, collisions with vehicles on paved and unpaved roads, and mortality resulting from diseases also contributed to the listing. The tortoise was state-listed in California as threatened in 1989, and is classified as State Protected and Threatened by the neighboring state of Nevada. Prior to state and federal listing, BLM initiated efforts to protect the tortoise in 1988 with a range-wide management plan (BLM 2001).

The USFWS desert tortoise recovery plan is the key strategy for recovery and delisting of this species (USFWS 1994). As part of the recovery strategy, the USFWS designated critical habitat for the desert tortoise in portions of California, Nevada, Arizona, and Utah (USFWS 1994). Further, the plan recommends implementation of reserve level protection of desert tortoise populations and habitat within Desert Wildlife Management Areas (DWMAs), while maintaining and protecting other sensitive species and ecosystem functions. DWMAs were developed to provide "reserve level" protection for the tortoise (USFWS 1994). Critical habitat was designated to identify areas containing key biological and physical attributes that are essential to the desert tortoise's survival and conservation, such as space, food, water, nutrition, cover, shelter, and reproductive sites. As part of the actions needed to accomplish the recovery of this species, land management goals within all DWMAs include restriction of human activities that adversely affect desert tortoises (USFWS 1994).

2.2.2 Natural History, Distribution, Abundance, and Habitat

The desert tortoise is a long-lived reptile with a high domed shell, stocky, elephant-like limbs and a short tail. *Gopherus agassizii* is one of four tortoise species found in North America. The desert tortoise's range includes the Mojave Desert region of Nevada, southern California, and the southwest corner of Utah and the Sonoran Desert region of Arizona and northern Mexico. The desert tortoise is divided into two primary populations, the Mojave and the Sonoran. The Mojave population is located north and west of the Colorado River and the Sonoran includes all tortoises south and east of the river in Arizona and Mexico (*in* Averill-Murray and Swann 2002). The Mojave population is primarily found in creosote bush (*Larrea tridentata*) dominated valleys with adequate annual forbs for forage.

Adult desert tortoises typically weigh 10 pounds or more and reach lengths of 11 to 16 inches (*in* USFWS 1994). Desert tortoises have been known to live up to 70 years or more but the typical adult likely lives 25 to 35 years (*in* USFWS 1994). Like many long-lived species, the tortoise has a relatively slow rate of reproduction. Sexual maturity is primarily size dependent (≥ 180 to 208 millimeters) with tortoises typically achieving breeding status at 15 to 20 years of age. Mating generally occurs in the spring (mid-March to late-May), with nesting and egg-laying occurring from April to July (Rostral et al. 1994, USFWS 1994). Desert tortoises have also been known to lay eggs in the fall (*in* USFWS 1994). The female tortoise typically lays her eggs in an earthen chamber approximately 2.7 to 3.9 inches deep, excavated near the mouth of a burrow or under a bush (Woodbury and Hardy 1948, USFWS 1994). Following egg-laying, the female covers the eggs with soil. Clutch size ranges from 2 to 14 eggs, with an average of 5 to 6 eggs (Luckenbach 1982). Females can produce as much as three clutches in a season. Eggs are subject to predation from a variety of predators, and female tortoises have been observed apparently defending their clutches from Gila monsters (Gienger and Tracy 2008). The eggs typically hatch 90 to 120 days later, between August and October. Hatchlings are born with a yolk sac that protrudes through the plastron. Eggs incubated above 89.3 degrees Fahrenheit (°F) develop into females and males are the result of cooler incubation (*in* USFWS 1994). This yolk sac typically sustains the animal for up to 6 months. Hatchling desert tortoises often go into hibernation in the late fall but often emerge for short active periods on warm sunny or rainy days (Luckenbach 1982).

Desert tortoise activity is seasonally variable. Peak adult and juvenile desert tortoise-activity in California typically coincides with the greatest annual forage availability during the early spring and summer. However, tortoises will emerge from their burrows at any time of year when the weather is suitable. Hatchling desert tortoises typically become active earlier than adults and their greatest activity period can be expected between late winter and spring. During active periods, tortoises feed on a wide variety of herbaceous plants, including cactus, grasses, and annual flowers (USFWS 1994).

Annual home ranges have been estimated between 10 and 450 acres and are age, sex, seasonal, and resource density dependent (USFWS 1994). Although adult males can be aggressive toward each other during the breeding season, there can be a great deal of overlap in individual home ranges (USFWS 1994). More than 1.5 square miles of habitat may be required to meet the life history needs of a tortoise and individuals have been known to travel as much or more than 7 miles at a time (BLM 2001). In drought years, tortoises can be expected to wander farther in search of forage.

During their active period, desert tortoises retreat to shallow burrows and aboveground shade to escape the heat of the day. They will also retire to burrows at nighttime. Desert tortoises are primarily dormant in winter in underground burrows and sometimes congregate in communal dens.

Tortoise population densities have changed over time, resulting in their federal and state listing. Estimated densities of the total desert tortoise population in the 1980s ranged from 10 to 84 individuals per 0.5 hectare (*in* Boarman 2002). The same estimate for tortoises less than 140 millimeters in length ranged from 2 to 63 individuals for every 0.5 hectares, with the realization that juvenile tortoises are more difficult to find and likely underrepresented in population estimates based solely on survey data. As presented in Boarman 2002, juvenile survivorship of 75 percent per year may be necessary to maintain population stability and survivorship of upwards to 97 percent may be required for the recovery of a declining population, making raven predation a major cause for concern.

The proposed Ivanpah SEGS is located in the southeastern portion of the NEMO Planning Area Boundary. The recent amendment to the NEMO addresses threatened and endangered species conservation and recovery (BLM 2001). This includes alternatives to address mortality caused by raven predation (BLM 2001). The NEMO defines five geographical areas of tortoise habitat in the planning area that include an Ivanpah Valley and a North Ivanpah Valley area, the Ivanpah SEGS being located with the Ivanpah Valley habitat area. The BLM has designated both Ivanpah areas as Category III desert tortoise habitat with a management goal to maintain a viable tortoise population (BLM 2001). According to the NEMO, the non-lakebed portion of Ivanpah Valley area is excellent quality tortoise habitat with some of the highest population densities in the East Mojave while the North Ivanpah Valley area is quantified as good quality tortoise habitat (BLM 2001).

The proposed Ivanpah SEGS project area is within the Northeastern Mohave Recovery Unit, one of six designated evolutionarily significant units within the range of the tortoise (USFWS 1994). When determining the size and location of DWMAs, the Service estimated that stable tortoise populations are likely to have densities of at least 10 adults per square mile (USFWS 1994). When the 1994 Recovery Plan was being issued some of the highest known tortoise densities were in southern Ivanpah Valley, with 200 to 250 adults per square mile (USFWS 1994). These 1990s densities were less than estimates for the southern Ivanpah Valley in the 1970s. That 20-year decline has been heavily attributed to raven predation (USFWS 1994). Densities for the northern Ivanpah Valley in the 1990s were typically less than 50 adults per square mile (USFWS 1994). (Note: the referenced density surveys for the southern and northern Ivanpah Valley did not include transects within the currently proposed Ivanpah SEGS project area.) According to the 1994 recovery plan, tortoise densities in the Ivanpah Valley DWMA were estimated between 5 and 250 adult tortoises per square mile and the area was given a threat level of 3 out of 5 (5 = extremely high) (USFWS 1994). The Desert Tortoise Recovery Planning Assessment Committee (DTRPAC) recommended revising the threat level for the Ivanpah Valley DWMA to a 4 to reflect 2003 conditions (DTRPAC 2004).

As a result of 2002 line distance sampling surveys in the Ivanpah Valley plots within the Mojave National Preserve, live tortoises were found on 16 percent of the transects while carcasses were found on 46 percent, but there was not enough statistical data to suggest a recent decline in the adult population (DTRPAC 2004).

It is well established that the desert tortoise is distributed throughout Ivanpah Valley with the exception of the dry lakes and developed areas. Twenty-five live tortoises, 97 carcasses, 214 burrows, and 50 other tortoise sign were encountered during the 2007 and 2008 USFWS protocol tortoise survey of the Ivanpah SEGS

2.3 Raven Biology

The Corvidae family includes birds such as magpies, jays, crows, and ravens. These medium to large-sized passerines are typically bold, vocal, and resourceful. In general, corvids are highly intelligent and have quickly adapted to human-dominated landscapes. Species such as crows and ravens have expanded their geographical distribution with the aid of irrigation, agriculture, landscaping, and organic trash accumulation that accompanies human encroachment.

The common raven has expanded its distribution in arid regions of the Western United States largely due to introduced food and water resources accompanying increasing human development. Increased human disturbance in and around Ivanpah Valley has likely increased the abundance of ravens in the area and additional local development has the potential to further exasperate the situation. Ravens are known predators of hatchling and juvenile desert tortoise. Measures directed at discouraging ravens by removing the availability of anthropogenic subsidies is an important component of maintaining a stable tortoise population in Ivanpah Valley.

An understanding of life history is important for effective management of a species. The following section includes a summary of life history information for the common raven, the primary corvid species with the potential to have a significant adverse affect on desert tortoise populations.

The common raven is a large, formidable, and adaptive bird that occupies a range of habitats in North America from the northern tundra to the southern deserts. They are found in both forested and open natural communities but have also adapted to human disturbance, particularly agricultural development. Raven abundance and distribution is increasing and expanding in some areas largely due to human encroachment. Human-occupation often introduces crucial food, water, and structural resources that were not previously available. In the Mojave Desert the raven is truly a subsidized predator in that due to their association with humans their populations have been allowed to grow beyond the natural carrying capacity of the habitat (Boarman 1992).

Ravens are opportunistic omnivores and are successful scavengers consuming carrion, agricultural fruits and grains, as well as organic material from landfills. They have been known to travel long distance between their territories and roost sites to visit “subsidized” food resources. Ravens are also adept predators preying upon a variety of wildlife including hatchling and juvenile desert tortoises. Raven foraging is typically concentrated in the morning and late afternoon, incidentally coinciding with peak tortoise activity in the summer (*in* Liebezeit and Gorge 2002).

Breeding raven pairs form long-term bonds and defend year-round territories. According to Kristan and Boarman (2003) the average spacing between occupied territories is approximately 1134 meters (3,720 feet). They travel beyond those territories throughout their "home range" in search of food. Average nesting territories of 5.1 square kilometers (2.0 square miles) have been described in coastal California (*in* Kristan and Boarman 2003), 1.2 square kilometers (0.5 square miles) at Camp Pendleton, California (*in* Liebezeit and George 2002), and 40.5 square kilometers (15.6 square miles) in Minnesota (*in* Liebezeit and George 2002); however, both territories and home ranges are highly variable, dependent on the abundance of local resources and it is not uncommon for other ravens to intrude upon those territories. Juvenile or otherwise non-paired birds rely on a home range for foraging and often return to communal roosts. Roost sites are typically located in trees, cliffs, or human structures and are usually near important food resources. Generally, the number of birds roosting at an individual site is dependent on the abundance of local food resources. Paired and juvenile birds can be found together at unique sites with abundant food resources, though pairs typically roost in their territory.

Ravens typically reach maturity at 2 to 4 years (*in* Liebezeit and George 2002). The raven breeding season characteristically begins in early to late winter with the onset of nest site establishment and nest building. Nest sites are often located on cliffs and trees and elevated structures such as utility poles/towers, billboards, and abandoned buildings. Established nests are often used in successive years. Three to seven eggs are laid in early March to mid-April; chicks hatch after 20 to 25 days; and typically fledge by mid-June (Liebezeit and George 2002). Chicks and fledglings are susceptible to predators such as large raptors, martens (*Martes americana*), and other ravens.

2.4 Raven Predation of Tortoise, Existing Raven Attractants, and Threats

The raven is an intelligent and resourceful scavenger and predator that has effectively expanded its range and/or presence in various locations in large part due to their close association with human encroachment. The expansion of this range has introduced a new or increased threat to the recovery of several at-risk species. Raven nest predation has become a concern in the recovery of species such as common murres (*Uria aalge*) (USFWS 2006, Schauer and Murphy 1996), western snowy plovers (*Charadrius alexandrinus nivosus*) (USFWS 2002), California least tern (*Sterna antillarum browni*) (Avery et al. 1995), marbled murrelets (*Brachyramphus marmoratus*) (Herbet and Golightly 2007), San Clemente Island loggerhead shrike (*Lanius ludovicianus mearnsi*), greater sandhill crane (*Grus canadensis*), and California condor (*Gymnogyps californianus*) (USFWS 2007). Ravens have also been observed mobbing northern spotted owls (*Strix occidentalis caurina*) (CH2M Hill personal observation in 2003).

Although much of the management emphasis in North America is given to raven nest predation of other bird species' eggs and nestlings, ravens are also known to prey on a variety of small to medium-sized mammals, amphibians, and reptiles. Ravens have been observed killing ground squirrels, weasels, invertebrates, chickens, and mice (in Boarman 1992). The Ueno Zoological Gardens in Tokyo, Japan, recently installed netting over some exhibits after crows (*Corvid* sp.) began attacking and carrying away prairie dog pups (*Cynomys* sp.) (Chris Nagano/USFWS, personal communication with Mikio Ohga/Ueno Zoological Gardens on May 10, 2008). Brown-necked ravens (*Corvus ruficollis*) are known to prey on juvenile Mediterranean spur-thighed tortoises (*Testudo graeca*) and Egyptian tortoises (*Testudo kleinmanni*) in Israel (in Boarman 1997).

Ravens scavenge on larger animal carcasses and can be common alongside turkey vultures (*Cathartes aura*) and other scavengers feeding on road kill and dead livestock. Studies have shown that ravens tend to be more common along heavily-traveled roads than away from them (Boarman et al. 1997). Despite their physical limitations, ravens have been known to be aggressive and attack livestock such as sheep (O'Gara et al. 1983, personal communication with William Boarman on May 12, 2008). In the United Kingdom ravens have increased their numbers by as much as 1000 percent since the late 1990s and have been recently accused of attacking a substantial number of adult sheep and calves (Fryer 2008).

Desert dwelling sub-adult or otherwise non-breeding ravens are typically concentrated at areas with dependable food resources such as landfills; while breeding pairs are more evenly distributed throughout the desert, as nest site availability and territorial behavior allows (Kristan and Boarman 2003). Due to this difference in distribution, non-breeding and breeding ravens likely have varied effects on juvenile tortoises. Non-breeding ravens likely have a more concentrated effect on juvenile tortoise nearby their reliable anthropogenic food resources while the predation effects from breeding ravens as a whole is likely more widespread. The term "spillover predation" (*in* Kristan and Boarman 2003) has been used to describe the typically communal non-breeding raven take of juvenile tortoises near their primary food resources. The breeding raven take of tortoises has been described as "hyperpredation" (*in* Kristan and Boarman 2003) because the juvenile tortoises are likely incidental to the raven diet and, therefore, the relationship lacks the classic long-term predator-prey population association . The predation risk posed by nesting ravens can be widespread throughout tortoise habitat as successful nest locations change from year-to-year (Kristan and Boarman 2003). Kristan and Boarman (2003) also found that the greatest risk of predation was near large groups of ravens that were distant from successful nests and near successful nests that had relatively small numbers of nearby ravens.

Raven predation of juvenile tortoise has been evidenced in the Mojave Desert by the remains of tortoise carcasses under raven nests, direct observations, and carcasses with distinctive raven damage (Boarman 1992). The shells of juvenile tortoises are also soft and pliable making it possible for ravens to puncture them. Therefore, for the desert tortoise it is primarily the smaller tortoises (< 100 to 110 millimeters) from hatchling to 8-year-olds that are at risk (Boarman 2003, Kristan and Boarman 2003, *in* USFWS 1994). Predation appears to include piercing of the carcass or biting of the head and/or limbs (*in* Kristan and Boarman 2003). Boarman (1992) suggests that more juvenile carcasses were found in Mojave during the 1980s because there were more juvenile tortoises in the population at that time. It is important to note that juvenile tortoises are unlikely an important component of the raven's diet in the Mojave. This is a classic situation for subsidized predators where the availability of subsidies insulates the raven from the effects of declines in the juvenile tortoise population (Boarman et al. 2006).

Ravens are not the only avian species that preys on desert tortoise. Other potential avian predators include golden eagles (*Aquila chrysaetos*), greater roadrunner (*Geococcyx californianus*), red-tailed hawk, burrowing owl and loggerhead shrike (*Lanius ludovicianus*) but no other birds are known to prey on juvenile tortoises in as great a quantity (Boarman 2002).

2.4.1 Threats and Attractants in the Ivanpah Valley

Ravens depend on human encroachment to expand into areas where they were previously absent or in low abundance. Ravens habituate to human activities and are subsidized by the food and water, as well as roosting and nesting resources that are introduced or augmented by human encroachment. The Ivanpah Valley includes several unauthorized public and open community dumps (BLM 2001), and the casinos at Primm generate a considerable amount of food-related trash that enable the presence of ravens and other bird species that are otherwise not as prevalent in the Mojave Desert. Associated structures, such as buildings, signs, lamps, and utility poles provide roosting and nesting opportunities that otherwise would be unavailable. Landscape irrigation, swimming pools, decorative fountains and ponds provide valuable water. The casinos are approximately 4.5 miles from the proposed Ivanpah SEGS site, and the Primm Valley Golf Club is approximately 0.5 mile from the project site.

The golf course is landscaped with trees and water features, which provide valuable resources for the raven that otherwise would be very limited if at all available. The Golf Club has two courses: the Desert Course and the Lakes Course. The lakes course is landscaped with large ponds, flowing streams, and trees; three features that are important to ravens and were previously unavailable as year-round attractants in the Ivanpah Valley. The Primm Valley Golf Club website describes the Lakes Course as "complete with dense groves of tall pine trees, an extensive lakes and river system…[1]". The desert tortoise was listed prior to construction of the Golf Club; however, developers did not initiate formal or informal consultation to address the likely take of tortoise during construction, or the management of ravens during operation (personal communication with Ray Bransfield/USFWS on May 15, 2008). Therefore, this development adjacent to the proposed Ivanpah SEGS provides year-round water, and trash subsidies for the raven as well as nesting opportunities.

Small mammal, fox, coyote, rabbit, lizard, snake, and tortoise road kill along I-15, Nipton Road, Yates Well Road, Colosseum Road, and other local roads provides an additional attractant and subsidy for opportunistic predators/scavengers such as ravens. These existing human activities and associated development present difficulties in controlling raven activities at, and adjacent to, the proposed solar site despite measures that will be implemented at Ivanpah SEGS.

It is unlikely that ravens were ever abundant in the Mojave prior to large scale human presence. Historical information suggests that in the 1930s, ravens were rare in the eastern Mojave Desert, did not overwinter, and were likely limited to migratory birds (*in* FWS 2007). Breeding Bird Surveys conducted by USFWS between 1968 and 1988 suggest that the number of ravens in the Mojave Desert had increased by over 1,500 percent (*in* Boarman 1992). Boarman and Berry (1995) estimated an over 1,000 percent increase between 1968 and 1992 in the Mojave and Colorado deserts. A current estimate for ravens in the California desert is approximately 37,500 birds (USFWS 2007). As stated in the NEMO, raven numbers around Stateline are likely to continue to increase with development (BLM 2001). Therefore, ravens can be expected to increase in numbers in the Ivanpah Valley as development continues.

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[1] http://www.primmvalleyresorts.com/golf_lakecourse.html

Ambitious large-scale raven management plans have been drafted for the purposes of tortoise recovery but implementation and success have been difficult. The BLM drafted its own plan in 1990 (BLM 1990), raven management goals are also stated in the NEMO (BLM 2006), and it has become standard for project applicants to implement a raven management plan as a result of Endangered Species Act section 7 or section 10 consultation with USFWS. According to the 2004 Desert Tortoise Recovery Plan Assessment, the evaluation of raven use and raven control has not been implemented in the Ivanpah DWMA (DTRPAC 2004).

The Ivanpah SEGS area is already likely subject to elevated raven predation pressure and any cumulative loss of juvenile tortoise due to the further addition of raven subsidies would have a long-term effect on the Ivanpah tortoise population by reducing the recruitment of juvenile tortoises into the adult life stages (Boarman 2003). The effects of this shortage may not be apparent for several years since tortoise do not typically reach sexual maturity until approximately 15 to 20 years of age.

2.5 Ivanpah SEGS Project Features, Construction, and Operation

There are aspects associated with the design, construction, and operation of Ivanpah SEGS that have the potential to provide resources for ravens.

2.5.1 Project Features

Solar Fields

The following sections describe the major components of the solar fields.

Heliostats and Solar Receivers

The solar fields would consist of one heliostat array constructed within each 100-MW plant (Ivanpah 1 and 2) and five heliostat arrays constructed within the 200-MW plant. Each heliostat array would be arranged around a single centralized solar receiver tower (or solar power tower, SPT) that will be 459 feet tall. An artist rendering is provided as Figure 3. The heliostats will automatically track the sun throughout the day and reflect the solar energy to the solar tower. It is estimated that the 100- and 200-MW sites would contain approximately 55,000 and 104,000 heliostats, respectively. Each heliostat would support two mirrors. Each mirror is 7.2 feet high by 10.5 feet wide (2.20 meters by 3.20 meters) yielding a reflecting surface of 75.6 square feet (7.04 square meters).

Solar Power Tower Height

The SPT tower height for all three solar plants would be 459 feet (140 meters). In addition, FAA-required lighting and a lightening pole would extend above the top of the towers approximately 5 to 10 feet (1.5 to 3 meters).

Electrical System

Ivanpah 1, 2, and 3 would be interconnected to an existing Southern California Edison (SCE) grid through an upgraded SCE 115-kV line passing between Ivanpah 1 and 2 on a northeast-southwest utility corridor. A substation will be constructed between Ivanpah 1 and 2 that will be used to connect Ivanpah SEGS to the electrical grid. Two options (A and B) are being considered for the location of the substation (see Figure 4).

The 115-kV transmission generation tie line (gen-tie line) from Ivanpah 1 to the substation will be approximately 5,700 feet long for location A and 6,600 feet long for location B. The Ivanpah 2 and 3 gen-tie lines extend approximately 2,300 feet and 13,100 feet, respectively, before coming together. The combined gen-tie line then extends 1,200 feet to the Ivanpah Substation at location A and approximately 1,500 feet to location B.

Each circuit will be supported by single-pole structures at appropriate intervals with final heights as determined during detailed design. The shared gen-tie line for Ivanpah 2 and 3 will be carried on a double-circuit pole line. The lines will be insulated from the poles using porcelain insulators.

The proposed Ivanpah substation would also require new telecommunication infrastructure to be installed to provide protective relay circuit, Supervisory Control and Data Acquisition (SCADA) circuit, data, and telephone services. The telecommunication path from Ivanpah substation to local carrier facility interface at Mountain Pass area consists of approximately 8 miles of fiber optic cable to be installed overhead on existing poles and new underground conduits to be constructed in the substation and Telecom Carrier interface point. This fiber optic route consists of two segments. The first segment is from Ivanpah substation to Mountain Pass substation using the existing Nipton 33-kV distribution line poles built along the transmission line corridor that crosses between Ivanpah 1 and 2. The second segment is from Mountain Pass substation to the telecommunications facility approximately 1.5 miles away at an interface point to be designated by the local telecommunication carrier. The fiber cable would be installed on the existing 12 kV distribution line poles.

Fuel System

Natural gas will be used as a supplementary fuel for facility operation. It will be obtained by the construction of a new 6-mile-long, 4- to 6-inch distribution pipeline from the existing Kern River Gas Transmission (KRGT) pipeline located approximately 0.5 mile north of the Ivanpah 3 site (see Figure 4). A permanent gas metering station (100 feet x 150 feet) and a temporary construction area (200 feet x 200 feet) will be located at the point of connection. From the tap station, the natural gas line will head south along the western edge of Ivanpah 3 to a metering station (10 feet x 40 feet) along its southeast fence line. Although the gas line and metering station will be within the area that was surveyed, they will be located outside the project's fenced heliostat fields and a dirt access road will follow the pipeline so that the gas company has access to it for maintenance.

From the metering station at Ivanaph 3, the gas line (and dirt access road) will continue along the eastern edge of Ivanpah 2 to another metering station (20 feet x 40 feet) on the southeast corner, below Colosseum Road that would service Ivanaph 1 and 2. Again, the gas line and metering station will be located within the project area, but outside the fenced heliostat fields. From that metering station, the gas line to Ivanaph 1 will be located within the paved access road that goes from Colosseum Road past the Administration building to the Ivanpah 1 site.

A gas-metering station would be required at the KRGT tap point to measure and record gas volumes. In addition, facilities would be installed to regulate the gas pressure and to remove any liquids or solid particles. Construction activities related to the metering station and metering sets would include grading a pad and installing above- and below-ground gas piping, metering equipment, gas conditioning, pressure regulation, and possibly pigging facilities. A distribution power line for metering-station-operation lighting, communication equipment, and perimeter chain-link fencing for security would also be installed.

The primary method of construction includes excavation of an open trench approximately 36 inches wide and 4 to 10 feet deep, depending on the site-specific soil type. With loose soil, a trench up to 8 feet wide at the top and 3 feet wide at the bottom may be required. The pipeline would be buried to provide a minimum cover of 36 inches. During construction, a 75-foot-wide ROW may be disturbed. This temporary construction corridor would be used to store the excavated soil, provide access for equipment and vehicles, and space for fitting the pipeline prior to installation and backfill via backhoe. The cathodic protection system would be designed to control the electrochemical corrosion of designated metal piping buried in the soil. Depending upon the corrosion potential and the site soils, either passive or impressed current cathodic protection would be provided.

Construction would require temporary disturbance of the ROW (e.g., vegetation clearing, trench excavation, soil compaction, dust generation, and restoration). The temporary construction disturbance area for the natural gas pipeline would be a 200-foot by 200-foot area required for the KRGT tap point. Construction of the Ivanpah 3 metering set would use a temporary laydown area within the Ivanpah 3 site; whereas, construction of the Ivanpah 1 and 2 metering set would use a temporary 1.37-acre triangular area just south of the metering set.

Water System

Two new wells would be drilled and developed to provide raw water for the Ivanpah SEGS project. The water would be drawn daily from one of the two wells that would be located near the northwest corner of Ivanpah 1 (see Figure 4), with the other well serving as 100 percent redundant backup. To reduce impacts on the land and provide operating efficiencies, the wells would provide water to all three plants. The complete 400-MW Ivanpah SEGS project would require up to 46 gallons per minute (gpm) of raw water make-up, which would be drawn from the wells and distributed to the plants via underground high density polyethylene (HDPE) or polyvinyl chloride (PVC) pipe. Each plant would have a raw water tank with a capacity of 250,000 gallons. A portion of the raw water (100,000 gallons) is for plant use while the majority would be reserved for fire water.

There will be a dirt access road to the wells. The water supply line would go from the wells to the paved road on the northwest corner of Ivanpah 1 and run north to Administration Building, Ivanpah 2 and Ivanpah 3 along the same corridor as the gas line; and south to Ivanpah 1 along the paved access road leading to the power block. This new water distribution line will be approximately 600 feet long from the wells to the main line going to each of the sites.

The primary method of construction of the water supply line includes excavation of an open trench approximately 36 inches wide and 5 to 10 feet deep, depending on the site-specific soil type. With loose soil, a trench up to 8 feet wide at the top and 3 feet wide at the bottom may be required. The pipeline would be buried to provide a minimum cover of 36 inches.

During construction, a 50-foot wide right-of-way may be disturbed. This temporary construction corridor would be used to store the excavated soil, provide access for equipment and vehicles, and space for fitting the pipeline prior to installation and backfill via backhoe.

Construction would require temporary disturbance to the corridor (e.g., vegetation clearing, trench excavation, soil compaction, dust generation, and restoration). The temporary construction disturbance area for the water supply line outside of the footprint for three solar fields encompasses 1.2 acres, with permanent disturbance of 0.38 acres.

In addition, a monitoring well will be installed southeast of the Administration Building near a northwest corner of Ivanpah 1 (see Figure 4). The permanent area required for the installation of the monitoring well and access to it is 0.23 acres.

2.5.2 Construction

Schedule, Workforce, Access, and Laydown

Construction of Ivanpah SEGS, from site preparation and grading to commercial operation, is expected to begin after the First Quarter of 2009 and be completed within 48 months. The phasing is planned so that Ivanpah 1 (southern site) would be constructed first, followed by Ivanpah 2 (middle site), then Ivanpah 3 (northern site), though the order of construction may change. Construction of each site would begin about 12 months following the start of the prior site. Construction of the shared facilities would occur with the first solar facility.

There would be an average and peak workforce of approximately 474 and 959, respectively, of construction craft people, supervisory, support, and construction management personnel onsite during construction. The peak construction site workforce level is expected to occur in Month 32.

Typically, construction would be scheduled to occur between 5 a.m. and 7 p.m. on weekdays and Saturdays. Additional hours may be necessary to make up schedule deficiencies, or to complete critical construction activities (e.g., pouring concrete at night during hot weather and working around time-critical shutdowns and constraints). During some construction periods and during the startup phase of the project, some activities would continue 24 hours per day, 7 days per week.

The construction laydown and parking would occupy areas of the solar sites within the heliostat fields and in the area between Ivanpah 1 and Ivanaph 2 (see Figure 5). The temporary construction support facilities in these areas (primarily located in Area F on Figure 5) will include:

- 10 single-wide full-length trailer offices or equivalent
- Chemical toilets
- Parking for 200 vehicles
- 5 tool sheds/containers
- Equipment parking for 20 pieces of construction equipment
- Construction material laydown area
- Solar field equipment laydown area
- Fabrication sheds

A construction equipment noxious weed wash station will be constructed within the project site (currently planned in Area F6) or within an alternate area approved by BLM.

Construction access would be from Colosseum Road to the plant entrance road (Figure 4). Colosseum Road is an existing dirt road, which is planned to be asphalted from the Primm Valley Golf Club to the project site. The project would re-route a portion of Colosseum Road around the southern end of the Ivanpah 2 site. In addition, paved access roads would be created to access the power blocks of the three Ivanpah sites.

Clearing and Grading

Prior to clearing and grading, each site boundary would be permanently fenced with an 8-foot-high chain-link for security purposes and permanent desert tortoise exclusionary fencing would either be attached to the base of the security fence or installed outside the security fence to allow construction of linear facilities. Cattle grating would be installed to allow equipment access to the fenced sites and exclude desert tortoises. The first step would include clearing an approximate 10-foot-wide linear swath of vegetation along the entire outer edge of each facility boundary to create a perimeter road and install the fencing. The perimeter road would be within the fence line or site boundary. Once the fence is installed and prior to site clearing and grading, a desert tortoise clearance survey according to USFWS protocol and a project-specific translocation plan would be performed. Upon completion of the desert tortoise clearance survey and translocation, and prior to clearing and grading, the barrel cactus and Mojave yucca that would otherwise be removed or impacted during construction would be offered up for public salvage per BLM policy. These activities would be coordinated with the BLM.

The estimated size of the area for Ivanpah 1 (Phase 1) is 914 acres; for Ivanpah 2 (Phase 2) the area is 921 acres; and for Ivanpah 3 (Phase 3) the area is 1,843 acres. To construct the heliostat array fields located within these sites, clearing and grading would occur. The amount of the site subject to grading varies with each site. In areas where general grading is not required for stormwater management, grading would be performed only between every other row of the heliostat arrays that radiate outward in concentric arcs from their associated receiving towers. The cleared rows would provide access from either side of the road for service and cleaning of the heliostat mirrors, thus minimizing soil disturbance within the heliostat array fields. Although soil disturbance would be minimized to the degree possible, the entire site would be permanently affected because it would no longer be available to tortoises. The sites would be surrounded by a fence and tortoises excluded during construction and operation. Inclusive of these sites and the area used for access roads, transmission poles, and the substation and administration buildings, the total area that would be permanently disturbed by clearing and grading activities consists of approximately 3,760 acres or approximately 5.9 square miles, with approximately 300 acres being revegetated once construction of all three phases of Ivanpah SEGS is complete.

Existing root systems would remain in place to anchor the soil reducing the potential for erosion. Occasional cutting of the vegetation may be required to control plant re-growth that could affect mirror movement. All cut vegetation would handled as described in Chapter 7 of the Closure, Revegetation and Rehabilitation Plan (Attachment DR125-2A).

In regard to stormwater runoff and hydrologic connectivity, the solar field development would maintain unobstructed sheet flow to the degree possible. The finish grade of the power block and power tower areas would be 3 feet above the surrounding grade with moderate transition slopes to protect them from floods and return the relatively small local diversions to sheet flow through the solar fields. Detention ponds will be used on the west side of the project to reduce the stormwater velocity and allow sediment to drop out. Also, a few drainage channels would be required to redirect the stormwater and minimize erosion. Access roads would be protected from floods via ditches and local fords with reinforced concrete shoulders. Overall the project would be designed to maintain, to the extent possible, the existing sheet flow patterns and ephemeral drainages.

2.5.3 Operation

Ivanpah SEGS will be designed for an operating life of 50 years.

Solar Fields

Management, engineering, administrative staff, skilled workers, and operators would serve the three Ivanpah SEGS plants. Ivanpah SEGS is expected to employ up to 90 full-time employees. The facility would be operated 7 days a week, 14 hours per day. Ivanpah SEGS is expected to have an annual power plant performance availability of 92 to 98 percent.

Water System

Operation requirements necessitate the washing of some portion of the project's solar heliostats on a nightly basis. Individual heliostats are thus washed about once every 2 weeks. Because of dust created during site grading, this washing cycle may be more frequent (but not likely more than double) when Ivanpah 1 is operating and Ivanpah 3 is being graded. Thus, for no more than the first 5 months of construction of Ivanpah 3, Ivanpah 1 could use twice as much water as it would during standard operations. However, the total amount used would not exceed 100 acre-feet/year.

Best Management Practices (BMPs) for the use of wash water is outlined in a Draft Drainage, Erosion, and Sediment Control Plan (DESCP) (see Attachment DR140-1A, Data Response Set 2B). The water used for heliostat washing would be deionized water, and thus, very high quality containing only minimal iron and copper from the water piping. A pressure washer or other method would be used to wash the heliostats to minimize the amount of water used (about 2.5 gallons per heliostat), and no water is anticipated to run offsite as a result of these washing activities. Due to the high evaporation rates in the area, and the minimal amount of water used, it is likely that wash water would evaporate at or just below the ground surface. Stormwater discharge during construction would adhere to a Stormwater Pollution Prevention Plan (SWPPP) and the DESCP and to state water quality standards.

Water consumption is considered minimal (estimated at less than 100 acre-feet/year for all three solar plants) and would mainly be used to provide water for washing heliostats and to replace boiler feedwater blowdown. Groundwater would go through a treatment system for use as boiler make-up water and to wash the heliostats.

Concrete Holding Basins

Any reject streams from water treatment (for example from the reverse osmosis system, if used) would be trucked offsite for treatment or disposal. However, two concrete-lined holding basins of about 40 feet by 60 feet are included in the power block area. They can serve for boiler commissioning and emergency outfalls from any of the processes.

Waste Management

Waste management is the process whereby all operational wastes produced at Ivanpah SEGS are properly collected, treated (if necessary), and disposed of in a closed system. Wastes include process and sanitary wastewater, nonhazardous waste and hazardous waste, both liquid and solid. A large sewage package treatment plant would be located at the Administration Building/Operations and Maintenance area, located between Ivanpah 1 and 2. This primary wastewater collection system would collect process wastewater from all of the plant equipment, including the boilers and water treatment equipment. Additionally, each phase would include a small onsite wastewater plant located in the power block that would treat wastewater from domestic waste streams such as showers and toilets. Sewage sludge would be removed from the site by a sanitary service provider. All wastewater would be recycled in the system, except for a small stream that would be treated and used for landscape irrigation or possibly re-injected into the process water stream. If necessary, a small filter/purification system would be used to provide potable water at the Administration Building.

Fire Protection

The fire protection system would be designed to protect personnel and limit property loss and plant downtime in the event of a fire. The primary source of fire protection water would be the raw water storage tank. An electric jockey pump and electric-motor-driven main fire pump would be provided to increase the water pressure in the plant fire main to the level required to serve all fire fighting systems. In addition, a back-up diesel engine-driven fire pump would be provided to pressurize the fire loop if the power supply to the electric-motor-driven main fire pump fails. A fire pump controller would be provided for each fire pump.

The fire pump would discharge to a dedicated underground firewater loop piping system. Normally, the jockey pump would maintain pressure in the firewater loop. Both the fire hydrants and the fixed suppression systems would be supplied from the firewater loop. Fixed fire suppression systems would be installed at determined fire risk areas such as the transformers and turbine lube oil equipment. Sprinkler systems would also be installed in the Administration/Control/Warehouse/Maintenance Building and Fire Pump enclosure as required by National Fire Protection Association (NFPA) and local code requirements. Handheld fire extinguishers of the appropriate size and rating would be located in accordance with NFPA throughout the facility.

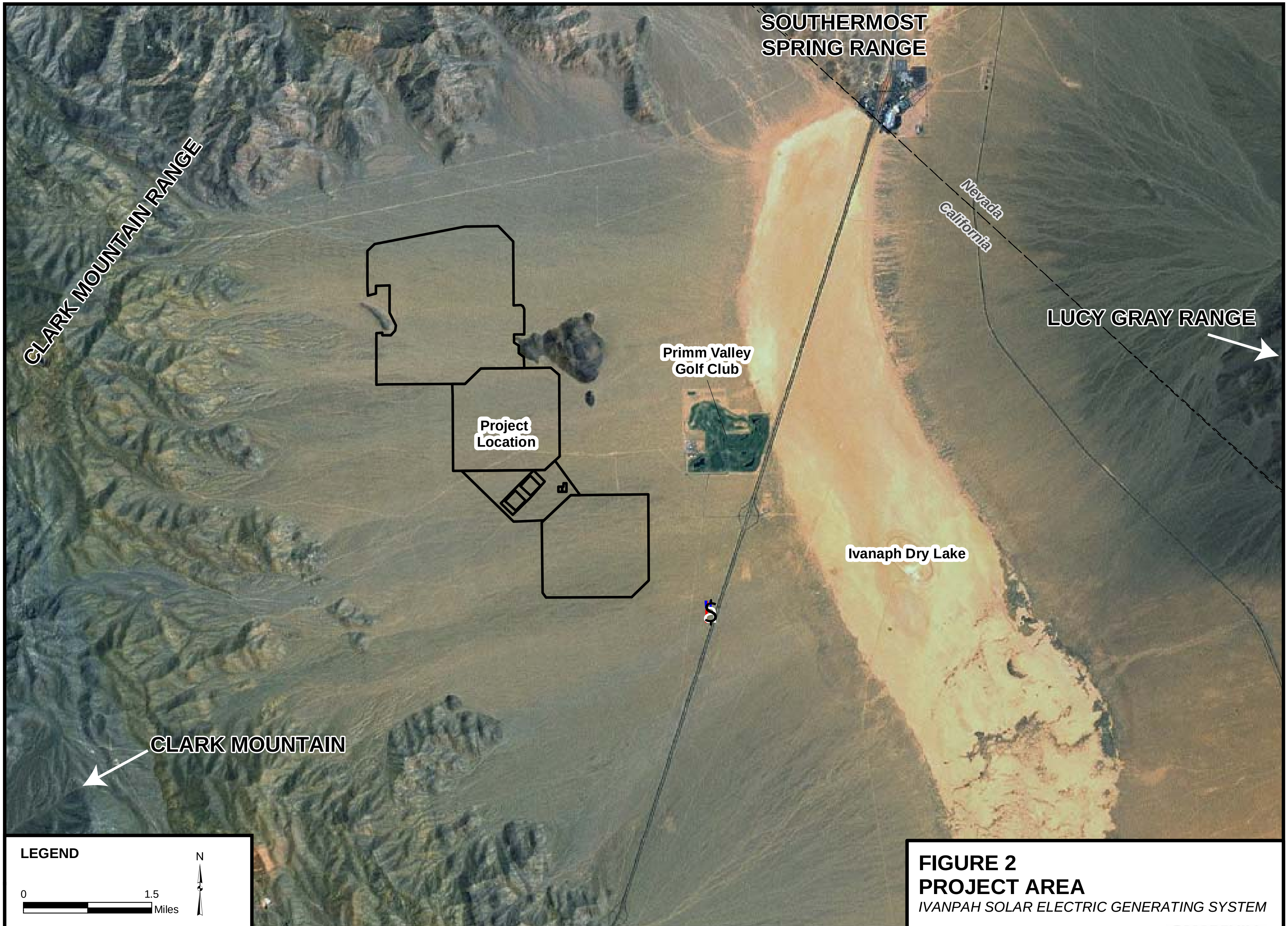

FIGURE 2
PROJECT AREA
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

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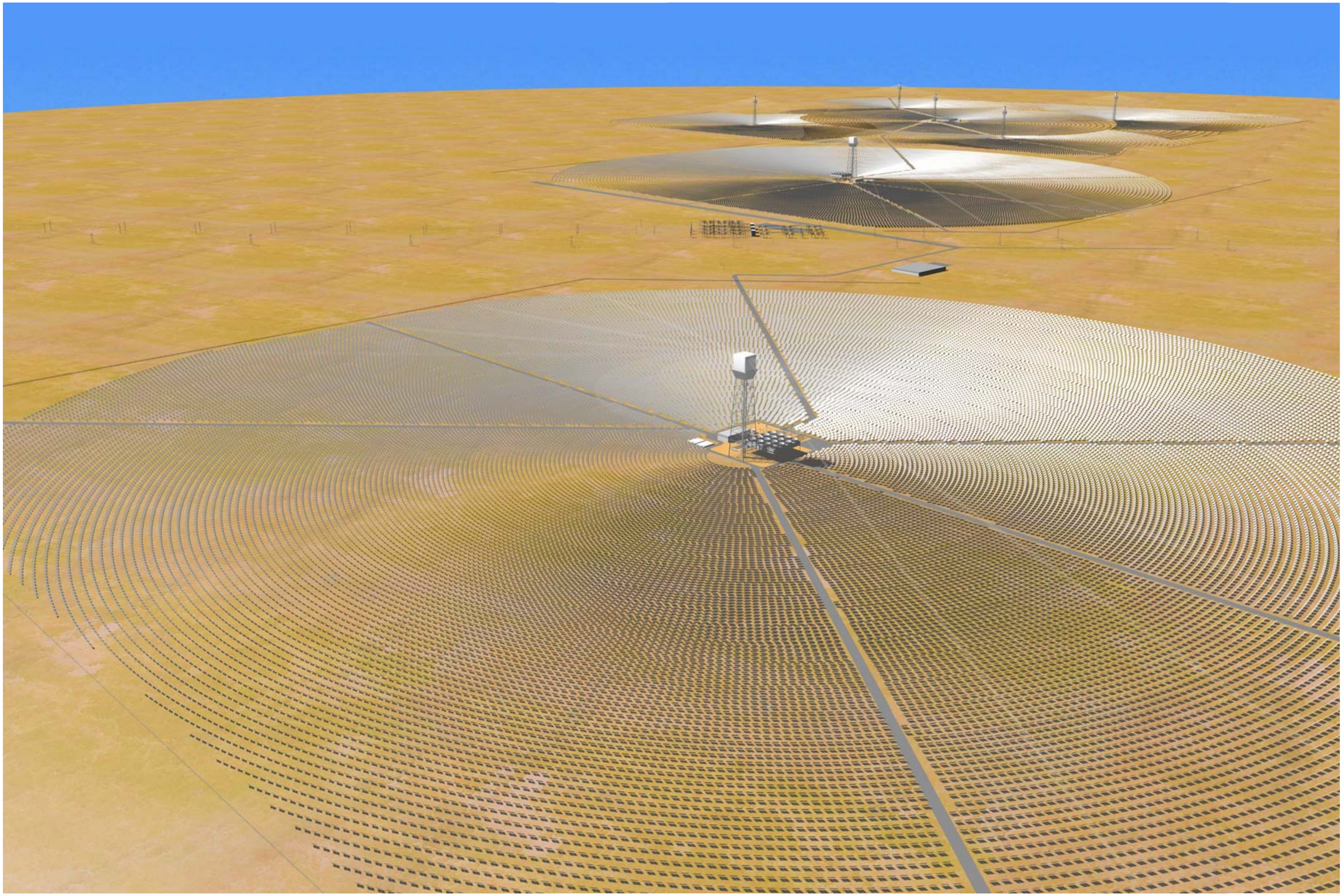

FIGURE 3
ARTIST RENDERING
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

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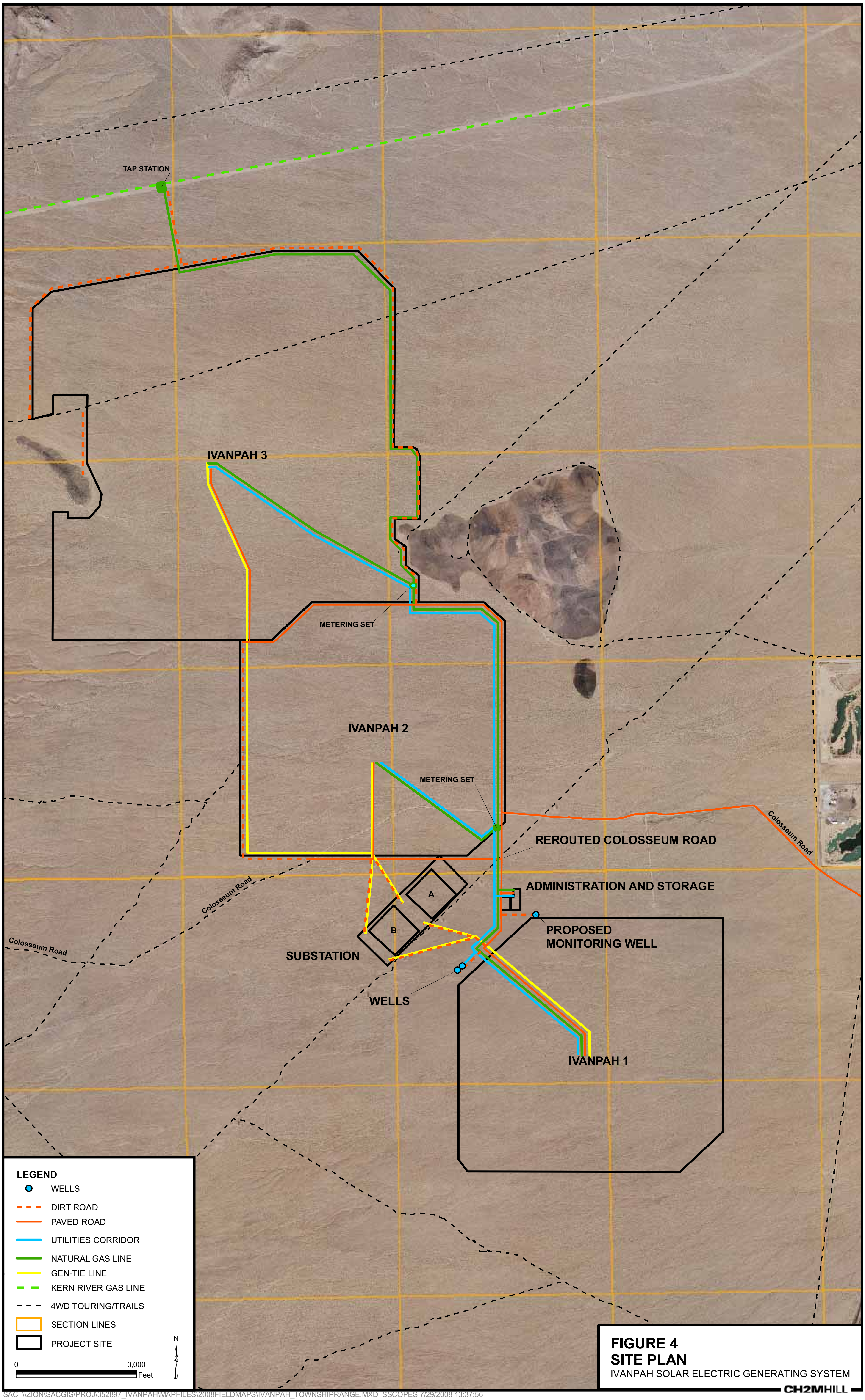

FIGURE 4
SITE PLAN
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

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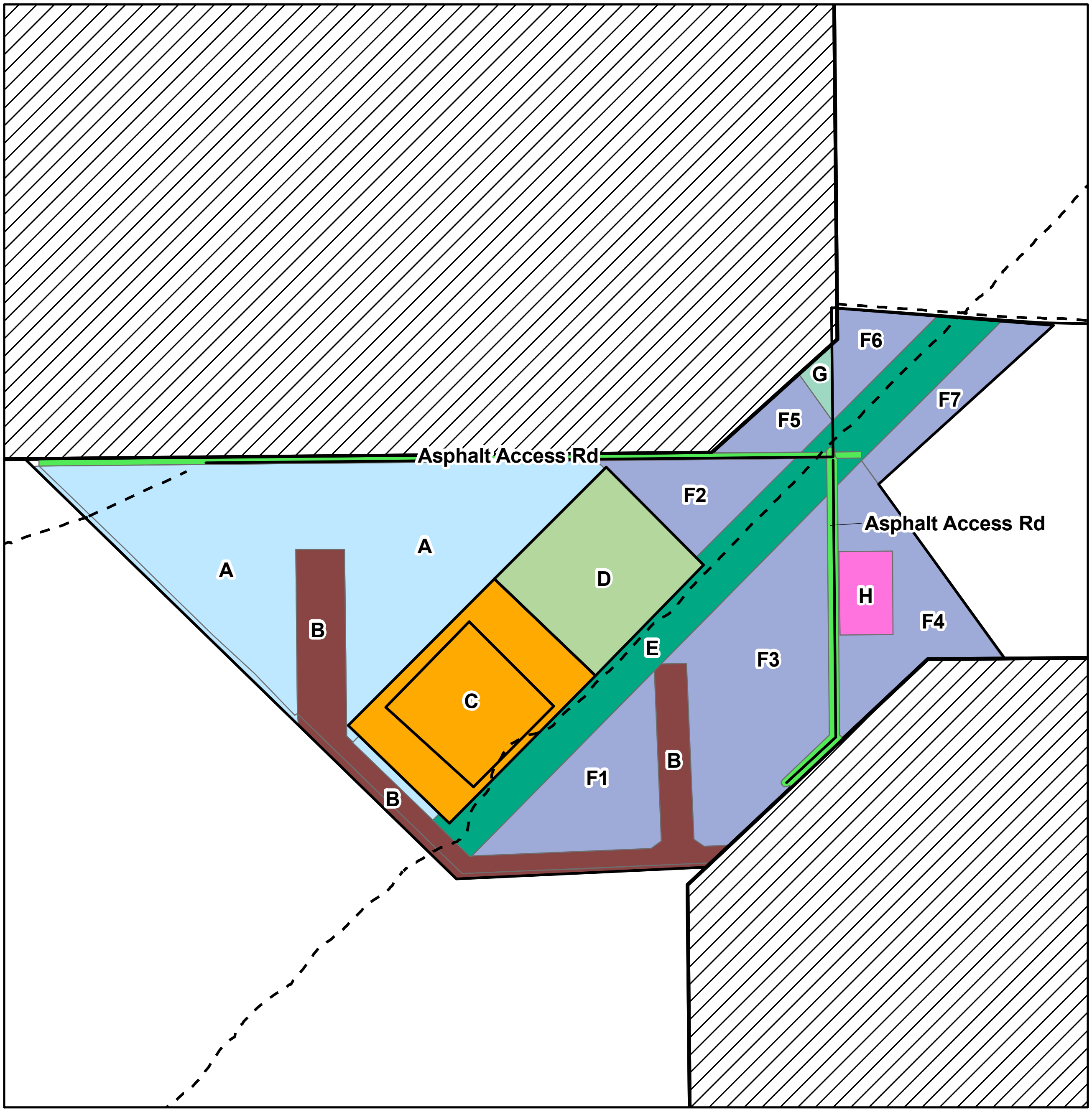
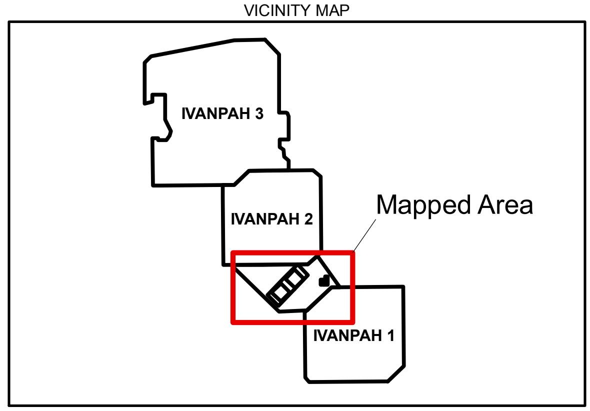


LEGEND

Construction Logistics Area

- A: 99.4 acres
- B: 29.1 acres
- C: 35.6 acres
- D: 25.7 acres
- E: 47.9 acres
- F1: 21.5 acres
- F2: 12.6 acres
- F3: 45.5 acres
- F4: 30.7 acres
- F5: 6.1 acres
- F6: 7.0 acres
- F7: 9.4 acres
- H: 5.7 acres
- G: 1.6 acres
- Asphalt Access Rd: Not included in acreage calculations
- Project Site

VICINITY MAP



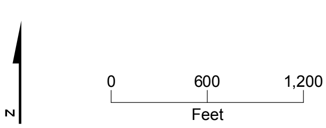


FIGURE 5
CONSTRUCTION LOGISTICS AREA
IVANPAH SOLAR ELECTRIC GENERATING SYSTEM

SECTION 3

Raven Management

3.1 Management Goals

The goal of the Raven Management Plan is to implement non-lethal measures to deter raven depredation of hatchling and juvenile desert tortoise such that overall numbers of desert tortoise and the recruitment of young tortoises into the local breeding population do not decrease due to conditions enabled by the construction or operation of the Ivanpah SEGS.

3.2 Raven Management Measures

Raven management measures were designed to discourage ravens by limiting the availability of subsidized food and water resources as well as roost and nest site opportunities. Lethal methods of raven control, such as shooting or poisoning, will be avoided to the greatest extent due to public and government agency concerns and associated implementation risks. The non-lethal measures outlined below are primarily based on guidance from the preferred Alternative B in the USFWS *Draft Environmental Assessment to Implement a Desert Tortoise Recovery Plan Task: Reduce Common Raven Predation on the Desert Tortoise* (FWS 2007), *Summary of Predation by Corvids on Threatened and Endangered Species in California and Management Recommendations to Reduce Corvid Predation* (Liebezeit. and George 2002), and Boarman's extensive research and guidance for reducing raven predation on desert tortoises (Boarman 2003).

3.2.1 Reduce Access to Anthropogenic Food and Water Resources

It is unlikely that the Ivanpah Valley would provide sufficient year-round food and water resources for ravens without the availability of anthropogenic sources. Ravens are opportunistic feeders with a varied diet and are known to make long distance daily flights of at least 40 miles in search of food and water (Engel and Young 1992, Boarman 2003). Trash associated with the nearby casinos, golf club, and other services at Stateline are not adequately controlled and provide a consistent local source of food for ravens. Water is a vital and limited resource in the desert and breeding ravens in the eastern Mojave Desert have been observed leaving their territories every day to find water (Boarman 2003). The Primm Valley Golf Club is adjacent to the proposed solar site and includes a "Lakes Course" that is landscaped with large ponds and simulated streams. These existing anthropogenic influences enable ravens to remain in Ivanpah Valley and provide reliable food and water to facilitate greater survival and reproductive success. These baseline conditions make it difficult to discourage raven presence in around the proposed Ivanpah SEGS.

Ivanpah SEGS construction activities and the completed solar facilities are likely to attract the attention of ravens that are bound to investigate the site. To prevent the addition of food and water subsidies, as well as attracting ravens to the proposed solar facility, the project owner will implement the following:

- **Trash management.** All trash associated with the project during construction and operation will be contained in secure receptacles to prevent the introduction of subsidized food resources for ravens, coyotes, and other predators. Self-closing trash bins will be used during construction for organic waste. To reduce the possibility of ravens or other scavengers such as coyotes from ripping into the bags and exposing the trash, plastic bags containing trash will not be left out for pickup. This is consistent with the NEMO Desert Tortoise Conservation Strategy that states that all trash and food items generated by construction and maintenance activities shall be promptly contained and regularly removed from project sites to reduce the attractiveness of the area to common ravens and other desert predators (BLM 2001).

  The environmental awareness program will also inform construction and operation personnel that they are prohibited from intentionally feeding ravens.

  The project owner will dispose of any animal roadkills on the project site and along the access road in self-closing trash bins or another secure method. To discourage tortoise and other wildlife from crossing over the road, and thereby decreasing the potential of tortoise and other small animal roadkill, fencing will be installed along Colosseum Road from the existing paved road (near the Golf Club) to the project site. The proposed tortoise exclusion fencing along the access road also meets NEMO Desert Tortoise Conservation Strategy guidelines that state that fence design standards need to consider the prevention of roadkills to discourage ravens and coyotes (BLM 2001). This fence should be used in concert with culverts to allow animals the size of an adult tortoise to cross under the access road. Boarman and Sazaki (1996) found that a 6-millimeter mesh barrier fence reduced vertebrate mortality by 90 percent on one Mojave Desert transportation project. The exclusion fence will comply with the USFWS-approved design (as seen at http://fws.gov/nevada/desert%5Ftortoise/documents/misc/dt_exclusion_fence2005.pdf)

- **Facility fencing.** The solar facility will be surrounded by a security fence that will also be designed and maintained to exclude coyotes and foxes from entering the site and exposing garbage for raven access. Tortoise exclusion fencing will be attached to the bottom of and inside the security fence with the previously mentioned specifications. Cattle grating will be installed at the security fence access breaks to deter tortoises from entering at these open locations. The facility gates will be closed at the end of each construction day. The entry gates will be automated to open and close for individual vehicles following construction and during facility operation.

- **Reduce availability of water.** Water is a valuable resource in the Mojave Desert and predictably limited during the late spring and summer. Therefore, unnatural sources have the likelihood to facilitate a higher raven population by providing water during the very dry times of the year. Water subsidies may also allow ravens to range further out in the desert from natural water sources (Boarman 2002).

  Access to standing water on the project site will be limited during construction and operation. Truck cleaning areas will be kept free of standing water during construction. Water used for dust suppression during construction will be applied at a rate that discourages puddling.

Operational requirements necessitate the washing of some portion of the project's solar heliostats on a nightly basis while ravens are inactive. Using high pressure water will limit the amount needed. The water will run off the mirrors to the ground below. No puddling is expected and runoff should be absorbed in the soil by morning. Surface drainage will be re-established through the solar fields such that runoff due to rain events continues to flow through the three solar sites. The surface drainage will be rerouted around the administration building, the power block, and other large facility features built on a foundation. This design is intended to discourage the interruption of the existing landscape surface hydrology that could result in ponding or other water accumulation.

Water used during operation for all three solar facilities will be drawn from one of two wells located at the northwest corner of Ivanpah 1. This water will be distributed to the facilities via underground HDPE or PVC pipe. Water for facility use and fire prevention will be stored onsite in a closed 250,000-gallon tank. Water used for operation will be processed in a closed onsite wastewater treatment system and recycled for facility use. There will be two approximately 40- by 60-foot concrete-lined drying beds at each of the three solar facilities that will be used on a temporary basis for boiler commissioning and emergency outfalls. These drying beds will be covered with netting or metal grating to exclude ravens during inundation. Any water used for vegetation restoration or landscape irrigation will be delivered via a drip system that will be regularly checked to prevent leaks and puddling. Operations maintenance will prevent dripping faucets, and water misters used for comfort in hot weather will not be installed or used.

As suggested by Boarman (2003), reducing raven access to standing water will be accomplished by covering the water, altering the edge of the pond with vertical walls, placing monofilament line or screening over the water, and/or adding methyl anthranilate or other harmless taste aversive chemicals to the water. Screening the basins is the preferred option. As part of the adaptive management, one or a combination of these alternatives will be used if exclusion screening is not effective.

3.2.2 Discourage Nesting

Raven predation of juvenile tortoise has been evidenced in the Mojave Desert by the remains of tortoise carcasses under raven nests, direct observations, and carcasses with distinctive raven damage (Boarman 1992). One hundred eighty-five juvenile carcasses that were collected near one raven nest in 1987 near Kramer Hills were attributed to raven predation (*in* Boarman 2002). The addition of buildings, billboards, signs, utility poles, landscape trees, and other structures in Ivanpah Valley have introduced raven nesting opportunities that were otherwise very limited. Although most ravens observed in one study at Edwards Air Force Base nested in Joshua trees (*Yucca brevifolia*) others were observed nesting on various structures such as radar towers, power poles, telephone poles, and buildings (Boarman 2002). Transmission line structures have been shown to increase raptor and raven nesting densities relative to other nesting substrates (Steenhof et al. 1993) and ravens that nest in close proximity to anthropogenic resources have exhibited increased probability of their fledglings surviving to at least 2 years of age (*in* Boarman et al. 2006).

According to Boarman (2003), the majority of raven predation on tortoises can be expected to occur in the spring (April and May) when tortoises are most active and ravens are feeding their young. Ravens feeding chicks have been observed spending most of their time foraging within 0.25 miles of their nest site (*in* Boarman 2003). Other data suggests that ravens in the eastern Mojave Desert spend 75 percent of their foraging time within 400 meters of their nest (=0.5 hectare foraging area) (*in* Boarman 2002). Therefore, the establishment of a new nest can have significant adverse effects on the local juvenile tortoise population. Although a nesting raven pair has the potential to prey on a large number of juvenile tortoises, nesting pairs actively defend their territories against intruding ravens; thereby, limiting the number of ravens within a given area during the breeding season.

The proposed three solar facilities are located within 1.5 miles of 6 transmission lines, including a transmission corridor that runs between Ivanpah 1 and 2.

The NEMO Desert Tortoise Conservation Strategy states that poles and towers of electrical distribution lines must be designed to discourage raven nesting (BLM 2001). The NEMO also states that structures which may function as common raven nesting or perching sites are not authorized except as specifically stated in the appropriate BLM document and project applicants must provide a graphic description of all structures to be erected on the site.

To prevent nesting on structures associated with the Ivanpah SEGS, the project owner will implement the following:

- **Utility structures.** The Ivanpah SEGS generation tie-lines will be installed on utility poles designed to be incompatible with the establishment of raven nests. Transmission towers and other anthropogenic structures may provide nesting ravens with greater protection from the elements, avoidance of mammalian predators, and greater productivity than cliff or tree nest site alternatives (APLIC 2006). Lattice towers typically provide more protection than pole towers. Knight and Kawashima (1993) found that ravens nested on power line structures in greater numbers than expected based on the availability of potential nest substrates.

  Conversely, nests on utility structures also include increased risk of electrocution and entanglement as well as increased risk of nest failure due to disturbance from maintenance and construction operations and persecution. According to avian studies in North America and in Europe, corvids, and especially ravens, have some of the highest incidence of electrocution (APLIC 2006). A new transmission line in northern Mexico was retrofitted to help reduce the high incidence of Chihuahuan raven (*C. cryptoleucus*) electrocutions (and resulting power outages) that peaked during the nesting and fledging season (April to September) (APLIC 2006). Raven nests on anthropogenic structures are likely to be more conspicuous to biologist with the desire to monitor and manage the species. In one study, 98 percent of raven nests were found on the uppermost portion of transmission towers (Steenhof et. al 1993).

  As suggested in APLIC guidelines, the project owner will attach PVC pipe or corrugated drain pipe to transmission line structures to discourage nesting (APLIC 2006). However, ravens are resourceful and have nested around such perch and nest discouraging features (APLIC 2006). Therefore, it is important to monitor the usefulness of the deterrence measures and implement different measures if the current effort is unsuccessful. The installation of triangles, plastic owls, and spikes has also been used to discourage nesting but are often unsuccessful (APLIC 2006). The use of spikes can even stabilize the nest and aide the accumulation of nest material (APLIC 2006). Even successful nest deterrent materials or measures will require occasional maintenance and replacement.

As stated in the NEMO Desert Tortoise Conservation Strategy, all new transmission lines associated with Ivanpah SEGS will be designed in a manner that would reduce the likelihood of nesting by common ravens and the project owner will remove any raven nests that are found on its structures in cooperation with BLM, CDFG, and USFWS (BLM 2001). The NEMO clarifies that take of ravens or active nests require a permit from the USFWS's Division of Law Enforcement (BLM 2001). Even if an identified nest is free of eggs or young, BLM, CDFG, and USFWS will be contacted should those agencies be interested in attempting to trap, tag, and/or transmitter the raven pair.

When inspecting or removing nests, species identification is important in order to avoid disturbing the nest of a non-target species such as a red-tailed hawk (*Buteo jamaicensis*) or a barn owl (*Tyto alba*). Boarman (2002) suggests the benefits to removing a raven nest with an egg in it are: (1) it may be too late for them to re-nest that year and if they do, it is more likely to be unsuccessful; (2) there will be chicks to feed after the eggs hatch; and (3) it decreases the likelihood of juvenile tortoise predation. Removing unoccupied nests during or outside the breeding season may also be beneficial because there is some evidence from Edwards Air Force Base (in the Mojave Desert) that birds with no nest in their territory at the beginning of the breeding season were less likely to commence nesting than those ravens with an intact nest (*in* Boarman 2002). Therefore, the project owner will rely on biologists from the BLM or other resource agencies and/or a BLM-approved biologist to conduct or direct any raven nest disturbance or removal during the breeding season. According to the NEMO Desert Tortoise Conservation Strategy, BLM will require some actions to mitigate actual raven nesting on authorized structures, such as requiring the proponent to secure necessary permits to remove nests in a timely fashion (BLM 2001). The BLM also clarifies that due to protection provided the raven by the Migratory Bird Treaty Act (MBTA), the USFWS rarely authorizes nest removal if birds are present in the nest, but does authorize removal after the birds have left (BLM 2001). It is important to note that nests used by raptors can be used by ravens in following years.

- **Building structures.** The project owner will contact BLM when raven nests are found in any of the structures associated with the Ivanpah SEGS.
- **Structure Removal Following Decommission.** Elevated structures including utility poles will be removed from the Ivanpah SEGS site when decommissioned and dormant.
- **Limiting Raptor Enhancement Measures.** Utility pole and tower construction will not include raptor-friendly designs or retrofits outlined in the APLIC guidelines (APLIC 2006) intended to encourage or enhance the potential for raptor nests that could also be used by ravens.
- **Hazing**. The long term effectiveness of hazing/harassment techniques such as noise making, displaying bright objects, pyrotechnics, and chemical agents are often limited when used to deter frequent nuisance species such as Canada geese (*Branta canadensis*),

striped skunk (*Mephitis mephitis*), and corvid species. To be effective, hazing must be continuous, focused on the target individual(s), and bothersome enough to drive the target animal away from the resource of attraction. Even when hazing seems to yield results, the animal is likely to move on to become a nuisance elsewhere. Hazing also does not address the problem associated with source of the animal's attraction to the location.

The Applicant will focus on limiting raven attractants rather than hazing. Unless implemented properly, hazing could have unintended consequences. Therefore, hazing will only be implemented under the direction of BLM, CDFG, and USFWS in situations where it is considered the best course of action.

3.2.3 Discourage Roosting

The addition of power poles and towers and other elevated structures provides roosting opportunities that are otherwise limited in the Mojave Desert. Elevated roost locations offer ravens a view of their surroundings and prey below.

The solar technology used at the Ivanpah SEGS involves the concentration of sunlight on a central power tower. The heat at the concentration point will be intense enough during the daylight hours such that birds that fly into the reflected sunlight between the heliostats and the power towers could be inflamed. Therefore, it is unlikely that ravens or other birds will be roosting on the solar collection power towers during daylight hours.

The installation of transmission lines and poles will be constructed according to the most recent "raptor-friendly" guidelines (APLIC 2005), ensuring that conductor wires are appropriately spaced to minimize the potential of raptor electrocution. Additionally, all overhead power lines will be equipped with raptor perch guards. The transmission line structures will not be designed to otherwise accommodate nesting or perching.

The security fence around each of the three sites, along with faculty buildings and other facility structures, will provide likely locations for ravens to perch. The interior structures are unlikely to provide optimal foraging roost for ravens since tortoises should be effectively excluded from the fenced sites during operation. Juvenile tortoises outside the solar sites and adjacent to the security fences will likely experience an increased predation risk if ravens regularly perch on the fence.

The largest known communal raven roost included as many as 2,103 ravens on transmission towers in southwestern Idaho (*in* APLIC 2006). During 1995-1997 raven surveys at Fort Irwin, an average of 446 ravens were observed at one night roost and over 1,000 ravens were observed at the location on a single winter evening even though only an average of 18.6 ravens were observed during daytime surveys (Boarman et al. 2006). Boarman (2003) states that there is little value in modifying structures to prevent perching because ravens primarily hunt on the wing and readily perch on shrubs or the ground. Boarman (1995) also maintains that although anti-perching measures could be successful in keeping ravens from perching on particular features, ravens are too resourceful for broad-scale application to be successful.

The Avian Power Line Interaction Committee's (APLIC) Suggested Practices for Avian Protection on Power Lines addresses the desire for land managers to prevent corvids from perching on power line structures where it may adversely affect at risk species, such as desert tortoise (APLIC 2006). According to the APLIC guidelines perch discouragers may not be appropriate on the Ivanpah ISEGS project because: (1) perch discouragers are intended to move birds from an unsafe location to a safe location and do not prevent perching, (2) predation can occur regardless of the presence of a power line, and (3) electrocution risk for non-target bird species, such as raptors, may be increased if perch discouragers are installed on long consecutive spans without providing alternative perch sites. The APLIC guidelines do not offer alternatives to perch discouragers primarily due to the increased electrocution risk it may pose to raptors. The guidelines state that utilities and agencies should work together to identify predation risk to sensitive species that results from corvid use of poles; determine retrofitting methods or designs that are appropriate, effective, and commensurate with the level of risk; and develop best management practices or guidelines.

However, it is prudent that the Ivanpah SEGS project avoid the introduction of new perching opportunities for ravens. If ravens are strongly attracted to the project vicinity it will be difficult to eliminate or control perching. Even if anti-perching measures are effective within the project site, ravens are likely to find other perching opportunities immediately adjacent to the project site. To discourage perching on structures associated with the Ivanpah SEGS, the Applicant will implement the following:

- **Roost Prevention as a Contingency.** As stated in the USFWS *Draft Environmental Assessment to Implement a Desert Tortoise Recovery Plan Task: Reduce Common Raven Predation on the Desert Tortoise* it is questionable whether modification of utility poles and towers to preclude raven perching and nesting is feasible or effective (USFWS 2007). According to the Environmental Assessment, USFWS dismissed such modifications because perch availability may not limit raven population size, modification would adversely affect other avian species, potential perch and nest sites are already too numerous, and the measure would require considerable cooperation with the utility companies (USFWS 2007).

  The objective of this plan is to avoid the introduction of new roost and nest locations for ravens (and consequently non-target avian species). Given the questionable utility of physical perch deterrents, Ivanpah SEGS will not include such features on structures greater than 60 inches in height. However, contingency measures will be implemented when it becomes apparent that a particular structure is providing a favorable location for daytime perches or evening roosting. In such a case, bird barrier spikes or the functional equivalent will be used to minimize the opportunity. Such a contingency measure will be implemented following specific discussion with the BLM, CDFG, and USFWS.

- **Hazing**. As stated in the preceding nest deterrence section, hazing will only be implemented under the direction of BLM, CDFG, and USFWS in situations where it is considered the best course of action.

- **Structure Removal Following Decommission**. Elevated structures including utility poles will be removed from the Ivanpah SEGS site when decommissioned.

3.2.4 Avoid Increased Predation Risk Associated with Tortoise Translocation

Measures developed to minimize and avoid adverse effects to desert tortoise as a result of the Ivanpah SEGS development include the implementation of a tortoise translocation plan. This plan remains in development with the cooperation and guidance of BLM, CDFG, USFWS, and the National Park Service (NPS). Based on the 2007 and 2008 tortoise surveys of the project area, an estimated minimum of 25 tortoises will likely be displaced from the fenced heliostat arrays for Ivanpah 1, 2, and 3 as well as the temporary work areas for the utility tie-ins. The optimal alternative is to move individuals the shortest distance possible beyond harm's way and, at a minimum, emphasis is being placed on keeping the tortoises within the Ivanpah Valley, north of I-15 and west of the Nevada state line. Other factors include avoiding areas adjacent to human activity, roads, overhead utility structures, and the host of anthropogenic raven subsidies.

Even tortoises captured, processed, and moved a short distance are likely to experience some level of disorientation and confusion as they encounter physical barriers that exclude them from all or portions of their former home range, unfamiliar surroundings, no personal or familiar burrow or cover locations, and possible competition with resident tortoises. This displacement is likely to leave adult and juvenile tortoises more vulnerable to starvation, exposure, disease, and predation. This is possibly a factor in the high mortality due to canid predation recently observed for tortoises translocated out of the expansion area for the Fort Irwin National Training Center.

These concerns should also extend to the potential for increased raven predation of translocated juvenile tortoises. This issue should be recognized and addressed in the translocation plan with measures to minimize this increased risk. Such measures may include efforts to ensure that translocation of individuals does not occur when ravens are present. Translocation typically includes monitoring of tortoises with the use of radio telemetry. Juvenile tortoises may not be likely candidates for this method of monitoring due to the size of the telemetry units. Therefore, another option to increase their post-translocation survival may be to move juvenile tortoises to a predator-proof enclosure designed to support their life history needs until they reach sufficient size. The Mojave National Preserve plans to construct such a juvenile tortoise holding facility in the Ivanpah Valley that would likely be supported as a recovery action under the soon-to-be revised recovery plan for the Mojave population of the desert tortoise (personal communication with Debra Hughson/NPS). This enclosure may be completed prior to implementation of the Ivanpah SEGS translocation plan and should be considered as an option to increase the survivorship of juvenile tortoises displaced by the Ivanpah SEGS. Another concern of note, translocation may occur in late winter or early spring, which coincides with the period when breeding raven pairs are becoming more active and therefore, compounding the potential risk to juvenile tortoises. Other juvenile-specific components of the translocation plan are likely to be incorporated into the Ivanpah SEGS translocation plan given guidance from the various agencies.

3.2.5 Removal of Problem Ravens

Corvids were not protected under the original 1918 MBTA because they were considered agricultural pests. However, a 1972 amendment to the MBTA provided legal protection of corvids, including active raven nests.

Boarman (1992) believes that lethal removal would be the most effective means for broad-scale, short-term raven population reduction and localized removal on a more permanent basis. In the early 1990s, BLM initiated a pilot program in cooperation with other resource agencies in tortoise habitat to control ravens with lethal poisoning by way of treated hard-boiled eggs (*in* Boarman 1992). The project was terminated following a temporary restraining order filed by the Humane Society of the United States.

The Applicant prefers to avoid lethal removal except in cases where problem ravens have been identified and other deterrent or harassment methods have not been effective. Lethal removal would only be conducted by, or under the direction of the BLM, CDFG, and USFWS, and would be considered a short-term solution. As outlined in the NEMO Desert Tortoise Conservation Strategy, the BLM is committed to remove ravens that are known to prey on tortoises through selective shooting or trapping and euthanasia where there is evidence of raven predation in or within one mile of a DWMA (BLM 2001). Although not within a mile of a DWMA, the Applicant would cooperate with the BLM to implement this measure at the Ivanpah SEGS if warranted. Boarman (2002) recommends removal of any territorial raven found within 1.6 kilometers (estimated territorial radius) of at least one tortoise shell showing evidence of being killed by a raven within the prior 15 months. Boarman (2002) suggests target ravens that cannot be shot with a rifle or shotgun be trapped and humanely euthanized and that young ravens in the nest be euthanized. The effectiveness of removing individual ravens can be limited because other ravens are likely to move in to occupy the vacant territory. Given their intelligence, lethal removal of subsequent individuals in a shared area can be difficult and lethal removal can also be unpopular with the public. It is important to note that removal does not address the issues that enable raven presence and vacated nesting territories are likely to be quickly occupied by another raven pair.

3.3 Success Criteria

The effectiveness of the Raven Management Plan will be monitored through the construction of all three site construction phases during which previous phases will be in operation. Reporting associated with the implementation of the plan will continue for 2 years following completion of all three sites.

It will be difficult to determine if the project is contributing to a decline in the local desert tortoise population because it is difficult to monitor juvenile tortoise densities and raven predation. Furthermore, it will be difficult to attribute raven abundance over time to the Ivanpah SEGS given the existing human presence and planned development throughout the Ivanpah Valley and the proximity to the large population centers of the Las Vegas Valley. Therefore, the success of this Raven Management Plan will be based on how successful the project design features and implementation of the Plan is in discouraging ravens from gaining food, water, nesting, or perching opportunities associated with the Ivanpah SEGS project. Much of the plan’s success lies in the effectiveness in discouraging human practices that would attract ravens to the area. Despite the challenges associated with managing an intelligent and resourceful animal such as the raven, implementation of this management plan will likely have a better chance of success given ravens may be more likely to frequent other nearby areas of human activity and occupation where they are less likely to be harassed and valuable resources are more available.

The Applicant proposes to discontinue the survey and reporting requirements after 2 years if it can be determined that the project design, operation, and raven management plan have been successful. The site maintenance; waste and water management; identification of problem ravens, roost, and nest sites; and the reporting of juvenile tortoise predation aspects of the management plan will need to be continued for the life of the solar facility.

It would be ideal if the Ivanpah SEGS raven monitoring efforts could eventually be incorporated into a large-scale inter-agency regional plan for the Ivanpah Valley. Such a plan may aid the long-term goals of two of the largest local land managers, the BLM and NPS.

3.4 Adaptive Management

Adaptive management will be required if existing raven management measures are not effective in controlling significant raven predation of the desert tortoise. Ravens are notoriously adaptive, resourceful, and clever, further necessitating the need for adaptive management. Given that ravens threaten the recovery of other at-risk species, deterrent and aversion methods continue to be developed and tested in a variety of situations. For example, biologists found some success in using nonlethal conditioned aversion to reduce predation by ravens on the eggs of California least terns (Avery et al. 1995) and similar methods may be developed to reduce predation on juvenile tortoises. An experimental program was recently initiated in Japan where honey bees are being used to deter crows from the nests of little terns (*Sterna albifrons*), demonstrating the need for creative solutions when dealing with corvids (Ryall 2008). Resource agencies also continue to work on ways to better monitor and find juvenile tortoises and learn more about the dynamics of raven territoriality, dispersal, daily movements, and use of anthropogenic subsidies (Boarman 1997). Flexibility, and a willingness to adopt new or experimental methods and measures, are likely to be crucial for the effectiveness of any long-term raven management plan.

The project owner will consult with the CDFG, BLM, and the USFWS prior to implementing adaptive management changes. The minimum 5-year monitoring period will be re-initiated following the implementation of any adaptive management changes.

SECTION 4

Raven Monitoring Plan

4.1 Raven Population Monitoring

The objective of raven monitoring is to determine raven abundance, distribution, nest site locations, and behavior exhibited in the Ivanpah Valley prior to, during, and for a minimum of 2 years following completion of all three solar facilities.

4.1.1 Methodology

Abundance and Behavior Surveys

Depending on the project permitting and licensing schedule, surveys for raven monitoring may begin as early as the late winter or early spring of 2009. The object of the surveys will be to characterize raven presence in the project vicinity and to monitor abundance and behavior in those areas over time. The purpose of the surveys will be to identify the local sources of anthropogenic subsidies and raven activity relative to the Ivanpah SEGS.

The investigation will consist of driving surveys that will target the Ivanpah SEGS site, the translocation site (location yet to be determined), the nearby transmission line corridors, the Primm Valley Golf Club, and the community of Primm, NV. Due to likely access problems, surveys of the golf club would be completed from the perimeter road.

The survey coverage will be revised if it becomes apparent that the route is not providing adequate observation of raven activity centers in the general project area. Most of the survey coverage is based around the Ivanpah SEGS site vicinity. Primm is included for reference as the closest area of significant human activity.

The roads will be driven slowly. With the use of binoculars and spotting scopes it is estimated that conspicuous raven activity will be observable within 2 kilometers of the road, dependant on landscape and other barriers. All raven observations will be documented and will include date, time, location, habitat, number of individuals, and behavior. The locations of occupied and potential nests will also be recorded.

Survey visits will occur twice a month during the peak of tortoise and breeding raven activity (March to June) and once a month for the remainder of the year (July to February). Each survey visit will consist of a 2- day effort. Each day the survey route will be driven once in the early morning (starting 30 minutes prior to sunrise), a second time in the mid-day (starting between noon and 2 p.m.), and a third time in the evening (timed such that the survey can be completed within one hour following sunset).

Nest Surveys

The areas under occupied and potential nests will be surveyed during the March through June visits for sign of juvenile tortoise predation. The feasibility of the survey will depend on access. It is unlikely that access will be provided to investigate nests observed within the golf club.

The carcass survey will cover a 50-meter radius originating from the nest location. This area will be walked with 10-meter interval transects. The location of all juvenile tortoise carcasses or other sign of predation will be mapped and photographed. The sign will be collected or marked based on guidance from the resource agencies.

Incidental Observations

Biologists will have a year-round presence during Ivanpah SEGS construction conducting clearance surveys, monitoring construction activity, monitoring environmental compliance, translocating tortoises, and monitoring translocated tortoises. While conducting these activities, biologists will be instructed to document raven observations. Relevant incidental observations will be included in the yearly monitoring reports and will be immediately reported to the appropriate resource agency of particular interest or concern.

4.2 Survey Participants

The desert tortoise and raven surveys associated with the Ivanpah SEGS project will be conducted by experienced desert biologists that will be subject to BLM, CDFG, and USFWS approval.

4.3 Monitoring Reports

The project owner will submit monitoring reports to the CDFG, BLM, and USFWS no later than December 31 of each raven management year. If after 2 years of reporting following the operation of all three facilities, the agencies determine that the raven management program is effective, and ravens are not adversely affecting the local tortoise population due to Ivanpah SEGS operation, then the raven surveys and reporting schedule will be phased out. However, the raven management practices, such as employee education, trash containment, and reporting raven nests, will be implemented for the life of the solar facility.

The annual report will include:

- The number and behavior of observed ravens
- Raven nest and perch locations
- Results of the management techniques;
- The observed effectiveness of the techniques in minimizing raven presence
- Suggestions for improving raven management

Observations of raven predation of juvenile tortoises (including sign) and occupied raven nests will be reported to the designated contacts at BLM, CDFG, and USFWS by an electronic mail message within 2 days of the observation.

SECTION 5

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September 12, 2008
File No.: 04.02.06.02
Project No. 357891

Mr. Che McFarlin, Project Manager
California Energy Commission
Systems Assessment and Facilities Siting Division
1516 9th Street, MS 15
Sacramento, CA 95814-5504

RE: Data Response, Set 1H
Ivanpah Solar Electric Generating System (07-AFC-5)

Dear Mr. McFarlin:

On behalf of Solar Partners I, LLC, Solar Partners II, LLC, Solar Partners IV, LLC, and Solar Partners VIII, LLC, please find attached one original and 12 hard copies of Data Response, Set 1G, which addresses Staff's data requests dated December 12, 2007.

Please call me if you have any questions.

Sincerely,

CH2M HILL

John L. Carrier, J.D.
Program Manager

Enclosure
c: POS List
Project File

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA

APPLICATION FOR CERTIFICATION
FOR THE *IVANPAH SOLAR ELECTRIC GENERATING SYSTEM*

DOCKET NO. 07-AFC-5

PROOF OF SERVICE
(Revised 7/14/08)

INSTRUCTIONS: All parties shall 1) send an original signed document plus 12 copies OR 2) mail one original signed copy AND e-mail the document to the web address below, AND 3) all parties shall also send a printed OR electronic copy of the documents that shall include a proof of service declaration to each of the individuals on the proof of service:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 07-AFC-5
1516 Ninth Street, MS-14
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DECLARATION OF SERVICE

I, Mary Finn, declare that on September 15, 2008 I deposited copies of the attached Data Response, Set 1H in the United States mail at Sacramento, California with first-class postage thereon fully prepaid and addressed to those identified on the Proof of Service list above.

Transmission via electronic mail was consistent with the requirements of California Code of Regulations, title 20, sections 1209, 1209.5, 1210. All electronic pages were sent to all those identified on the Proof of Service list above.

I declare under penalty of perjury that the foregoing is true and correct.

Mary Finn