STATE OF CALIFORNIA

**Energy Resources Conservation
And Development Commission**

In the Matter of:

**Application for Certification for the
Hidden Hills Solar Electric Generating System**

Docket No. 11-AFC-2

California Energy Commission
DOCKETED
11-AFC-2
TN # 69495
FEB 12 2013

ENERGY COMMISSION STAFF'S REBUTTAL TESTIMONY

In accordance with the Commission's Order, tn: 68965, the Energy Commission staff files its supplemental testimony, which is attached.

Dated: February 11, 2013

Respectfully submitted,

/S/_____

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HIDDEN HILLS SOLAR ELECTRIC GENERATING SYSTEM (11-AFC-2)
REBUTTAL TESTIOMONY

TABLE OF CONTENTS

ALTERNATIVES ..... Page 3

BIOLOGICAL RESOURCES ..... Page 10

CULTURAL RESOURCES ..... Page 59

FACILITY DESIGN ..... Page 61

HAZARDOUS MATERIALS MANAGEMENT ..... Page 68

NOISE AND VIBRATION ..... Page 69

SOIL AND SURFACE WATER ..... Page 74

TRAFFIC AND TRANSPORTATION ..... Page 76

VISUAL RESOURCES ..... Page 78

WATER SUPPLY ..... Page 82

WORKER SAFETY ..... Page 101

STAFF REBUTTAL TESTIMONY

ALTERNATIVES

by: Jeanine Hinde

Q: What is the purpose of your testimony?

A: To address the Applicant's testimony of February 4, 2013.

Q: In that testimony the Applicant states that there are favorable technological attributes to concentrating solar thermal energy generation that photovoltaic (PV) generation lacks, and that these attributes are inadequately analyzed in the final staff assessment (FSA). What is staff's response?

A: The Applicant states that solar thermal has certain favorable attributes that are lacking in a PV alternative, such as inertia and reactive support. The FSA acknowledges that solar thermal has the ability to maintain some stability and consistency in the megawatts of electricity produced during periods of cloud cover (see page 6.1-25 of the **Alternatives** section of the FSA). The value of the attributes listed by the Applicant to the rest of the grid system will vary with the point of interconnection. However, this does not make a PV generation alternative infeasible. Rather, it means that such attributes will need to be provided separately, perhaps at greater cost and by different projects. But PV facilities are entirely feasible alternatives, and several utility-scale projects are being constructed in California and the Nevada border areas.

Q: The Applicant's testimony suggests that the PV alternative, or any other alternative, would be infeasible because it would require changing the terms of the existing power purchase agreements (PPAs). What is staff's response?

A: Any of the project alternatives other than the No-Project Alternative could require different or amended PPAs. However, this does not make a project alternative infeasible, including the PV Alternative. The California Public Utilities Commission (CPUC) regularly considers requests for approval of amendments to PPAs (see page 6.1-62 of the **Alternatives** section of the FSA). If a PPA is seen as a limitation on feasible alternatives, then applicants can simply abrogate the legislatively required CEQA alternatives analysis by contracting it away. But the PPAs specifically contemplate full CEQA review after their issuance, and such analysis is legally required.

Q: The Applicant's testimony states that the PV Alternative and the Parabolic Trough Alternative are infeasible because BrightSource Energy does not design, construct, or operate those types of projects. What is staff's response?

A: Staff's alternatives analysis includes comparisons of the environmental effects of alternative technologies to the Applicant's proposed solar power tower technology. Limiting the alternatives analysis to the Applicant's proprietary technology would mean that no alternative technology could be treated as a feasible alternative to the proposed project. The Applicant also objects to staff's inclusion of the Solar Power Tower (SPT) with Energy Storage Alternative, stating that it fails to avoid or reduce any of the proposed project's significant impacts. Given the potential for

this alternative to achieve most of the project objectives, the fact that BrightSource Energy is developing its storage technology, and the need for renewable projects in the state to include energy storage, staff would have been remiss to eliminate the alternative from full consideration in the alternatives analysis.

Q: The Applicant's testimony states that the PV and Parabolic Trough Alternatives should not be included in staff's alternatives analysis because neither of them could achieve most of the FSA's project objectives. What is staff's response?

A: The **Alternatives** section of the FSA includes discussions and analysis on the extent to which the project alternatives could attain the seven basic objectives of the project. Based on staff's analysis in the FSA, the PV and Parabolic Trough alternatives could each potentially satisfy five or six of the project objectives (see pages 6.1-77, 6.1-78, and 6.1-93 of the FSA). There is no set number of project objectives or an established percentage of project objectives that an alternative must meet to be carried forward for full analysis. Staff considers it reasonable to conclude that both alternatives could feasibly attain most of the project objectives.

Q: In its discussion of the relative land/energy efficiencies of the different technologies, the Applicant's testimony identifies staff's alleged mistakes in the acreage data presented in **Alternatives Table 5** for two of the PV projects summarized in the table. The Applicant states that the AV Solar Ranch One PV Project is 2,093 acres and not 1,955 acres as stated by staff. The Applicant states that the California Valley Solar Ranch PV Project is 1,861.7 acres and not 1,500 acres as reported by staff. What are staff's responses?

A: *AV Solar Ranch One* – The final environmental impact report (FEIR) for the AV Solar Ranch One project includes details on site acreage showing that the entire 2,093 acres would not be developed. In response to a comment on potential impacts from the loss of 2,100 acres of habitat, the FEIR states that the "total acreage impacted (including both the project site and the transmission line route) would total 1,955 acres, and the total acreage set aside for preservation and enhancement would total 550.6 acres (100.6 acres within the project site and an additional 450 acres at an off-site location within the Antelope Valley)" (County of Los Angeles 2010a). The Notice of Completion and Availability of the draft EIR for the AV Solar Ranch Project states that the project site consists of approximately 2,100 acres and that it would involve development of approximately 1,955 acres of the overall project site (County of Los Angeles 2010b). Staff's analysis correctly states in **Alternatives Table 5** that 1,955 acres will be subject to direct ground disturbance for the AV Solar Ranch One Project.

A: *California Valley Solar Ranch* – The Executive Summary in the FEIR for the California Valley Solar Ranch Project includes the following statement (County of San Luis Obispo 2011):

> *In response to comments on the Draft EIR and to further reduce the significant impacts of the project and in response to ongoing consultation with resource agencies, the Applicant proposes to implement a modified alternative layout for the project. This layout is presented in Section E, Alternatives, as T0 Alternative M3.*

Section E, "Alternatives," of the FEIR describes T0 Alternative M3, stating that it would "reduce permanent disturbance from 98 acres to 92 acres, and temporary disturbance from 1,762 acres to 1,401 acres…." As shown in Table E-8 of the FEIR for the California Valley Solar Ranch Project, the total disturbance area is 1,492.5 acres, including acreage for permanent and

temporary disturbance (County of San Luis Obispo 2011). Redesigning the site footprint did not reduce the planned 250-megawatt (MW) generating capacity of the project. Staff's analysis correctly states in **Alternatives Table 5** that 1,500 acres will be subject to direct ground disturbance for the California Valley Solar Ranch Project.

Q: The Applicant's testimony states that constructing a PV project on the HHSEGS site would yield significantly lower energy production compared to HHSEGS. What is staff's response?

A: The Applicant used the data on the four sample PV projects from staff's **Alternatives Table 5** in the FSA to calculate the differences in energy production for each of those four projects if they were constructed using the same acreage as HHSEGS. The Applicant's data is presented in Table Alt-2 of BrightSource Energy's opening testimony. For the AV Solar Ranch One Project, Desert Sunlight Solar Farm Project, and Topaz Solar Farm Project, the reduction in energy generation compared to HHSEGS is 34.5 percent, 31.6 percent, and 32.3 percent, respectively. Except for the AV Solar Ranch One Project, which includes 52 MWs of horizontal trackers, these three projects are using fixed-tilt panels to collect solar energy. The 250-MW California Valley Solar Ranch Project under construction in the Carrizo Plain is using all single-axis tracking; the reduction in energy generation for this PV project compared to HHSEGS is approximately 1 percent. Based on the example provided by the California Valley PV project, a PV alternative constructed using a single-axis tracking technology on the same number of acres as HHSEGS would achieve close to the same energy output as the proposed project.

Based on 2012 data on CPUC's long-term procurement process, the annual energy production for a thin-film PV project would be greater in the state's desert regions compared to a similar project in the Carrizo Plain. Therefore, it is reasonable to assume that a PV project like the California Valley Solar Ranch Project could at least match the energy production anticipated from the HHSEGS project at its proposed location.

Q: The Applicant's testimony states that the estimates for annual energy production for the four sample PV projects, in gigawatt hours per year (GWh/year), are inaccurately reported by staff in **Alternatives Table 5**. The Applicant provides different values for GWh/year for AV Solar Ranch One, Desert Sunlight, Topaz, and California Valley that are intended to correct staff's alleged mistakes. What is staff's response?

A: The values listed by the Applicant show increases in annual energy production for two of the projects compared to the values listed by staff and decreases in energy production for the other two projects compared to the values listed by staff. The differences range from an increase of 36 GWh/year to decrease of 54 GWh/year for the four PV projects.

Staff obtained the data on annual energy production for the four PV projects from representatives of the project developers for those projects and included citations and references for that data in the **Alternatives** section of the FSA. The Applicant cites different sources for the data on estimated annual energy production. The predicted annual energy production varies slightly depending on the source, but the differences are small. For the California Valley Solar Ranch Project under construction on the Carrizo Plain, annual energy production will only be about 0.9 percent lower than what is planned for HHSEGS. Therefore, it is reasonable to assume that a PV project like the California Valley Solar Ranch Project could at least match the energy production anticipated from the HHSEGS project at its proposed location.

Q: The Applicant's testimony states that PV requires substantial grading and foundations for grounding a PV system. The Applicant claims that staff's analysis of the PV Alternative understates impacts on biological and cultural resources and that site grading and installation of foundations under the PV Alternative would cause greater impacts compared to the proposed project. What is staff's response?

A: Staff reviewed the analyses in the final environmental compliance documents for the four sample PV projects discussed in the **Alternatives** section of the FSA, including details on site preparation and grading for those PV projects (see pages 6.1-75 to 6.1-77 of the FSA). As discussed on page 6.1-76 of the FSA, limited site grading is described for the PV projects. Citations and references are provided for all statements in the FSA regarding site disturbance.

Staff contacted representatives of the project developers for two of the PV projects discussed in the FSA to obtain current information on construction of those projects, including details on site grading and restoration and photographs showing the ground under some of the array fields. Staff's requests for updated information and the corresponding responses are provided below.

1) Please describe the extent of site grading and leveling that has (or has not) been required to install the PV system.

Topaz Solar Farm Project (all fixed-tilt panels, about 9 million panels total): The major site grading technique is based on farming methods that consist of a tractor/disc and tractor/drag box operation to limit ground disturbance (Bernheimer, pers. comm., 2013). Limited small-scale earthmoving/grading operations are accomplished with scrapers and motor graders with machine controls. Varying post lengths (for the solar panels) are used to compensate for small variations in ground elevation and yet still achieve a uniform, level array. Because of this method of installation, minimal grading is required[1]. Also, the project conditions do not allow alteration of the existing topography outside of the areas that have been determined to require adjustment for structural design tolerances. **Alternatives Figures 1a, 1b,** and **1c** show before and after photographs for construction at one of the PV array blocks.

California Valley Solar Ranch (CVSR) Project (all single-axis tracking, about 757,320 panels total): Construction at the CVSR site employs SunPower's "light on land" development practices, which minimize or eliminate grading for PV installation and operation (Ekstrom, pers. comm., 2013). The extent of ground disturbance from clearing and grubbing at most of SunPower's projects is minimal, if any.

For CVSR, unusual circumstances required more extensive grading in some areas. To avoid certain protected species habitat, SunPower revised the array layout to relocate some arrays on steeper slopes or on reclaimed mining areas, resulting in more grading than otherwise would have been needed for a typical SunPower project. Even so, many arrays are located on terrain that is relatively flat and required no grading and no removal of existing vegetation (except for noxious/invasive weeds). In areas where some clearing or grubbing occurred, native vegetation has rapidly returned under the arrays.

[1] It states on page 5.2-5 of the **Geology and Paleontology** section of the FSA that "[t]he topography across the site is relatively planar to slightly undulatory with a gentle slope from east to west." Given the HHSEGS site topography, staff assumes that installation of the PV Alternative at the HHSEGS site would not require the high extent of grading that the applicant implies would far exceed that of the proposed project.

The graded areas at the CVSR site fall into two categories:

- Light grading: Minimal grading in some array areas was done to cut small hills and fill in small dips in the landscape. These areas will be revegetated with native grasses when construction is complete.

- Heavy grading: One solar array is located on top of an old existing gypsum mine that the project permits require to be reclaimed. This array area, which had poor biological value, is being graded to improve the contour and drainage and will be revegetated with native grasses.

2) For temporarily disturbed areas in the array fields, please describe the extent to which those areas have been or will be restored and revegetated.

Topaz Solar Farm Project: All areas where existing vegetation is disturbed, whether temporary or permanent, must be restored with what has been determined as the natural vegetation mix. **Alternatives Figures 2a** and **2b** show revegetated areas below the solar panels.

California Valley Solar Ranch Project: When any ground disturbing work is done, SunPower follows strict procedures for top soil retention. After ground disturbance, the top soil and seed bank that has been removed is returned and redistributed over the disturbed area to revegetate the site, in accordance with an agency-approved Habitat Restoration and Revegetation Plan.

3) Please describe the details of any foundations (e.g., concrete or other material to support the posts) required for installation of the PV solar modules and arrays.

Topaz Solar Farm Project: Posts supporting the arrays are driven piles without concrete foundations (see **Alternatives Figure 3**).

California Valley Solar Ranch Project: SunPower PV installations do not require foundations to support the trackers and panels. The supporting piers are pushed directly into the ground with special, low-impact equipment, and each pier has a footprint of approximately 4½ inches in diameter. (Staff notes that the supporting piers for the PV panels are very similar to the SPT heliostat pylons for the proposed project.)

Q: The Applicant's testimony states that the Parabolic Trough Alternative would have environmental impacts that were not, but should be, adequately analyzed in the FSA.

- No analysis of the efficiency impacts for this alternative. In other words, the Applicant states that the Parabolic Trough Alternative would require more solar collectors to produce the same amount of electricity.

- No analysis of the potential impact from vaporization of the heat transfer fluid (HTF) into small amounts of volatile organic compounds.

- No analysis of the impacts from fire risk, including demand for emergency services.

- No analysis of the impacts from greater ground disturbance on various resources, including cultural, paleontological, sensitive biological habitats, and soils.

- No analysis of impacts from heavy equipment use during construction and operation.

What are staff's responses?

A: The Applicant's claim is simply incorrect. Staff's responses correspond to each of the Applicant's bulleted statements above:

- The **Alternatives** section of the FSA compares the energy generation systems of the project alternatives (see pages 6.1-117 to 6.1-120 of the FSA). An analysis of the Parabolic Trough Alternative is provided on page 6.1-119. Staff's analysis states that "the SPT technology uses land more effectively and collects solar energy 30 percent more efficiently than the parabolic trough technology."

  For staff's analysis of the comparative environmental impacts of the alternatives, no expansion of the HHSEGS site is assumed. Staff's analysis of the Parabolic Trough Alternative states that "[t]he total potential generating capacity of this alternative is unknown and could be less than the proposed 500-MW capacity of the proposed project." (see page 6.1-93 of the FSA)

- An analysis of impacts related to potential vaporization of HTFs is provided on page 6.1-97 of the FSA.

- An analysis of impacts related to an increased demand for fire protection and emergency response services is provided on pages 6.1-99 and 6.1-100 of the FSA.

- Conclusions for the comparative analysis of environmental impacts from construction and operation of the Parabolic Trough Alternative vary depending on the resource. The impacts of this alternative are analyzed on pages 6.1-97 to 6.1-105 of the FSA. Impacts on soil and surface water resources are included in the analysis. Regardless of the intensity of site grading, the developed site would not retain its functional value to terrestrial wildlife; therefore, the impact of the net loss of the habitat, given a project alternative with the same boundaries, would essentially be the same as HHSEGS.

- Analyses of impacts on soil and surface water resources under the Parabolic Trough Alternative are provided on pages 6.1-104 and 6.1-105 of the FSA. Differences in impacts between the parabolic trough technology and the proposed project's technology are described throughout the analysis for this alternative.

Q: The Applicant's testimony states that under the No-Project Alternative, it is reasonable to expect that up to 170 individual landowners would build residences at the HHSEGS site. What is staff's response?

A: Staff's analysis of the No-Project Alternative is provided on pages 6.1-19 to 6.1-23 of the FSA. As stated on page 6.1-21, staff concludes based on available information that the No-Project Alternative is characterized by the continuation of existing conditions at the HHSEGS site. Staff describes approval of an EIR prepared by Inyo County in 1974 for a project to subdivide and develop several thousand acres in an area that includes the proposed project

site. No significant development occurred at the site and no development-related or public services infrastructure was brought to the site. Inyo County staff has stated that no plans are identified to construct any residential units on any of the lots should the proposed project not proceed. As stated by staff on page 6.1-21 of the FSA, "[t]he mere existence of subdivided property does not make development of this relatively isolated area reasonably foreseeable." Staff believes that its assumptions for the No-Project Alternative in the FSA are reasonable given the history of the project site and the obstacles to its residential development.

References

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County of Los Angeles 2010b — *Notice of Completion and Availability, Draft Environmental Impact Report for the AV Solar Ranch One Project*, County Project No. R2009-02239, Conditional Use Permit No. RCUPT200900026, Los Angeles County Department of Regional Planning, Los Angeles, CA. Available: <http://planning.lacounty.gov/assets/upl/case/project_r2009-02239_noa.pdf>. Accessed January 25, 2013.

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Ekstrom, Ingrid. Corporate Communications Director, SunPower Corporation, San Jose, CA. January 31, 2013 — e-mail to Jeanine Hinde of the Energy Commission on the extent of site grading that has been required at the California Valley Solar Ranch PV Project site.

BIOLOGICAL RESOURCES

by: Bill Haas, Chris Huntley and Carol Watson

Q: What is the purpose of your testimony?
A: To respond to certain points made by Applicant in its January 28, 2013, testimony.

Q: What is the underlying theme of applicant's testimony?
A: Applicant's testimony labors to suggest that Staff's proposed mitigation for endangered species and species of special concern is either unnecessary or excessive. It does so by discounting many wildlife and habitat issues, and discounting the habitat of the project site. The applicant for example suggests the site is highly disturbed when in fact it is largely comprised of intact habitat. Applicant also fails to account for active tortoise sign on portions of the project, and recommends mitigation ratios that would result in a net loss of habitat. It states that bird use on the site is low and that the site is not within migratory pathways, contrary to evidence that it is a migratory pathway. Most importantly, Applicant proposes to greatly weaken or eliminate conditions of certification that are necessary to mitigate project impacts, and to greatly reduce compensatory mitigation for desert tortoise, a species listed for protection under the California Endangered Species Act (CESA). This proposal to reduce mitigation to less than a 1:1 ratio for take and habitat loss does not meet CESA's requirements that a project be "fully mitigated," as the California Department of Fish and Wildlife (DFW) will separately attest.

Q: Applicant's testimony states that the project has been sited to avoid significant impacts to biological resources. What is your response?
A: The project is proposed to be located in habitat described in USGS surveys as prime desert tortoise habitat, and that is home to many other species DFW, the State's trustee agency for wildlife resources, routinely requires mitigation. In addition, the project site supports a broad array of rare plants and wildlife including burrowing owl, American badger, the listed desert tortoise, and the fully protected golden eagle.

Q: Applicant describes the loss of 3,199 acres of habitat as a "temporary loss." What is staff's response?
A: It makes no sense at all to term the loss "temporary". The project site is very large, is located in a fragile environment, and can reasonably be expected to operate for many years—probably well beyond 30 years—given the capital investment of more than two billion dollars. Such land use and habitat loss cannot fairly be described as temporary.

DESERT TORTOISE

Q: Applicant's testimony contends that Staff has "overcounted" desert tortoise occurrence and required excessive compensatory mitigation.. What is your response to this contention?

A: Staff and DFW very much disagree. Both Staff and DFW conducted several site visits of the project site to evaluate habitat conditions and determine if the mitigation approach identified in the PSA was valid. Staff found that some portions of the site did not support desert tortoise sign (i.e., burrows) but the majority of the site is desert tortoise habitat. Further clarification on staff's responses regarding desert tortoises, including estimated presence, is described below.

A: How “disturbed” is habitat at the site?

A: Applicant overstates the level of physical disturbance to the site. Portions of the site have been subject to historic disturbance (likely in the form of agriculture) and a rectilinear road system was constructed to support some form of residential development. However, the planned residential development never occurred, and the site largely consists of relatively intact native habitat. Weeds are common in some areas, but this has not prevented the success rare plants that occur across much of the site. Wildlife have been commonly observed on the project site including desert tortoise, burrowing owls, American badgers, rodents, kit fox, and a variety of birds.

Q: Applicant contends that compensatory mitigation ratios proposed by Staff and DFW are too high based on its assertion that “no desert tortoise was found in shadscale scrub areas, which comprises approximately half of the site, has a generally low value for the species, and is associated with less suitable soil types.” Do you agree with this statement?

A: No. Desert tortoise burrows were documented by both Applicant and Staff in areas dominated by shadscale scrub communities. Although no live animals were detected, desert tortoise burrows were identified both on the project site and in portions of the zone of influence surveys, all in areas supporting shadscale scrub. Staff further documented active desert tortoise burrows in areas dominated by shadscale during surveys conducted in December and January 2012-2013. Some of these burrows were previously identified by the applicant during desert tortoise surveys while other burrows were detected by staff. This supports the position identified in the FSA that the project does support desert tortoise. The mitigation ratios identified in the FSA were developed in consultation with the CDFW, the State Agency responsible for the implementation of the California Endangered Act on non-energy commission projects. The mixed ratios were intended to address the various habitat functions, distribution, and densities of animals, and provide full mitigation to off-set impacts to this species.

Q: The Applicant proposes a less than 1:1 ratio for habitat because the site is not located in Designated Critical Habitat or in areas identified by the BLM as Desert Wildlife Management Area (DWMA), Wilderness Areas, or Areas of Critical Environmental Concern (ACEC) that the land consists of low quality habitat. What is your response?

A: The designations referred to have nothing to do with habitat value. The very same statements were actually made by Applicant in the Ivanpah proceeding, yet that area was comprised of the very highest habitat values, as even Applicant would be likely to now acknowledge. The NEMO is a planning tool and does not always reflect conditions on the ground. For example as described previously in the FSA the USGS report that models habitat for desert tortoise in the Mojave Desert rates the habitat conditions on the project site as very high. The FSA described this fact and noted that these are tools for regional planning and require site specific analysis. Second, the site is not located on BLM land and would not benefit from range-wide management actions. In addition, BLM has stated that these plans were not developed for very large projects involving many thousands of acres, such as the one considered here. Most of the large scale projects conducted on BLM lands required plan amendments.
The 2011 USFWS Desert Tortoise Recovery Plan states as follows: “Development of the plan has been a dynamic process that has evolved over time. And because land use change and desert tortoise recovery implementation will continue to evolve, the Final Plan is being published

as a living document which will similarly evolve in the future. For example, when Plan revision began we did not anticipate the extent to which the landscape of desert ecosystems in the Pacific Southwest might become modified as a result of the nation's renewable energy priorities (since 2009, an emphasis on renewable energy has resulted in a large increase in the number of proposed utility-scale projects within the range of the desert tortoise in California)." The plan further states" Still, the plan does not provide a single, comprehensive strategy for addressing renewable energy. To more comprehensively address this threat, the Service will soon add a renewable energy chapter to the living Plan that will act as a blueprint to allow the Service and our partners to comprehensively address renewable energy development and its relationship to desert tortoise recovery. This supplemental chapter will focus on renewable energy in a manner that could not have been envisioned when Plan revision began."

Were the project being permitted for "take" by DFW, it would require compensatory no less than that proposed by Staff—a rough average of 2:1—for the project to be "fully mitigated as required by CESA. Applicant purports to propose 1:1, but the actual acreage proposal is actually well below 1:1. As previously stated, in the FSA we disagree with this approach and do not believe the mitigation meets the full mitigation standard required to comply with the CESA.

Q: The applicant continues to suggest that staff is overestimating the expected number of desert tortoise that may occur on the project site. What is your response?

Response: This issue has been answered repeatedly, most recently in the FSA.
Q: Applicant contends that the FSA lumps compensatory mitigation with listed species and non-listed together, thus blurring mitigation required by CESA and CEQA. What is your response?

Response: Applicant is correct that only the desert tortoise is CESA-listed; compensation for the other species (species of special concern) is pursuant to CEQA. The compensatory mitigation approach allows the applicant to nest mitigation together under certain circumstances. For example, if lands acquired for desert tortoise also meet the requirements for burrowing owls, then the land acquisition mitigation requirements can be "nested". This provides Applicant with the possibility of reducing its total land acquisition requirements. This does not elevate non-listed species to listed status.

BURROWING OWL

Q: The applicant contends that the FSA treats burrowing owls as if they were a listed species under the CESA/ESA, that no presence of owls was discovered in surveys, and that the mitigation requirement for this species (acquisition of 600 acres) is unprecedented and inconsistent with other projects. What is your response?

Response: First each of the points identified by the applicant has been previously addressed in the FSA and in our response to applicant comments (See Appendix 1: PSA Response to Comments, Biological Resources page 30, comments 13.13). Owls are not CESA-listed, but are treated by DFW as species of special concern because is declining across its range. DFW requires that such impacts be mitigated, and so does the Energy Commission in all prior projects that impinged on owl habitat.

The mitigation ratio in this case is higher than in previous cases because it is based on current guidance from the DFW, primarily the Staff Report on Burrowing Owl, prepared by the agency responsible for managing California plants and wildlife. Staff recommends the DFW approach as reasonable.

As to presence on the site, the surveys intended to document nesting or wintering use were never conducted. In addition, staff has observed several active burrowing owl burrows at a number of locations on the project site as recently as December 2012 and February 2013. This suggests that owls are in fact using the site. Similarly, a burrowing owl was observed by staff in flight at the eastern margin of the site, not far from an active burrow during the February site visit. Based on these factors alone there is every indication that the project area provides useful habitat for this species.

Noxious Weeds, Special-status Plants, Waters of the State and Groundwater-Dependent Ecosystems

by: Carolyn Chainey-Davis

Q: Applicant's testimony also addressed the issue of rare plants, and other issues. What other issues were raised in that testimony?

A: There are a number of issues raised, and I have broken them down by subject area, as follows: Staff carefully reviewed the Applicant's proposed revisions to the following conditions of certification (BSE Testimony, pp. 97-128) for consistency with the analysis and conclusions in the FSA, and to assess whether impacts to these biological resources would be reduced to less than significant levels with adoption of the proposed revisions:

BIO-18 (Weed Management Plan);
BIO-19 (Special-status Plant Avoidance & Minimization Measures);
BIO-20 (Special-Status Plant Compensatory Mitigation Plan);
BIO-21 (Botanist Qualifications and Duties);
BIO-22 (State Waters Compensatory Mitigation and Impact Avoidance & Minimization Measures); and
BIO-23 (Groundwater-Dependent Vegetation Monitoring Plan)

In the applicant's opening comments, they concede the project's impacts to these resources are significant, that monitoring or mitigation is required to minimize impacts, but then belabor many of the same arguments against staff's significance conclusions that were already addressed fully in the FSA. This includes assertions that were strongly contradicted by evidence provided by staff, or questionable interpretations of Fish and Game Code and other applicable LORS. The most significant differences are summarized below under "Areas of Disagreement".

Nevertheless, there are many areas of agreement in the applicant's proposed changes to the Conditions of Certification **BIO-18** to **BIO-22**. However, staff does not agree with all of the applicant's proposed changes. Areas of agreement on the more significant proposed changes are summarized below. Also included below is a response to the California Native Plant Society's (CNPS) concern about the sufficiency of the mitigation for gravel milkvetch (*Astragalus sabulonum*) expressed in a comment letter received February 5, 2013.

AREAS OF AGREEMENT

Staff is agreeable to many of the applicant's proposed changes to conditions of certification because they represent a minor revision to an avoidance or minimization measure that still protects the resource and ensures a less-than-significant impact. In other cases, they reflect proposed revisions discussed during workshops that staff agreed had merit and warranted consideration. Where the applicant argues deletions are justified because they are contained in other general conditions, staff carefully reviewed both to confirm the other condition adequately addressed the biological impact or concern. The most significant areas of agreement are listed below.

NOXIOUS WEEDS

Prioritizing Weed Management & Feasibility of Control

Weed management should focus on species with the greatest ecological risk and feasibility for control (Randall et al. 2004; CDFA 2012; and others); a strategy promoted by land managers, including The Nature Conservancy, BLM, US Forest Service, and other land managers. Staff agrees with many – but not all – of the proposed edits to **BIO-18** (Weed Management Plan). Areas of agreement are depicted in the revised conditions of certification later in the testimony.

SPECIAL-STATUS PLANTS

Additional Offsite Surveys

Some of the affected special-status plants may be more common than previously known because: 1) they were only recently added to the CNDDB or California Native Plant Society (CNPS) *Inventory of Rare and Endangered Plants* and in some cases were added after the applicant's offsite surveys were initiated (i.e., surveys to determine if there were additional unrecorded occurrences offsite), and 2) the 2012 season was exceptionally dry and precluded efforts to determine the offsite distribution of the affected species. Additional offsite surveys would have the advantage of identifying additional mitigation opportunities – both for acquisition and restoration – and provide clarification of the distribution and range of these species in California. Staff will allow additional surveys in 2013 on the condition they comply with the stricter thresholds for significance and performance standards identified in subparagraph 4 (FSA, p. 268) of **BIO-20** (Special-status Plant Compensatory Mitigation Plan). This would not represent deferred mitigation because: performance standards have been defined for what the end result mitigation must achieve; a range of options has been provided, and the agency – through verification language – has committed to the mitigation (Bass & Rivasplata 2006).

Opportunities for Enhancing Gravel Milk-vetch Mitigation – Addressing CNPS Concerns

Staff agrees with the CNPS proposed approach to mitigation that considers not only a species' rarity rank but the degree of impact (percentage of statewide occurrences affected), thereby conferring the strongest protection to those species most affected. CNPS argues that the project must acquire at least four occurrences offsite to offset the project impacts to four occurrences onsite. However, only two of the four occurrences of gravel milk-vetch observed in the last 20 years occur on private land. The other two are in Death Valley National Park (DVNP): one in "nearly pristine" habitat, the other threatened by Russian thistle, ORV, and sledding on the dunes where the plants occur (CNDDB 2012). Eleven of the 19 occurrences in

CNDDB have not been observed or surveyed in over 20 years. They are not presumed extant nor extirpated but their contribution to the stability of the species' statewide distribution should not be assumed without field work.

Of the two recently observed gravel milk-vetch occurrences in the project vicinity, one is on a very large parcel contiguous with the southern Pahrump Valley Wilderness Area. Although rare plant occurrences can be maintained on small parcels in some cases, larger parcels, which are more defensible, and those with connectivity to wilderness areas have higher value than small or mid-sized parcels with no connectivity. Although the overall integrity of the large parcel is very good, the occurrence is threatened by noxious weeds and offers a valuable opportunity for rescue with restoration and enhancement as required in **BIO-20.** Thus the mitigation benefits of the acquired lands are enhanced by requiring habitat restoration (see subparagraph 5 (c), page 263 of the FSA) over and above the requirement to purchase lands and place them under permanent protection.

Restoration is a critical element of the overall strategy for mitigation of rare plants (Pavlik, pers. comm.; Moore pers. comm.). Restoration can address net losses more directly than acquisition by rescuing occurrences in decline.

Additional offsite surveys in 2013, including surveys of historic (>20-yr) occurrences, may yield additional mitigation opportunities because gravel milk-vetch was only recently added to CNDDB and thus has not been on surveyors "radar screen". This doesn't guarantee additional undocumented occurrences will be found but certainly increases the likelihood, relative to species that have been in the CNDDB for many years. Nevertheless, unless the applicant finds many additional offsite occurrences that either significantly reduce the species' rarity rank or reduce the percentage of statewide occurrences affected to less than 10 percent, staff proposes increasing the mitigation for gravel milk-vetch, as proposed by CNPS, by requiring the project to fund restoration or rescue of the known occurrences on public land and acquire one additional occurrence if new opportunities are identified this spring. The DVNP occurrence described above is a good candidate for a project-funded restoration. By accepting conservation easements or other deed restrictions on a subset of the parcel(s) that contain the occurrence(s), the likelihood of finding willing sellers increases, and may provide a cost savings to the project, relative to acquiring lands in fee title. New performance standards have been added to **BIO-20** to: 1) ensure the easement is large enough to maintain the viability of the occurrence and protect it from edge effects; 2) require the stewardship fees are adequate to manage and defend the easement; and 3) provide ongoing oversight and accountability in the form of monitoring and reporting requirements.

In-Lieu Option

Staff is agreeable to the applicant's proposal to add language to allow the project to satisfy all or a portion of its mitigation obligation by paying an in-lieu fee to a third party land trust or other qualified 501(c)(3) or public agency, to acquire mitigation lands or implement restoration. Staff added language to the in-lieu option requiring the third party meets all the monitoring and reporting requirements, and performance standards contained in the revised **BIO-20**, and any proposals to exercise the in-lieu option would be subject to review and approval by the CPM in consultation with CDFW. The in-lieu option would be consistent with the provisions included in **BIO-25** (In-Lieu Fee and Advanced Mitigation Option) except with the addition of an option for restoration.

WATERS OF THE STATE

Specific Terms and Conditions of the Waters Mitigation

Staff accepts the proposed changes to **BIO-22** (State Waters Compensatory Mitigation and Impact Avoidance & Minimization Measures) relating to the authority of the CDFW ("CDFG"); the CPM can confer with CDFW but ultimately has the single authority to issue a "stop-work order". Staff accepts the strike-out on page 121 regarding changes in legal conditions as they are already embodied in the subparagraph "Change of Conditions". The applicant has already fulfilled the requirement in **BIO-22** to submit to CDFW the 1600 Notification and Fees, and provided a revised delineation map.

GROUNDWATER-DEPENDENT VEGETATION MONITORING

Photo Monitoring is an Acceptable Supplement but not a Replacement for Quantitative Measures

The photo-monitoring proposed by the applicant is <u>not</u> an acceptable substitute for the quantitative monitoring measures described in **BIO-23** (Groundwater-Dependent Vegetation Monitoring Plan)**,** but could be useful in two ways: one is to provide a visual picture of the sites that are assessed via the quantitative monitoring already prescribed. The second is to facilitate visiting more sites than could reasonably be monitored by quantitative measures. This would provide a photo record of what the photo monitored-only plots look like compared to the quantitatively monitored sites (which would also have photographs associated with them). The photographs would be most useful if taken to assess the vertical structure because of CDFWs observations (Keeler-Wolf pers. comm.) and studies documenting the tendency of mesquite to "flatten out" when stressed, well before the stress registers as a decrease in aerial extent. Guidelines for supplemental photo-monitoring are provided in the revised **BIO-23**.

AREAS OF DISAGREEMENT

NOXIOUS WEEDS

Compensate the Agricultural Commissioner for Increased Monitoring Costs

Q: The Applicant wants to delete the requirement in the Weed Monitoring Plan (**BIO-18**) proposed by staff to compensate the County agricultural commissioner for offsite monitoring that staff believes is necessary to address the threat of introducing noxious weeds from out of state. The Agricultural Commissioner argues – and staff agrees – that the increase in traffic from out of state by project employees and contractors significantly increases the risk. Does the management of weeds onsite required in BIO-18 eliminate the need for any role or reimbursement for the County Agricultural Commissioner?

A: No; it does not, and cannot. Washing vehicles as they enter and leave the project site during construction, as required in **BIO-18**, minimizes the threat of weed transmission to and from the site but this does nothing to prevent the spread of weeds from Nevada to California, a threat that would continue for the 30-year life of the project. Vehicles can spread invasive plants and insects, which is why the California Department of Food and Agriculture (CDFA) maintains

Agricultural Inspection Stations along the California border; why BLM, the US Forest Service, and other land managers require vehicle cleaning stations for construction of federal lands. Weed seeds and stolons hitchhike easily from location to location on vehicles as well as construction materials like aggregate and fill dirt, and are inadvertently deposited along roadsides. Because employees and contractors are expected to come from the Nevada communities of Pahrump and Las Vegas, each of the 4,000 daily construction-related vehicle trips, each of the 100 daily vehicle trips during operation has the potential to introduce weeds and other pests across the state line. Because the applicant cannot be required to monitor for and control these pioneer infestations on public roads, there is still the need for the Agricultural Commissioner to conduct the roadside surveys and eradicate any new infestations before they threaten the state's agriculture or wildlands. This requires a significantly greater level of effort than is currently required or provided in this remote portion of southeastern Inyo County.

SPECIAL-STATUS PLANTS

Q: The applicant's testimony includes a subheading, in reference to the special-status plants for which staff is requiring compensatory mitigation, " These Plants Are Not as Limited in Distribution or Number as Stated In the FSA." Has Staff overstated the rarity of these special-status plants?

A: No. The four significantly affected species have a highly restricted range in California and their distribution in the state is limited to a very small number of known occurrences; occurrences in some cases restricted to areas of the state prioritized for renewable energy development. The limited number and distribution of these species in the state is depicted spatially in Biological Resources Figure X. The statement is misleading because the applicant, in fact, does not appear to argue with staff's conclusions about the limited distribution of these four species. The statement is merely a preface to the applicant's proposal to conduct additional surveys in spring 2013 to determine if there are occurrences of these four species that are not currently in the California Natural Diversity Database or the records of the California Native Plant Society and university herbaria. The applicant hopes to find many new occurrences because it would lessen the significance of the project's impact (which is as high as 50 percent of the state's known or extant occurrences for two species) and lessen their mitigation obligations, which are based on the species' rarity rank. Staff necessarily based their assessment on current information about the species' rarity –not speculation. However, as already described above under "Areas of Agreement", staff accepts the applicant's proposal to conduct additional surveys and **BIO-20** (Special-status Plant Compensatory Mitigation Plan) includes thresholds, performance standards, options, and verification language for revising the mitigation in the event their spring surveys are successful. Staff has no other fundamental differences with the applicant's rare plant testimony beyond their attempts to minimize the significance of the project's potential impacts to these very rare species on the basis they are not already CESA-listed.

WATERS OF THE STATE

The 1:1 Mitigation Ratio Proposed by the Applicant Will Not Offset the Net Loss of Desert Wash Habitat and is not Supported by CDFW

Q: Staff has proposed a 2:1 mitigation ratio for project impacts to 23.21 acres of jurisdictional Waters of the State that staff believes is justified and feasible. The applicant wants to lower the ratio to 1:1, from a 46-acre obligation to 23 acres. Does a 1:1 mitigation ratiooffset the net loss of desert wash habitat in the Pahrump Valley basin?

A: No, it does not, and agency staff from the CDFW Lake and Streambed Alteration (LSA) and Renewable Energy programs agree that a 1:1 mitigation ratio does not adequately mitigate the project impacts to jurisdictional state waters. The Corps of Engineers agrees that, in principle, a a 1:1 mitigation ratio via preservation *does not and cannot address a net loss*. Staff consulted the Sr. Engineering Geologist from the LSA Program (Vyverberg pers. comm.), the Bishop Regional Office (Branston, Hawk, pers. comm.), and Bruce Henderson, Senior Project Manager, Corps Regulatory Division, North Coast Branch. In the Corps' new formal mitigation guidelines (33 CFR 332, subparagraph (f) (2)), "the district engineer must require a mitigation ratio greater than one-to-one where necessary to account for the method of compensatory mitigation (e.g., preservation)..." "I fully agree that preservation greater than 1:1 must occur to offset a net loss. It's never made any sense to me from a mitigation perspective why you accept a loss with only the assurance that other acres won't be lost." (Henderson, pers. comm.)

The applicant makes much of the 1:1 and 1.5:1 mitigation ratios assigned by another regional office for "unvegetated" desert washes on several ARRA projects. However,CDFW rejects that argument and emphasizes that it is the agency's practice to require full mitigation and the ratios assigned on other projects are not in any way binding or precedent setting :

> "The CDFW's acceptance of differing mitigation ratios for other renewable energy projects has no bearing on and is not precedent setting from one to the next; each renewable energy project is located in a unique and varied location and includes a different array of biological resources and associated project impacts. The CDFW comments from prior renewable energy projects do not take precedence over comments specific to The Hidden Hills Solar Electric Project or to the CDFW's standard practice of seeking a full mitigation replacement-to-impact ratio for fish and wildlife resources."

Staff did accept the applicant's argument that by allowing the washes to pass through the site (between the mirrors and across access road) rather than diverting them around the site, that the project was maintaining at least some portion of the hydrologic and geomorphic functions, even if the value of the habitat inside the project fence is highly degraded and essentially lost for most species. Accordingly, staff reduced the mitigation ratio from the 3:1 requested of the Energy Commission by regional staff to 2:1. The applicant implies that staff exaggerated the credit it already provided for maintaining some portion of the washes' hydrologic and geomorphic processes onsite. Staff's comment about mitigation credit from the FSA was confirmed by CDFW:

> "The CDFW initially proposed a 3:1 replacement-to-impact ratio to compensate for permanent impacts to the Pahrump Playa stream network and associated ecosystem services lost as a result of project activities. However, we agreed in this instance to accept a minimum 2:1 ratio for these impacts based on the applicant's modification to a project design that permits natural flows and physical processes to continue unaltered on a portion of the streams within the project area."

Regarding the Applicant's argument that the streams are or should be mitigated at a lower ratio because some are, in their words "unvegetated": Staff and a representative from the Bishop Regional Office field reviewed the applicant's delineation and observed no "unvegetated" streams, i.e., features with unvegetated banks, such as "badlands", gullies, or unvegetated desert pavement, with the exception of the "problematic alkaline soil areas" and other stream reaches that never were included in the calculation of jurisdictional state waters. Of course the active channel of a stream would always or typically be unvegetated due to scouring or deposition. They cite the Waters of the U.S. delineation report, which notes that the streams do not support classic 'riparian species' or 'riparian communities, which rarely occur on ephemeral desert streams and particularly not on alluvial fan stream types. However, the channel banks and/or active floodplains of the complex channel networks are hardly "unvegetated". There is nothing in Fish and Game Code to support the arbitrary devaluation of ephemeral desert washes that don't support the characteristic riparian species of larger streams, or streams in other parts of the state (such as microphyll woodland), or on the basis of their size, as they have also argued.

Staff consulted the CDFW Lake and Streambed Alteration Program (LSA) about its definition of "riparian" "While the presence of riparian vegetation can be an appropriate indicator of the jurisdictional limit of streams in temperate perennial and intermittent stream ecosystems, it is not and has never been used by the LSA Program as a stand-alone indicator of stream corridor boundaries, or of F&GC jurisdiction." (Vyverberg pers. comm.). In practice, the LSA Program defines riparian areas (or zones) to be:

> "…areas adjacent to perennial, intermittent, and ephemeral streams or lakes, and estuarine-marine shorelines that are transitional between terrestrial and aquatic ecosystems and that are distinguished by gradients in biophysical conditions, ecological processes, and biota; an area through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. Riparian areas include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence)."

Thus, as is appropriate to a definition with statewide application, the presence or absence of riparian plant species is not used by the LSA Program to define riparian areas. (Vyverberg pers. comm.)

Note that there is no implied or explicit hierarchy of ecosystem value in the above definition based on species composition of the adjacent habitat, the channel size, or a reference any specific plant communities, length of inundation, documentation of wildlife use of the stream, or any of the other unstated criteria the applicant uses to justify its argument against a 2:1 ratio for 23 acres of jurisdictional waters.

Q: To support its position that the 23 acres of state jurisdictional waters should be mitigated at a ratio of 1:1, not 2:1 as staff proposed, the applicant argues "*While it is clear that some onsite drainages support wildlife functions, it is unlikely that 100 percent of the onsite drainages are equally supportive.*", and "*...no direct linkage between onsite streams and associated aquatic life and wildlife was made; and the PSA emphasis was on plant life*." What is your response?

A: Not only do they fail to provide any basis or evidence supporting this conclusion, but the Fish and Game Code definition referenced above does not require the Department [or Staff] to document the wildlife use of each delineated feature to justify requiring mitigation. The value of desert washes to wildlife is presumed by the Department, based in part, on a significant body of scientific literature.

The scientific literature and agency documents supporting these assumptions were provided by staff in the FSA. Staff described the wash vegetation onsite, based on a field verification with CDFW staff of the delineated features, and noted that desert washes are also important dispersal pathways for the seeds of many rare plant species in the desert (Moore & Pavlik pers. comm.). After first arguing that some of the features have less value based on vegetation characteristics, applicant then argues that staff's descriptions of the "plant life" are irrelevant. Fish and Game Code defines Fish and wildlife as:

> "...all wild animals, birds, *plants*, fish, amphibians, invertebrates, reptiles, *and related ecological communities, including the habitat upon which they depend for continued viability* [emphasis added] (FGC Division 5, Chapter 1, section 45, and Division 2, Chapter 1, section 711.2(a), respectively). Fish means wild fish, mollusks, crustaceans, invertebrates, or amphibians, including any part, spawn or ova thereof (FGC, Division 5, Chapter 1, section 45)."

Q: The Applicant often references the definition of a stream from the California Code of Regulations (CCR), Title 14 Section 1.72 definition of a stream. Section 1.72 of defines a stream as: "…a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation." Do the desert washes for which staff is proposing mitigation meet this definition?

A: Staff consulted the CDFW Lake and Streambed Program (LSA) to determine if the LSA Program uses the CCR definition (versus the Fish and Game Code definition) in its determinations:

> "Title 14 CCR 1.72 *does not apply to the F&GC, and is not used by the Department in general or specifically by the LSA Program,* although it is often mistakenly cited as the stream definition used by the Department (Vyverbeg pers. comm.).

GROUNDWATER-DEPENDENT VEGETATION MONITORING

One of the most substantial areas of disagreement between staff and the applicant on plant-related issues is in the applicant's proposed revisions to Condition of Certification **BIO-23** (Groundwater-Dependent Vegetation Monitoring Plan), which would eliminate the *quantitative* monitoring measures and replace them with qualitative measures that undermine the effectiveness of mitigation and its ability to protect both the resource *and* the project, make it difficult to enforce and could lead to substantial compliance issues. The applicant also weakened accountability -- their and our accountability to the resource agencies charged with managing the mesquite and groundwater resources in the project area in perpetuity.

In the interests of protecting the project and the resource, for reasons detailed below and in the FSA, staff must oppose the applicant's proposed revisions to **BIO-23**, with a few exceptions shown in staff's strike-out version of the condition.

Only Sensitive, Quantitative Measures of Plant Stress Can Protect the Mesquite

Q: Staff has proposed specific quantitative monitoring of plant stress in the mesquite areas east of the border to determine the effect of the project-related groundwater drawdown on the mesquite and other dependent habitats. Will the photo monitoring of mesquite die-back suffice instead, as proposed by applicant's testimony?
A: No, it cannot protect the mesquite, and because these techniques and measures are qualitative and imprecise, they is difficult to enforce and could lead to endless conflict in trying to enforce mitigation during the compliance phases of the project.

Photo-monitoring can be a useful supplement to more quantitative techniques; this is discussed under "Areas of Agreement". Staff consulted John Willhougby, retired California BLM State Botanist and co-author of a standard reference on sampling and monitoring plant populations (Elzinga et al. 1998):

> "*Photographic monitoring of plant die-back is only suited for situations in which the level of change is expected to be rather large and happen quickly. In this case, where the change in cover or structure would be subtle, at least for a substantial period of time; photography comparison is not sensitive enough to readily detect impact.*"

By the time die-back is detected with any level of accuracy (+/- 20%), and particularly from a photo, it will be too late to mitigate with a change with decreases in pumping or other modifications. Recovery of the water table would take as long to reach the mesquite as it took to drawdown, potentially years, and the drawdown impacts would get worse before they improve.

Compounding these uncertainties, die-back can be influenced by many factors other than water stress; pests and disease, fire, fuel wood cutting, and more. For reasons unclear to staff, applicant proposes die-back as a measure even though it contradicts the applicant's own PSA comments about the potential for mesquite mistletoe, a common mesquite parasite, to cause die-back. Thus, this proposed revision could leave the project vulnerable to blame for factors not attributable to the project.

Staff also consulted Juliet Stromberg, a specialist and recognized expert in the study of groundwater pumping impacts to riparian and groundwater-dependent vegetation. Ms. Stromberg advised staff that, based on her field experience:

> "*...these measures would only be adequate if the groundwater table were to recover immediately, but "if there was a delay once the die-back threshold was exceeded, then recovery becomes less likely, i.e., the more time that passes between indicator and action, the less likely recovery is. To be safe and cautious, one would want to rely on the earlier indicators of stress; this would reduce the chance of irreversible changes in the water table and in the mesquite health."*

Staff originally proposed using die-back, among other measures of plant stress, in the PSA, generating a chorus of comment from vegetation ecologists and hydrologists representing BLM

California and BLM Nevada, Inyo County Water Department, The Nature Conservancy, Amargosa Conservancy, and others, expressing concern about the inadequacy of die-back to protect the mesquite for reasons described above, that the measure is not sensitive enough, that earlier warning signs should be employed.
Staff consulted Sophie Parker, Regional Ecologist for The Nature Conservancy:

> "*Photo-monitoring of mesquite die-back cannot adequately quantify changes in plant water status that will allow for the detection of drought stress before plants begin to die. After they are dead or dying, monitoring them doesn't do much good.*"

Resumes for John Wilhoughby, Juliet Stromberg, and Sophie Parker are provided as exhibits.

Staff's Proposed BIO-23 Utilizes Only the Most Objective, Accurate, and Quantitative Measures of Plant Stress

Q: How does mesquite manifest drought stress, in the early stages?

A: According to Juliet Stromberg (pers. comm.), "*There will be declines in stem water potential, transpiration rate, and amount of carbon fixed (via photosynthesis) in the early stages.*"

Q: What are the most accurate, objective, and quantitative techniques for measuring mesquite stress from declining water tables?

A: "*Objective techniques for measuring drought stress include measurements of 1) stem water potential (technically xylem water potential); 2) gas exchange rate; 3) transpiration rate.*" (Stromberg pers. comm.). *These field techniques yield quantitative data using the pressure chamber technique or a psychrometric technique. These techniques are well-established, objective, standardized measurements that are routinely made by plant physiological ecologists to determine the water status of plants* (Parker pers. comm.). *They have been used successfully for several decades, and are neither expensive nor complicated*."(ibid.)

The applicant expressed a concern about the variability of these measures. Concerns about variability in the measurements over the course of a day and between shrubs are "*eliminated through the use of pre-dawn measurements*. "(Parker, Stromberg, pers. comm.). "*Once the pressure chamber is set up, it only takes about 5 minutes per stem to collect the measurements.*" (*ibid.*).

The Trigger for Adaptive Action is Defensible and Allows the Project to Resume Pumping if Evidence Shows Effects Caused by Other Factors (or No Effect)

Q: Staff has proposed baseline and control monitoring in **BIO-23** to protect mesquite habitat east of the project, including a 0.5 foot drawdown "trigger" for adaptive action, to be measured at the monitoring well on the project boundary, *west* of the fault line. The 1applicant's testimony states that the 0.5 ft drawdown trigger is an indefensible significance threshold and cannot be detected with any level of accuracy because of the seasonal variability of water levels in wells *east* of the fault. Is the 0.5 foot "trigger" a reliable indicator?

A: Yes. But to clarify: the 0.5 ft drawdown trigger is not a "significance threshold". Because a declining water table does not recover immediately once pumping stops or is reduced, and can potentially continue to decline before it improves, it is critical to identify a conservative trigger; one that doesn't wait until its too late, as discussed above The whole point of the trigger is to *avoid* a significant impact to mesquite; mesquite habitats, including mesquite coppice dunes, are rare and sensitive habitas with exceptional ecological value. They are an identified conservation priority by BLM and other agencies, as demonstrated in the FSA, and a significant number of comments have been received expressing concern about adequately protecting the mesquite. . The 0.5 ft. drawdown is a *trigger for adaptive action*, action that includes stopping pumping but allows for the project to collect and provide evidence that a deeper drawdown, made in 0.5 ft increments, will not adversely affect the mesquite habitats. The 0.5 ft trigger merely represents the *minimum detectable change*, i.e., a starting point.

The applicant incorrectly asserts that the 0.5 ft drawdown cannot be detected with any level of accuracy because the 0.5 ft falls within the normal range of seasonal variability of the area wells. This is addressed in the Water Supply rebuttal testimony. In fact, the water levels in the well on the project side of the fault where the drawdown would be measured are highly stable; Water Resources staff state that the 0.5 ft drawdown can be detected with nearly 100 percent accuracy. Wells east of the fault are unstable or seasonally variable but this is a moot point; the trigger will be measured at the project boundary, west of the fault.

The trigger for action, if reached, will come as no surprise to the project; the progress of the project-related drawdown can be tracked in the series of monitoring wells between the project's wells and the property boundary. The project can and should begin collecting quantitative baseline data immediately and can anticipate an impending 0.5ft or greater drawdown and collect baseline data, and data from reference plots or "controls", as described below. Conditions of certification **BIO-23** and **WS-4** define the minimum standards for the collection of baseline and control data that would be required to make the determination. Additional clarification of how the evidence will be evaluated is provided in this testimony, below, and in the Water Supply staff testimony.

Mesquite Rooting Depths Are Variable and Have Not Been Demonstrated in the Project Vicinity

Q: The applicant has suggested that the drawdown trigger is too conservative and indefensible because mesquite are documented to root to great depths to obtain groundwater, and proposes a drawdown of 2 feet to 5 feet to reflect the potential of mesquite to root deeply to find available groundwater. Why is such a conservative drawdown trigger necessary?

A: As clarified above, the 0.5 ft drawdown represents neither a threshold of significance nor the limits of the mesquite's tolerance; it is a trigger for adaptive action designed to avoid an adverse effect but allows for the re-setting of the drawdown trigger, in 0.5 ft increments, if the evidence demonstrates that a deeper drawdown would be tolerated without an impact. Staff acknowledges that mesquite are deep-rooting but, for reasons described above, it is essential to begin adaptive action before it's too late. The applicant's proposal amounts to waiting for the mesquite to start dying before action is taken, and then hope or assume the water table recovers immediately. Applicant's anecdotal reference to a case study of a mesquite that

rooted to a depth of over 150 feet – a different species, from a different eco-region, and an *atypical* case in which the roots followed a mine shaft, is of little or no relevance.

Mesquite is a deep-rooted species that roots at variable depths depending on the soil profile, soil chemistry, depth to water table, soil oxygen, and other factors. Because of the geologic and hydrogeologic complexity of the project vicinity, staff expects that rooting depths in the project vicinity are quite variable and no single threshold could be applied without resulting in unintended mesquite losses, and, more importantly, no studies have been conducted in the area that could inform such a threshold. Nor do we know to what extent the water table has declined relative to the maximum effective rooting depth of the mesquite, which could already be at or near a tipping point, given the history of drying springs and lowered groundwater tables in the Pahrump area (Comartin 2010; Harrill 1986; and others).

Juliet Stromberg (pers. comm.) provided staff with documented case studies of the variability of mesquite rooting depths, and advised staff:

> "*The rooting depths of mesquite cannot be established without examining soil cores or monitoring the mesquite response to a declining water table. There are a few atypical examples of mesquite rooting to depths near 53 meters (174 ft), but 15 meters (50 ft) is more typical and rooting may be limited to as little as 3m (10 ft) in settings with restrictive soil layers*."

As demonstrated above, without soil cores, we can only speculate that the mesquite are rooting to depths somewhere between 3 meters and 20 meters, depending on the soil profile and other factors.

Q: The applicant also deleted guidelines in the groundwater vegetation monitoring proposed by staff (**BIO-23**) for using soil cores as part of the monitoring program. Is this an onerous or superfluous monitoring technique?

A: It is perplexing why the applicant would delete the allowance for using soil cores to provide additional evidence that a greater drawdown trigger would not harm the mesquite, as the soil cores are the only tool that can provide direct visual examination of the actual rooting depths. As an additional benefit, they could install shallow piezometers where the soil cores are drilled. This would provide *very compelling evidence* on the water table relative to the mesquite roots at a given monitoring plot. If there is no change in water levels at the mesquite, as measured in the piezometers (shallow monitoring wells), this is strong evidence. Such a deletion is inexplicable.

Perhaps the applicant was concerned they could not get permission from BLM to collect soil cores. Staff considered this and consulted BLM during the development of the condition to determine if a soil core study would qualify for a Categorical Exemption; the BLM Nevada Southern Nevada District hydrologist, in consultation with other BLM staff, suggested it would qualify and estimated it may take as little as three weeks to process the application for an exemption (Poff pers. comm.). Nevertheless, the soil cores were offered in staff's **BIO-23** as an allowable manner to attest to continuing mesquite health, not a requirement.

The Before-After Control-Impact (BACI) Study Design Can Determine Whether Effects Are Caused by Other Factors

Q: Can the groundwater-dependent vegetation monitoring plan (**BIO-23**) proposed by staff protect the project from being held accountable for impacts not attributable to the project's pumping?

A: Yes. Staff consulted 16 recognized experts in measuring and monitoring plant populations, vegetation ecology, environmental statistics, hydrogeologists, and the impacts of groundwater decline on dependent species in the development of this condition over a three-year period. The condition has been peer-reviewed repeatedly by these experts; including another round of peer review (Stromberg, Willhoughby, Parker, Custis, and others) just prior to the preparation of this rebuttal testimony. The focus of staff's inquiries and consultations has always included a sensitivity to the applicant's concerns about certainty, with the goal of developing monitoring plan guidelines that both *protect the resource from a "false negative"* (an effect rightly attributable to the project) *and protect the project from a "false positive"* (an effect caused by non-project factors).

To accomplish this, staff, in consultation with a panel of contributing experts, many of whom gave very generously of their time, employs a BACI study design – a "Before-After, Control-Impact" design – the strongest study design for detecting ecological impacts caused by human disturbances on populations or communities of plants or animals for the purposes of environmental impact analysis. It employs baseline data for a pre- and post-impact comparison, and uses reference areas to establish background trends or decline caused by other pumpers or climate factors. The reference areas, or "controls", located in the same mesquite formation but beyond the zone of the project's measured drawdown, can provide a straightforward determination of whether fluctuations observed in things like water potential are natural or caused by the project. The project would not be responsible for effects that do not exceed the background trend and cannot be correlated to a project-related groundwater drawdown (as measured in the array of wells radiating out from the project pumping wells). If there is no difference between the data collected at those plots, and the data collected from plots beyond the project's influence, then no project impact would be assumed.

The normal range of seasonal variability in measures of xylem pressure and other objective, accurate, and quantitative measures would be established during the baseline data collection, as well as the range of variability between plots. Assuming that one or two years of baseline data collection does not adequately capture the full range of seasonal variability, the baseline data can continue if there is no project-related drawdown, or continue at plots located beyond the zone of influence, and would be updated annually to reflect a wider range of variability. No impact would be assumed unless it exceeded the normal reference range (as in the reading of a 'chem panel'). It is perplexing to staff why the applicant would propose waiting until after the trigger is reached to begin monitoring, as an argument that the drawdown resulted in no impacts to the mesquite could only be defensibly argued with baseline data for a pre- and post-drawdown comparison, after adjusting for seasonal variability and background trends. Again, the applicant inadvertently proposes weakening its protection. As Kit Custis, the hydrogeologist for CDFW, a 30-yr veteran with many years at the California Department of Mining Resources, told staff when consulted about monitoring techniques and the precedence for groundwater mining "*They'll always fight the monitoring, up until the time of licensing, and then they realize <u>monitoring becomes their best friend</u>. The more baseline monitoring, the better.*"

Groundwater Pumping Has Been Demonstrated to Cause the Decline and Death of Mesquite

Q: Are there examples of mesquite sites that were degraded or killed by groundwater pumping?

A: Yes. In California, the Sr. Ecologist of the CDFW Vegetation Program, co-author of the Manual of California Vegetation cited the following examples: "We have multiple locations, with photos, up and down the Mojave River from Hinkley to Camp Cady, out to Cronese Lakes. We also have photos of from Kohn Lake and several other localities." Stromberg cites a mesquite woodland that died as a result of groundwater pumping located along the Gila River, in the Casa Grande National Monument, AZ (Judd et al. 1971), and another along the Santa Cruz near Tucson (see Webb and Leake 2006).

Facultative Groundwater-Dependent Species May be Affected before the Mesquite and Must be Monitored

Q: BIO-23 requires mapping and monitoring plant communities in the project well cones of depression (drawdown zones) dominated by "facultative" groundwater-dependent species. The applicant deleted this language, arguing that 'virtually any vascular plant in the area could be a facultative phreatophyte", and proposing they should only be required to monitor the "obligate" groundwater-dependent species. Why is it important to monitor these seemingly more drought-tolerant "facultative" species?

A: The comment demonstrates the applicant is either misusing the definition of a facultative groundwater-dependent species, or does not understand the importance of monitoring the facultative species.

Desert phreatophytes are a complex group of species with varied adaptive mechanisms to tolerate or avoid drought. They should not be considered simply as a group of species that avoid desert water stress by utilizing deep ground water unavailable to other desert species (Nilsen et al 1984). There are two types of phreatophytes (deep-rooting plants that rely on groundwater, to varying degrees, as follows):

> 1) *Obligate phreatophytes* are deep rooted plants that only inhabit areas where they can access groundwater, via the capillary fringe, to satisfy at least some portion of their environmental water requirement. Access to groundwater is critically important to their presence in a landscape. Mesquite are facultative phreatophytes in regions of higher rainfall (Arizona, New Mexico, etc.) but in California and Nevada they are considered obligate phreatophytes (Sawyer et al. 2009).
>
> 2) *Facultative phreatophytes* are deep rooted plant species that tap into groundwater, via the capillary fringe, to satisfy at least some portion of their environmental water requirement, but will also inhabit areas where their water requirements can be met by soil moisture reserves alone. That is, the species will be *groundwater dependent in some environments, but not in others.*

Staff consulted Stromberg (pers. comm.), Willhoughby (pers. comm.) and Parker (pers. comm.) about the need for monitoring facultative species and not just the obligate species.

> "*More importantly, it does not matter what a given species is able to do in other locations or under other water supply scenarios. What matters is the current plant hydrological status and groundwater use by plants at the site in question. If 'virtually any vascular plant in the area could be a facultative phreatophyte', then it would follow that perhaps all vascular plants at the site should be studied to determine if water drawdowns by pumping are negatively impacting their water status. Declining or fluctuating water tables have been shown to greatly reduce productivity of saltbush* (*Atriplex* spp.) [facultative species], *especially in high-porosity soils. See Phreatophytic vegetation and groundwater fluctuations: a review of current research and application of ecosystem response modeling with an emphasis on Great Basin vegetation* (*Environmental Management* 35:726–740). *Based on this study alone, Atriplex spp. in particular should* <u>*not*</u> *be removed from the list of phreatophytes in this document* (Parker pers. comm.).

From staff's consultations with John Willhoughby (pers. comm.) on the subject of whether the monitoring should include facultative species:

"*In areas where facultative species may be using groundwater for at least some portion of their annual water needs, it may be particularly important to focus monitoring more on these species than on mesquite, given that mesquite can make use of groundwater that is much deeper than the groundwater used by, for example, the saltbush species known to occur in areas of shallow groundwater (e.g., playa margins), whether they are very deep-rooted or not. Because these saltbush species are making use of groundwater closer to the surface than the mesquite, these species may feel the effects of even a minor water level decline, and well before the effects show up in the mesquite*."

Staff observed just such a scenario around an agricultural well in Chuckwalla Valley, east Riverside County. In the drawdown zone immediately around this particular well, the mesquite were mostly unaffected but all of the four-wing saltbush and seep-weed (*Suaeda moquinii*) had died.

To ensure project pumping does not result in significant adverse impacts to groundwater-dependent communities, it must map and monitor all groundwater-dependent communities – not just the mesquite. Staff rejects the applicant's proposal to delete the requirement to include facultative groundwater-dependent communities in the overall monitoring plan.

TESTIMONY OF WILLIAM E. HAAS AND CAROL WATSON REGARDING SOLAR FLUX IMPACT ANALYSIS

GENERAL

Q: What contradictory underlying facts does the applicant present regarding the design of the heliostat field and project components? [Carol Watson]
A: The applicant's testimony that the heliostat fields are densely arranged to minimize the footprint of the facility and associated environmental impacts (page 20) while maximizing power generation inherently contradicts its assertions that the heliostat fields will not create a "mirage

effect" luring birds to crash into them because birds will be able to see the ground in the gaps between and around the heliostat mirrors (pages 45-46). The testimony and evidence does not explain or support this conclusion. Staff's FSA reviews the various well-established sources of data on avian collisions with heliostat fields and glass, buildings and similar structures (see FSA pages 4.2-95 -4.2-100). At issue is how birds would perceive a heliostat field when flying over the project site. The mirrors have a potential to reflect sky or clouds and confuse birds regardless of the heliostats' elevation off the ground; applicant's testimony does not demonstrate otherwise.

Q: How does the applicant characterize ongoing consultation regarding avian impacts with the USFWS in their testimony, and what is staff's response? [Carol Watson]
A: Brightsource says in its HHSEGS testimony: "they are coordinating with USFWS to develop "robust monitoring and adaptive management plan to avoid, minimize, and mitigate potential project impacts". However, the proposed condition lacks requirements for plans to minimize, avoid, and mitigate impacts.

The following testimony is of William Haas, except where noted
Q: What is staff's opinion of the applicants' fall survey data?
A: In general, the factual information presented in this report - in particular, the report of species occurrences – appears sound and surveys were conducted by capable biologists. Most of the species documented over the course of these surveys were found also by this Commission biologist during two separate one-day visits to the site, one in December of 2012, and a second in January of 2013.

Q: What information can be gleaned from the results of the fall 2012 surveys?
A: These surveys provide the following information:
a) They report on the occurrence during the surveys of - in this case the absence of detection of - federal and state-listed threatened and endangered species, and
b) They provide an introductory baseline (i.e., a generally accurate but incomplete) snapshot of fall species occurrence at the project site.

Q. What information cannot be gleaned from the results of the fall 2012 surveys?
A. These surveys provide insufficient data in the following areas:
a) They are inadequate to support the following survey findings:

- "Overall, species abundance … [was] quite low" (p. 14); the study's chosen methods are not appropriate for determining species abundance. Focused surveys to provide estimates of winter populations of individual species (e.g., the horned lark) that could demonstrate such findings appear nowhere in the report. The surveys addressed only a small portion (approximately 0.07%) of the project area, were limited in amount of time spent surveying relative to the size of the project, and the survey period covered only a small percentage of the fall migration period - not simply with respect to the dates of the survey but also with respect to the overall time (number of hours) necessary to detect migratory pulses.

- "Overall, species … diversity [was] quite low" (p. 14); this statement was presented without context (e.g., relative to other nearby sties, desert populations in general, etc.).

Moreover, the documented occurrence of eight raptor species contradicts this statement, especially in consideration of the small time period and limited scope of the surveys that were conducted and the necessary dedication of time required to detect migratory pulses.

- "The low number of potentially [sic] migrating species detected during these surveys suggests this site is not an important or heavily used fall migration pathway for songbirds" (p. 14); extensive, focused surveys to document migration were not conducted sufficient to make this statement. Moreover, available technologies designed to study migration were not utilized.

b) The methods, derived data sets, and results represent incomplete sampling for and the report marginally addresses the issue of migration for songbirds and raptors. Migration, both northbound and southbound, is the single most important ornithological topic that must be addressed in order to assess and estimate project impacts to birds.

c) The data are used to address an issue – airspace use by songbirds - for which a scientifically defensible method was neither described nor practiced. The data on airspace use were collected anecdotally during point count surveys in which observer influence cannot be discounted and the reported avian responses determined to be independent of those influences. Moreover, the results can be explained by alternate theories including species-specific responses to the presence of an intruder.
d) The data presented for songbird airspace use are not accompanied by any analysis or interpretation and thus the reader is left to infer the meaning of the data. This is not an acceptable utilization of the scientific method. What is especially lacking in addition to the analysis is any mention that the current conditions at the site have virtually no bearing on behaviors expected for the as-built project, which would result in a nearly 100% transformation of the project area.

Q: Of what value are the fall avian survey results helpful in determining project impacts to birds?
A: The survey methods have limited applicability in determining project impacts. For the reasons summarized above and explained in the following text, the methods chosen and the results are insufficient or inappropriate to come to the asserted conclusions:
a) Any generalizations of the heights at which songbirds were observed flying, primarily due to the probability of observer-influenced behaviors, with respect to stated or implied significance are not validated by an accepted or designed study method. In particular, no survey methods were described that ensure that observer influence was not the primary factor in obtaining these survey results or that sufficient time was dedicated to a scientifically defensible, statistically significant study of the phenomenon. Moreover, accepted, published methods for assessing airspace use (e.g., radar) were not used to derive the conclusions. For songbirds, it appears rather that these data were collected incidentally to an entirely different survey goal; that is, the enumeration and identification of occurring songbirds within designated point count circles via the point count method.
b) That "[t]he low number of potentially migrating species detected during these surveys suggests this site is not an important or heavily used fall migration pathway for songbirds: (p. 14) is accurate. Timing of the surveys (early October to late November), length of time devoted to surveys, and the survey methods (see below my discussion of the point count method) do not

take into account a large time period of migration, which in the western United States begins in mid-July. This does not mean that migrants (including nocturnal migrants) are known to occur in the area, only that the data presented do not support the stated conclusion.
c) Raptor surveys were not sufficiently comprehensive to assess raptor occurrence at the site, especially the unpredictable occurrence in migration. According to the Hawk Migration Association of North America (cited on p. 3 as a source of the study's chosen study methods), "Migration counts are often highly variable, from hour to hour, day to day, and year to year, in large part due to variability in weather conditions that provide the lift for raptor migration or concentrates raptors at certain landscape features."

Q: What are the constraints of using the point count method at the HHSEGS site?
A: Validity of the point count method to evaluate population size has been challenged (see, for example, general discussions in Anderson 1997 and Simons et al 2008), a challenge that has been widely accepted; hence the plethora of sampling methods - for example, Ralph et al (1993) describe a suite of survey methods and describe also under what conditions they should be utilized - as well as the development of species-specific study methods such as those used to survey for the burrowing owl (California Burrowing Owl Consortium 1993). Although the point count is a widely used study method with clear benefits for certain studies (e.g., for long-term monitoring and to document seasonal changes in avifaunal composition), there are limitations to point count data interpretation and extrapolation, especially at population and meta-population levels. The U.S.G.S. Patuxent Wildlife Research Center one of the federal government's foremost centers of expertise in avian studies provides an elegant summary regarding the pratfalls of this method. In their introduction to the method they state "The point count is a field method to study avian *population trends* or *response to treatment* [Emphasis added.]. Consider it among other methods to carefully match your sampling and field methods to your goals" (United States Geological Survey 2005).
Alternative methods of study abound; for example the line transect (e.g., Järvinen et al 1991) and other methods (e.g., Rosenstock et al 2002) to estimate population densities and relative abundance and the area search (Point Reyes Bird Observatory 1999) and modified line transect (Järvinen and Väisänen 1975) to assess breeding bird abundance. Point counts may also be tailored to yield reliable results (see, for example, Nichols et al 2000, Thompson 2002).
With respect specifically to the fall songbird point counts, their validity other than to document simple occurrence is limited in many ways, especially when attempting to assess bird populations (and thus project impacts), which is especially true on such a large project. A point count survey of a quarter-acre parcel, for example, may have some value in estimating population size of the area since the size of the point count circle provides statistically defensible area coverage for such a small survey area; although even in that circumstance other criticisms of the method (e.g., difficulty in finding rare and cryptic species) are still applicable. The choosing of 31 (especially *non-randomly* selected) points comprising a total of approximately 2.5 acres; that is, 0.07% of the project area, sampled for 10-minutes (the standard point count protocol) over a relatively short period of time (weeks) point to assess the approximately 3275-acre study site is inadequate to yield a statistically significant assessment of the site's avian population.

Beyond the small size of the area sampled, the following are the most pertinent criticisms that caution the use of point counts universally and correspondingly to assess this project's impacts:

- "Variation in detection probabilities may result in false conclusions about population trends" (Dawson et al 1995, p. 39) – moreover, the point count method is most valuable

when used as a long-term monitoring tool but not as a method to census, especially outside the period when birds are most vocal; this is the definitive criticism that should guide when and when not to use the point count method.

- Standardized point counts may be unsuitable for confirming even quite large relative differences in the occurrence rates of rare or cryptic species (Lynch 1995, p. 6); for example, the burrowing owl and the Le Conte's thrasher, two of several such species that occur at the site as well as rare migrants that might occur in the project area,

- Standardized point-count methodology across taxonomic and behavioral groups may result in high levels of variability in detection frequency (Lynch 1995, p. 6); for example, the Le Conte's thrasher, a skulker that is often detected singularly or in pairs is nowhere as easily detected as the winter-vocal white-crowned sparrow or the virtually constantly-moving horned lark, both of which occur in the project area;

- "Point counts lack a clear connection to biological parameters such as population density" (Burnham 1981); numerous alternatives are readily available in the scientific literature along with the purpose and conditions under which they should be implemented (see discussion above);

- Measurement error, misclassification of source, and bias in the point count method have been analyzed (e.g., Simons et al 2008) which may result from a variety of causes including stochastic events (especially weather conditions), idiosyncrasies of survey timing (e.g., missed migratory events), habitat changes, bird behaviors, and inconsistency of observers, and finally,

- The point count method, rather than censusing birds, provides incomplete counts of individuals present within a survey plot (Barker and Sauer 1995, p. 125).

Q: Why are point counts not well-suited for ascertaining or asserting avian flight patterns, especially when implying applicability to project impacts?
A: Overall, site conditions at the time of the surveys are in no way comparable to the conditions of the site as the built project. Bird occurrence (including the array of species present) and their behaviors cannot be extrapolated from the data collected. Instead, these sorts of data are typically collected using other study methods, especially a before-after control-impact study from previously constructed projects.

Additionally, the point count study method focuses attention on a very small area that surrounds each survey point. Each count circle has a diameter of 50-meters (164 feet). The observer is tasked not only with identifying and enumerating bird species within the point count circle but also limiting his/her disturbance to the study plot. This is virtually impossible, especially in relatively open habitats such as those that occur at the study site due to the visual acuity of the object species and the relative stature of the observer with respect to vegetation height. This survey method and especially the artifact of observer presence limit data applicability to the documentation of occurrence. The data may also provide insight into the relative number of

individuals observed at each point, but not the absolute numbers of each species that occurs. There is no justification in the scientific literature for using the point count method to assess avian flight patterns, including its use to suggest the heights at which birds typically fly.
The most common responses for ground-feeding birds in the vicinity of an observer during a point count survey where the surveyor is visible when moving into position are:

a) freezing (i.e., staying quietly in place), which even in a sparsely vegetated community - especially in fall when singing is not prevalent – limits count numbers,

b) moving discretely on the ground (a favored behavior of the sage sparrow (*Artemisiospiza belli*)), one of the site's most common and regular winter residents), and

c) flying short distances to a more secure area, which would occur via energy-efficient movement (i.e., neither high in the air nor of particularly long distance) to nearby cover, a favored behavior of the horned lark (*Eremophila alpestris*), the species most frequently counted during the fall surveys.

Correspondingly, especially for the primarily ground-feeding granivorous cohort, which constitutes the most common assemblage in the project area in fall, the flight behaviors (and because it was a focus of their analysis, height above ground) of the songbirds described in the testimony can be attributed to an artifact of the survey method rather than being descriptive of behaviors that are not associated with the surveyor or method. This and other alternative hypotheses that account for observed flight patterns are neither suggested nor tested. To determine flight patterns, an appropriate method wherein the observer does not influence the outcome must be chosen or developed. There are more appropriate unbiased methods and technologies to determine "airspace use", including avian-focused radar monitoring, if data on this behavior is to be collected.

Q. Mr. Haas, how do you know that point count surveys might have underreported birds? Did you perform any avian surveys at the HHSEGS site?
A. Yes, I did. I performed an informal line transect survey on 2 days: once in December, 2012, and once in January, 2013. My results can be contrasted against the results of the applicant's fall 2013 point count survey results as follows:

1. I found a greater number of raptor species than the entire suite of point counts, e.g. point counts identified 4 species (American kestrel, merlin, northern harrier, and re-tailed hawk), whereas only 2 days of line transect surveys identified those species plus prairie falcon and burrowing owl.
2. I found a greater number of raptor individuals than the entire suite of point counts eight (8) versus (7) raptors.
3. I found five fewer species (12 vs. 15) than the entire suite of point counts, when including passerine species.
4. I found 26% of the total number of birds in two visits that were found at 31 points that were surveyed once every two weeks from October 3, 2012, through November 29, 2012.
5. Additionally, the line transect data can be translated into population estimates based on habitat, view shed accessed, etc. whereas the point count data cannot.

Q: Applicant has conducted raptor surveys on the project site, what is staff's opinion of the results?
A: The raptor surveys are, like the songbird surveys, representative in general of the study area at the time the surveys were conducted; however, they are not sufficiently robust to make

predictions about the raptor cohort that may occur within the project area once it has been built nor does it address or fully sample for the potential occurrence of migrants, the phenomenon during which raptors would occur at the site in greatest numbers.

Beyond this, the survey methods for this study are not entirely clear. For example, the Reynolds (1980) protocol is "A bird census method ... that is designed for tall, structurally complex vegetation types, and rugged terrain" (p.1). It is unclear how this protocol was applied or how it was pertinent to a large, generally flat, sparsely vegetated area within a very large airspace; that is, where there are no obvious travel conduits to focus the studies. Bibby et al (1992) is a general text on bird survey methods; a specific reference to which survey method was used and its value and applicability are not clearly defined or described.

Testimony (p. 3) suggests that the raptor surveys were "consistent with methods used by the Hawk Migration Association of North America (HMANA); however it is unclear what these methods were or why their protocol was not also adhered to. However, this is what the HMANA recommends as guidelines for raptor surveys:

- "HMANA-affiliated full-time [hawk survey] sites typically conduct counts for 7 days per week for approximately 6 to 8 or more hours per day during an entire migration season. Typically counts span March through May in spring and mid-August/September through November/mid-December in fall. Some sites in the Hawkcount database conduct part-time counts or partial season counts, and *it is particularly unwise to attempt to extrapolate the magnitude of raptor migration at nearby sites from such data. This is in part because migration counts are often highly variable, from hour to hour, day to day, and year to year, in large part due to variability in weather conditions that provide the lift for raptor migration or concentrates raptors at certain landscape features* [Emphasis added.]."

Even more to the point, HMNA has developed an energy project strategy, which they developed for wind farm projects but which they recommend for all large energy projects:

- "…HMANA strongly endorses three-year full-time preconstruction monitoring, utilizing protocols specifically established for avian risk assessment, for proposed wind energy projects located on or near landscape features that may act as leading lines or diversion lines for raptors, as well as in known or suspected migration pathways and wintering or breeding concentration areas. Detailed data on flight patterns and flight altitudes at the proposed wind energy site should be collected for a variety of weather conditions in consultation with state and local experts. Such intensive monitoring will provide the kind of data needed to site turbines in locations where risk to raptors is minimized*. We are aware of cases where pre-construction raptor monitoring has consisted of one season (or partial*

season) of part-time data collection. Such a study design is inadequate for assessing potential risk to migrating raptors, whose movements are likely to be highly episodic (particular weather conditions, times of year, etc.) [Emphasis added.]."

My discussions with HMNA staff indicate that they would recommend a similar methodology (and/or have a critique similar to mine relative to the current surveys) for a large solar project such as HHSEGS. The testimony presents a potentially accurate "snapshot" view of the raptor cohort at the proposed energy generation site on a variety of fall dates; that is, the number and species cohort reported appear to be in keeping with the contention that the data are "consistent with the expected avian community occurring in the high desert scrub habitats comprising the HHSEGS site"(p. 14). However, these studies and results are not designed to assess the status of migrating raptors, Or, for that matter, songbirds, shorebirds, or waterfowl) and are not a substitute for either a) more extensive surveys as recommended by HMANA or b) more pertinent and methodologically sounder surveys, not only during fall/early winter but also during the late winter/spring northbound migration.
HMNA recommends surveys of such length and depth in order to address the detection of missed species; that is, those that are rare but also those species that alter (or may be difficult to detect) along their migratory pathways due to population status of the species, population status of their prey, and effects of stochastic events such as wildfires and extreme weather.

Q: Does the applicant present conclusions and analysis regarding the raptor surveys. What is staff's response?
A: Testimony claims the surveys are "consistent with methods used by the Hawk Migration Association of North America" (p.3). The surveys are not consistent with HMANA methods as testimony claims. The surveys were not sufficient to capture migratory pulses were they to have occurred. HMANA clearly warns of the pratfalls of conducting limited surveys of the type implemented for this study: "[we] are aware of cases where pre-construction raptor monitoring has consisted of one season (or partial season) of part-time data collection. But such a study design is inadequate for assessing potential risk to migrating raptors, whose movements are likely to be highly episodic (particular weather conditions, times of year, etc.)." Most important on this point, I do not feel that the fall raptor surveys were poorly conducted or that the data presented are not accurate, only that they are not sufficient to definitively categorize the site; especially, that the site is in any way unimportant.

Q: Applicant has supplied anecdotal reports of avian impacts at the Gemasolar Plant, La Monclova, Province of Seville, an operational power tower. What is staff's evaluation of the information contained in these reports?
A: Staff has reviewed the data provided by the applicant and makes several observations. Report 5 (Pleguezuelos 2012) presents data covering five months of project operation. Since there are four important time periods that generally characterize the annual avian life cycle in the northern hemisphere – breeding season, southbound migration, wintering, and northbound migration – this five month period would not address two of these periods and incompletely addresses all four, especially in view of the limited number of hours spent monitoring the site.

The monitoring efforts on the site would have been unlikely to detect carcasses, as they were made infrequently and with unclear methods; *to wit,* "we made several visits inside the circle to detect the existence of dead birds." (Pleguezuelos 2012, page 7).

Other competing factors, including the effects of vertebrate and invertebrate scavengers were not controlled for (or at least these control measure never described), the effects of which would have been exaggerated by the infrequency of site visits.
Moreover, Pleguezuelos (2011) presents data collected solely during construction, making those data irrelevant to any analysis related to solar flux or other aspects of a fully operational facility.

None of the comparison facilities – Solar1, Gemasolar, or SEDC- are located within a major passerine migratory corridor. Solar 1 lies within an east-west tending corridor along a small and, in the vicinity of the site, ephemeral river bed. Major migratory flyways are located both to the east and to the west but not through the site. Gemasolar lies within the middle of an agricultural valley near to but considerably east of Spain's most important migratory flyway; that is over the Strait of Gibraltar. Israel serves as one of the most important migratory flyways in the world, due especially to its location between northern Europe and Africa and, importantly, its location at the eastern edge of the Mediterranean Sea. Additionally, certain features of its geomorphology, especially its north-south tending mountains and similarly aligned rift valley, facilitate these movements. As with migration throughout the world, however, birds exploit favorable aspects of a landscape (e.g., extensive ridgelines and major riparian corridors) and avoid others.
Testimony correctly states for the SEDC site, "This desert region of the northern Negev is located approximately 10 miles west of the African-Syrian Rift Valley, which supports one of the largest and most concentrated bird migration flyway[s] in the world." (p. 3). However, during the broad front migration that occurs in fall over Israel in the region of the SEDC site, birds migrate at elevations "about 400 m [1312 feet] above ground level over the mountains but at about 1000 m [3281 feet] above ground level over the valley" (Shirihai 1996). In spring, the migration is more focused (i.e., not of the broad front variety) and the northbound migration through Israel is indeed focused east of the site along the rift valley and even further east along it's greener slopes, a probable result of having passed (in the south to north migration) over vast deserts (Ibid.).

On the other hand, the Hidden Hills site lies within one of Nevada's two primary north-south migratory corridor that feed the Great Basin " Two routes offer perennial surface water and cover for birds migrating though the western Great Basin. Ash Meadows and Oasis Valley form the southern end of one of those routes, while Pahranagat Valley Complex IBA to the east of Amargosa Valley forms the other route. Collectively these two valleys probably support a significant portion of the passerines (songbirds) migrating into or through the Great Basin…many thousands of warblers have been documented using Ash Meadows in migration" (McIvor 2005). Ash Meadows lies almost due north of the proposed Hidden Hills facility at the apex of two migratory corridors.

5. After a site visit to the Solar I facility, which is now barren of the old project infrastructure, I estimated the time and person-power it would take to adequately survey for carcasses of North American species that might be expected to occur at the Hidden Hills sites, which include several species of hummingbirds, the aforementioned warblers, kinglet, swallows, swifts, etc. I estimated that it would require a four-person team working for 6 - 8 hours/day to adequately search for carcasses of these 6 - 20-gram birds. Presence of the infrastructure would have made the search even more difficult (e.g., by casting shadows, adding difficulty to establishing a search image, etc.) I have not found in this testimony any reports or any study data that suggest that a carcass search within a solar project facility has dedicated comparable (i.e., sufficient) time to effectively document the presence or absence of species of the size that would occur in greatest numbers at the site. Note that the Solar I study did find carcasses of some of the larger of these species (swallows and swifts) with only a limited search effort.

In summary, I have not read any survey report or found any survey results anywhere in this testimony that adequately samples migratory phenomena that can be applied to the Hidden Hills site in order to even roughly estimate the potential impacts to migrants at the facility when it is fully operational. Perhaps repetitive, it is during migration that the greatest number of birds would be moving through the Hidden Hills geographic region yet the phenomenon has yet to be studied effectively at the site and as stated above, data from comparable sites is lacking.

Q: The applicant provided an assessment of avian eye physiology, with an evaluation of its a***ll***eged inherent protective capabilities. Did you review this testimony?
A: Yes, I assessed the validity of the testimony filed by Applicant pertaining to the potential for ocular damage to avian species from reflected light and radiant heat from power tower facilities.

Q: What is your overall response to that testimony?
A: My overall response is that it is entirely unconvincing. It is largely a collection of irrelevant data collected from textbooks regarding avian ocular mechanisms, spliced to a conclusion that any harm is unlikely. The generalized information provided simply does not support the conclusion. There is no relevant empirical data presented or discussed that supports the conclusion.

Q: Could your further describe your criticisms of this testimony?
A: Yes, but I will do so by pointing to various passages of Applicant's testimony, followed by my response, as follows:

<u>Question 1: In Section 1.0 Purpose, Dr. Schwab testifies:</u>
Assess the risk of birds being blinded by concentrated solar power (CSP) facilities that concentrate sunlight reflected by a field of heliostat mirrors to a solar energy receiver located at the top of a central tower. Such a risk is difficult to assess completely, but avian physiology and anatomy provide[s] several innate protections that would be active to protect birds from any noxious stimulus.
<u>In response:</u>
This summary is not only broad-sweeping in its generalizations but nebulous as well; note the choice to equivocate by using the phrase "avian physiology and anatomy provide[s] several innate protections that *would be active to protect birds*" rather than a definitive statement such

as “will protect birds from extreme heat, even up to 600° F. (316° C.), and a large, complex array of reflective mirrors” (emph. added). Dr. Schwab merely states that birds have evolved various physiological and anatomical features that would be activated under stress but not that they will in realty afford the protection necessary to avoid harm when the Hidden Hills Solar Energy Generating Stations (the project) is in full operation.

Question 2: In Section 2.0 Summary of Avian Ocular Protection Mechanisms, Dr. Schwab testifies:

Almost all avian species rely upon vision as much or more than other lineages. At least three principal, interacting mechanisms protect against avian eye damage from noxious stimuli: (1) the third eyelid, which can cover the cornea of avian species rapidly in response to noxious stimuli [.]

In response:

This membrane in birds is usually deployed in response to (and has been specifically evolved to combat) physical stimuli to which birds normally encounter - for example, dust - and also to lubricate the eye. Noxious, a general term, is potentially misleading, in the context of responding to serious questions about potential harm from non-particulate stimuli like solar flux energy from the project.

Question 3: In Section 2.0 Summary of Avian Ocular Protection Mechanisms, Dr. Schwab testifies:

At least three principal, interacting mechanisms protect against avian eye damage from noxious stimuli: . . . (2) the oscillatory motion of the eye known as microsaccades[.]

In response:

The role and even the importance of microsaccades to vision has been a controversial topic and only in the past few years has headway been made into understanding its function (see, for example, McCamy et al 2012). Such recent studies point NOT to microsaccades as a form of ocular protection but rather the mechanism by which the brain compensates to correct gaze errors (i.e., staring), foveate high interest targets, and incorporate neural impulses to search and integrate general information about the environment.

More specifically, because images on the retina fade from view if they are perfectly stabilized, the active generation of fixational eye movements by the central nervous system allows these movements to constantly shift the scene ever so slightly, thus refreshing the images on our retina (Hafed et al 2009). This prevents birds from the sensation that they are going blind, a dangerous situation *especially* when in flight. The brain then stitches together each visual scene (i.e., after each microsaccadal shift). This process is an ongoing phenomenon, not a specific response to noxious stimuli.

Incidentally, humans too have a well-developed microsaccadal response. This is not some avian-specific mechanism or neurological response to noxious stimuli and likewise would not adequately protect the human eye from the extreme stimuli presented by an operational solar flux facility. Even with the stimulus of the flux from on (1) sun, humans use sunglasses to protect their eyes in spite of microsaccadal movements and other response phenomena, including rapid reduction of pupil diameter.

Furthermore, while the testimony makes further reference to this phenomenon once, it nowhere explains, much less substantiates, the protective capabilities of this phenomenon but instead simply describes it in terms of its regular, normal, everyday function(s).

Question 4: In Section 2.0 Summary of Avian Ocular Protection Mechanisms, Dr. Schwab testifies:

At least three principal, interacting mechanisms protect against avian eye damage from noxious stimuli: . . . (3) the rapid pupillary constriction to any bright stimulus [.] Given the well developed protective visual systems birds have developed and the speed of flight though [sic] any flux field, I believe the chance of significant visual or heat injury to avian species is insignificant. Avian species will consciously avoid any direct injury and protect themselves with their well-documented speed and airborne agility and ability to rapidly recognize and respond to potential ocular hazards.

In response:

This raises several objections.

Humans, too, possess the capability to rapidly reduce the size of the pupillary opening; perhaps this occurs not as quickly as it might occur in some birds but it was definitely evolved in response to the same one (1) sun.

The "visual systems" referred to are nowhere described, much less empirically documented, in this offered testimony.

Not only are bird flight speeds highly variable, maximal speeds alluded to by the author would virtually never occur within the airspace of the proposed facility, not only by the fastest flyers such as the prairie falcon (*Falco mexicanus*) and white-throated swift (*Aeronautes saxatalis*) but also the majority of species, which fly typically at much slower speeds and do not approach even at maximum speed those to which the author alludes. In addition to being highly variable, flight speed would vary also by situation; for example, during feeding vs. migration. Migration speeds, the speeds at which the greatest number of individual would pass through the flux fields, are typically some of the SLOWEST exercised by birds in order to conserve energy to accomplish long distance journeys between breeding and wintering grounds.

The statement about avoiding heat injury is absurd in view of the range of temperatures that might be generated by the operational project, much less the universe. Without context, this statement has no absolute value or, equally pertinent, absolutely no value. This appears to be no more than unsubstantiated, non-expert opinion. The testimony provides no definition, either statistical or referential, for "significance" with reference to injury. In terms of scientific analysis, there is no indication anywhere in this manuscript as to what level of harm the author considers significant. The testimony is simply an unsubstantiated value judgment.

If the testimony is referring to individuals of any species, we already have contradictory evidence. If the testimony is addressing more broadly a) local populations of birds, b) subspecies cohorts that might pass through the area in migration, or c) avian species in their entirety, it should provide empirical evidence to make such claims. Aside from being purely speculative throughout this manuscript, no parameters are given by which any statements made with respect to significance have been made. Moreover, the parameters for making such judgments are nowhere specified (e.g., through what levels of flux? through what linear distance does he expect birds to travel within the influence of the flux field? What was the assumed rate of speed each individual will travel?). Without stating these parameters, the statements can only be dismissed summarily as unsubstantial.

Furthermore, it is impossible to claim knowledge of a bird's consciousness. Moreover, there is already evidence from much smaller facilities (e.g., at Solar I) that lower than project-levels of solar flux do indeed cause physical damage that result in mortality.

As previously mentioned, the testimony's reference to avian flight speeds as a protective function is questionable or erroneous. Avian flight speeds are not only species specific (e.g., woodpeckers are notoriously slow, weak flyers) but also task specific. Typical flight speeds of many species, especially in migration, are considerably slower (many on the order of 10 – 28 mph/16 – 45 kph); flycatchers, for example fly in migration at only 10 to 17 mph/16 to 27 kph. Migrant raptors in particular do not migrate at great speeds. Some species (e.g., Swainson's hawks (*Buteo swainsoni*) of the west and broad-winged hawks (*Buteo platypterus*) of the east often assemble in aggregations (called "kettles") whereby they may remain in one general location to take advantage of thermal columns to gain altitude and then use gravity and limited wing movements to glide to an ensuing thermal, but not with any great speed. Overall, birds do not move with any one "well-documented speed" (both the assumption and the statement are fallacious) with the implications that most birds flying through the facility would be subjected to elevated levels of solar flux for considerably greater time than the testimony has apparently assumed; in comparison, passage directly through the Hidden Hills facility would require far more time than would have been experienced at smaller facilities such as SEDC and Solar I were these presented as similar facilities.

Woodpeckers, for instance, demonstrate that "airborne agility" is not universal in the class Aves. The woodpeckers are in fact a prime food source of many North American populations of the also not-particularly fast but certainly more agile Accipitridae (especially Cooper's hawks (*Accipiter cooperi*) and sharp-shinned hawks (*Accipiter striatus*), which favor members of the family Picidae because of their slow, predictable flight patterns, which correspond to their size, weight, and specialized anatomical structures, which are decidedly NOT speed oriented.
The testimony does not address bird strike task forces (e.g., the military's (and aviation facilities') Bird/Wildlife Aircraft Strike Hazard prevention programs or the wealth of data documenting bird fatalities at wind generating facilities or even collision with windows (and other anthropogenic structures), which rank second only to habitat destruction in terms of adverse avian impacts. This information demonstrates birds do not always avoid collisions with large objects in their flight path.

Question 5: In Section 3.0 Introduction, Dr. Schwab testifies:
Almost all avian species are "eye-minded" and depend upon vision as much or more than other lineages. Visual abilities are highly important for reproduction, nutrition, shelter, and in some species for migration. Some avian species have evolved specialized visual adaptations to achieve the finest visual systems on earth. Avian species have developed sophisticated mechanisms to protect their extraordinary visual capabilities.

In response:
From the outset it must be understood that all of these avian systems and structures have evolved over millions of years in response to existing "natural" conditions; in particular with respect to this study, 1 sun and temperatures in the general range from ± -20° to 120°F (-30° to 49° C.) – and not the entire range for all species, which typically are best adapted to those conditions most commonly encountered in their typical habitats. No bird species has had sufficient time nor periods of exposure to adapt (much less evolve) to the extreme

circumstances to which they might be subjected by the project (e.g., temperatures in a range up to ± 600° F./316° C.).

Question 6: In Section 4.0 Orbital Protection, Dr. Schwab testifies:
Human eyes are recessed beneath, and protected by, an orbital rim or brow. Certain birds, such as hawks and eagles have a brow ridge that provides some shade and protection from intense light from above. For most birds, however, much of the eye is exposed especially on the temporal or lateral aspects, as if the eye has evolved almost beyond the orbit.6 To protect exposed ocular structures, most birds have developed a thin vertebral column and strong muscles permitting rapid and precise swiveling movements of the neck and head.11 Rapid head and neck movements provide protection by repositioning the eyes to avoid noxious stimuli, including bright light.

In response:
It is unlikely that any bird would fly with its head (and eyes) directed away from its direction of flight. See, for example, the article cited in footnote 23: Tucker, V.A., The deep fovea, sideways vision and spiral flight paths in raptors. J. Exp Biol., 2000. 203 (Pt 24): p. 3745-54. This article describes how some bird species, especially hawks and falcons, compensate for eyes that are specialized for acute vision in having their most acute vision towards the side, which "causes a conflict in raptors such as falcons when diving for prey" (p. 3745). Turning their head sideways to view the prey straight ahead with high visual acuity may increase aerodynamic drag by a factor of 2 or more and slow the raptor down (Tucker 2000). Raptors could resolve this conflict by diving along a logarithmic spiral path with their head straight and one eye looking sideways at the prey" (Tucker et al 2000, page 3,745). The reports cited show that wild peregrine falcons do indeed follow curved paths that resemble spirals when stooping; the head is kept in one position with one eye directed toward the prey item.

As with chasing prey, an individual bird will travel in the direction dictated by its vision (whether it be toward its prey, a perch, or a geographic feature along its migration route) just as humans follow the path of their focal area when driving a car, riding a bicycle, etc. Not that these highly specialized birds such as falcon cannot utilize "rapid head and neck movements", only that the statement made here applies to point source or short-term stimuli, not large mirror arrays or large areas (volumes) of flux-elevated radiation fields. Birds must still look where they are headed.

Question 7: In Section 4.1.1 How the Nictitan, Dr. Schwab testifies:
The nictitans is capable of extremely rapid sweeps across the ocular surface to clear the cornea of debris. The nictitans also moistens the ocular surface with an oily or sometimes aqueous substance, especially in birds. Woodpeckers illustrate the ocular protection provided by the nictitans. In the millisecond before strike, woodpeckers pull their tough and thick nictitans across the globe to hold the globe in place, much like a seat belt. This adaptation protects the eye from the intense force of the strike that could make the globes pop out of their sockets. The nictitans also protects woodpeckers from wood fragments or splinters that might otherwise cause eye injuries.

Woodpeckers, like most birds, also have a Harderian gland, associated with the leading edge of the nictitans and is a major source of fluid for surface lubrication in most birds. Diving birds such as cormorants probably exploit the oily liquid to prevent crenation, or drying out, of the

membrane by salt water. Falcons also use the oily tear film generated by the nictitans to keep the ocular surface hydrated during the high speed of flight, which can approach 300 km/hr. As described above, avian species have developed a unique nictitating membrane that provides rapid and effective protection against potential ocular damage.

Unlike other lineages, the avian nictitans can flash in front of the relatively small cornea in birds and instantly create a barrier between the eye and potentially harmful stimuli, including heat and light.

In response:
This is all very true although not pertinent to the issues related to potential exposure to the extreme heat produced in the vicinity of the solar reflectors. When flying through an area of flux, a woodpecker would not face the same stimulus; specifically, it would not be "pecking" nor would it encounter wood fragments or splinters. North American representatives of the family Picidae (the woodpeckers and sapsuckers) are highly specialized. Specifically, their anatomy has been evolved to exploit a very specialized method of hunting as well as nest and refugium building; and they have other adaptations to grasp and stabilize when moving vertically along tree trunks. These adaptations are certainly interesting, but their highly specialized ocular reflex is highly irrelevant. Moreover, most of their niche-related specialized features are not present in other North American species.

As I have stated earlier, the nictitating membrane aids in lubricating the avian eye and does so with regularity, a necessary response to having air passing over the a bird's eye, especially as it flies. There is no indication that birds can produce any sort of super-lubricant beyond what has been evolved to address its niche-specific needs – that is, it would not be surprising if the fluids produced by the Harderian glands of an (aquatic) diving bird such as a cormorant would be different from that of an aerial predator such as a falcon, but it does not support the assertion that any bird has evolved a gland that produces a super-fluid that would withstand up to 600°F/316° C.

Moreover, the nictitans is not for most species a protective covering that remains in place during flight but rather this membrane sweeps across the eye with great rapidity and at frequent intervals (see also the author's description of the highly specialized use by woodpeckers). The function of this membrane in flight is NOT to protect from long-term stimuli but rather a) to lubricate the eye surface and b) to sweep away debris, especially small, particulate matter. The nictitans does create a "barrier" when activated; however, the barrier has NOT been evolved to protect against heat and light but rather to brush away, and perhaps in anticipation resulting from external stimuli, instantaneously (and briefly) shield the eye from particulate matter. In some species the membrane may act as a prophylactic to potential damage due to physical contact (e.g., when feeding sharp-beaked young and or when subduing potentially dangerous prey); however, these uses are not common for most bird species and not a common general behavior even for those species that practice them.

Note also that the testimony states that the nictitating membrane provides a rapid and effective barrier but never specifies to what levels of stimulus it might be effective. The author's comments although based in general descriptive truth do not address the issues presented by the extreme conditions associated with solar flux. No studies, and in particular no pertinent studies (e.g., with respect to extreme temperatures and light) have been presented or conducted that allow this argument to be made.

In some species, use of the membrane may be extended but this is rarely the case when a bird is in flight. Peregrine falcons, for example, rapidly blink their nictitating membranes while diving on prey (stooping). They are also able to close the membrane for extended periods when feeding young and after making contact with their prey. However, these uses are implemented in accordance with the situation. The membrane is not left in place during flight when visual acuity and focus are necessary.

Additionally, this membrane is semi-transparent in order to minimize eye adjustment that would be necessary were the membrane impenetrable to light (e.g., to avoid the situation wherein the bird is subjected to ambient light, then to momentary darkness, and then back to ambient light). Passage of light to a bird's retina is not only minimally reduced but in general, vision is not greatly interfered with during the sweeping motion of the membrane across the outer surface of the eye. This movement, which occurs typically only for the briefest period – so quick is this movement in some (especially small) birds that the human eye cannot register it – allows a bird's brain maintain a general area of focus (see also comments to Section 2.0, above). Allowing the passage of light facilitates the neurological response between object and brain. The nictitating membrane is not to be mistaken for sunglasses or perhaps more appropriately, welding glasses (in terms not only of light-shielding capability but also sturdiness). The nictitating membrane is <u>not</u> "effective protection against potential ocular damage" from a very broad array of stimuli but instead a rather limited set of provocations. No attempt has been made, nor documentation presented, nor empirical data collected to show that the membrane in any bird species affords any specific protections to project-related stimuli (including extended exposure to elevated heat levels in regions of solar flux or focused light beams from large arrays of reflective surfaces.) Lastly, nowhere is there any evidence presented, from the scientific literature or a report of empirical testing, that the nictitating membrane offers any protection from extreme heat, whether caused by the solar flux or otherwise.

<u>Question 8: In Section 4.2 Pecten, Dr. Schwab testifies:</u>
Avian species have developed unique methods to provide nutrition for their inner retina that also help to protect against potential eye damage. In many lineages, the retina is relatively simple and thinner than about 150μm, and nutrients can diffuse from the choroid.28 Birds rely on vision to a greater extent than other lineages, and avian retinae have evolved to be thicker and more complex, with a larger number of amacrine and horizontal cells, than all other species to enhance the speed of retinal processing. Unlike other lineages, such as primates that have intraretinal blood vessels, birds do not possess obvious inner retinal mechanisms that can provide nutrients and oxygen to the high concentration of amacrine, horizontal, and ganglion cells present in the inner retina. Avian species sustain these cells through the pecten, comb-like structure of blood vessels located in the back of the eye, and ocular oscillations (saccades) that distribute nutrition from the pecten throughout the eye.28 The oscillatory movement required to provide nutrition in avian eyes also protects against light-related retinal damage.

The pecten projects a vascular plexus into the vitreous with multiple macroscopic and microscopic pleats to increase the surface area. The pecten is permeable to small molecules including fluorescein that will diffuse out of the pecten after injection. Fluorescein will remain pooled in the inferior vitreous immediately adjacent to the pecten until the bird performs a saccade, a rapid intermittent eye movement in which the eyes fix on one point after another in a visual field. Avian saccades are unique and do not occur in other lineages. In birds, each saccade has an associated oscillation of the globe that includes a pronounced cyclotorsion or

rotary component. Each saccade creates plumes of fluorescein rising from the inferior vitreous, billowing like steam rising off the spout of a kettle, to spread nutrients while the pecten acts as an agitator to diffuse oxygen to the inner retina. Using fluorescein angiography, it has been shown that during every saccade, the pecten acts as an agitator that propels perfusate towards the central retina much more effectively than is observed during intersaccadic intervals.1, 20 Absent their nutritive function, saccades would not be otherwise particularly necessary or helpful since most avian extraocular muscles are rudimentary and such movements would not greatly improve the bird's visual field, or field of vision.

In response:
The descriptive elements that precede this statement do not support the conclusion that a) oscillatory movements provide any protection from noxious stimuli or, more importantly, b) that they would protect a bird from the level of noxious stimulus to which they would be subjected by the project. The statements should indicate 1) to what level of subjected light would this nutrition-based function be protective, 2) what empirical data relative to the project were used to make this statement, and 3) what recent papers support the hypothesis that saccades protect against light-related retinal damage from high intensity or focused light beams and/or extreme heat. The testimony lacks citations to support (cf. footnote 20, a report of experiments and radiographic data from which much of the paragraph's information were derived, but which clearly does address much less support the author's conclusions).

Question 9: In Section 4.3 Pupillary Constriction, Dr. Schwab testifies:
The avian iris contains muscles to constrict the pupil much like many vertebrate species. Birds, however, have striated muscles in their iris as compared to smooth muscle in the human iris. Striated muscles, as would be found in your biceps, are much faster than smooth muscles as would be found in your gut. Although the speed of pupillary constriction of most birds has not been measured, a related mechanism, accommodation, has been measured and found to be 40 to 100 times faster. Furthermore; these striated muscles are under voluntary control to maximize the speed of constriction when necessary. Such speed of constriction will limit light entry into the eye as rapidly as possible, certainly faster than a human pupil.

In response:
There is no question that the avian eye and ocular system is in many ways far superior to those of humans; however, (a slower) speed of response is not the reason that humans a) use sunglasses (to protect against the harmful rays of but 1 sun) or b) more pertinently, use welding lenses (for more direct viewing of our 1 sun and/or other extremely bright light sources. The avian eye has evolved to respond to the same 1 sun within certain limits to respond physically, which would be exceeded by the conditions that would be imposed by the fully operation Hidden Hills facility.

Question 10: In Section 5.1 Flicker Fusion Rates and Responses to Potentially Harmful Stimuli, Dr. Schwab testifies:
Some birds' movement skill is highly developed although not all birds have been studied. It seems likely that all birds that fly must have highly a highly developed skill of movement detection for the purpose of flight. To survive high speeds in a tangled environment, birds have to sense and react to oncoming obstacles or predators.
As a result, avian species have higher rapid flicker fusion rates compared with other lineages.

The flicker fusion rate is the speed at which a retina unites images from individual “frames” or pictures of the world, refreshes itself to process the next image, then unites the images to generate a seamless moving image.

Some birds have a flicker fusion rate of approximately 175 cycles per second, almost four times as fast as the human rate (about 48 cycles per second). Birds can distinguish much more rapid movement and more movement detail than humans or other lineages with lower flicker fusion rates. Rapid avian image at a retinal or subcortical level facilitates rapid responses during flight, to prey capture, or to avoid noxious stimuli. Changes in light or heat that could be associated with concentrated solar flux would be immediately perceived by avian species, and it is reasonable to expect that birds will act to avoid such stimuli.

In response:
As stated above, most birds do not fly at extremely high speeds and those that are capable of extremely high-speed flight, rarely utilize it.
The reference to a “tangled environment” is inapposite where the environments through which affected birds would be flying in this instance are wide open with the exception of the collection towers. Additionally, detectability of the noxious stimuli of the operational plant is assumed but nowhere proved. The testimony does not address a large body of existing data that birds do not have the ability to avoid all obstacles (e.g., buildings), much less untangled minimally “visible” ones. It is uncertain how many species would interpret much less respond to the energy signatures of infrared as well as visible light that will radiate from the a solar electric generating plant. Despite the author’s notion that “changes in light and heat” perhaps “could” be associated with solar flux, the testimony states that birds “would” respond to these changes and do so immediately. This is unfounded and illogical.

Question 11: In Section 6.0 Potential Reaction to Heliostat Field Conditions, Dr. Schwab testifies:
Avian species have populated all continents and all manner of extreme conditions. Light that is more intense than ambient solar conditions, such as that expected in certain portions of the proposed solar field, is not typically encountered by birds and would generally be a new stimulus.

Many avian species encounter intense light stimuli that could easily resemble a second sun. For example, birds such as gulls or other water birds flying or migrating over flat water would experience intense glare and reflection that would damage a human retina with prolonged observation
.
Or, penguins, skuas, and other arctic and Antarctic birds would experience reflections from ice fields with high intensity and glare. These birds are not attracted to or damaged by such second sun reflections. Certainly, when exposed to direct sunlight or alternate sources of reflected light, birds are quite capable of avoiding injury.

Alternate sources of bright reflected light such as ice, snow, or water surfaces could also be considered novel and birds satisfactorily avoid such noxious stimuli.

Certain studies of avian responses to light that is more intense than ambient solar conditions, however, suggest that birds will generally act to avoid such illumination. Lasers and focused

light beams of up to one million candle power have been successfully used to disperse birds at airports or other locations, for example, although some species do not respond in the same manner. Bird species that have been documented to avoid such stimuli, include[ing] Canada geese, cormorants, wading birds, gulls, crows, vultures, starlings, mallards, and partial avoidance responses have been observed in herons, certain waterfowl and some species of gulls. Many birds become habituated or learn to avoid bright lights, and some have been observed to actively land in shadowed areas to avoid such stimuli (although artificial lighting may attract certain birds in hazy or foggy conditions).

Bright light (2000 watts) has also been used to decrease or eliminate crop depredation by duck species in rice fields.

Direct ocular exposure to sun light also does not seem to harm birds. Some birds will gaze at the sun to obtain an azimuth orientation. Other avian species are believed to fly over the Himalayas while viewing the sun from altitudes of over 7,000 meters to maintain direction with no harm to their eyes.

Finally, avian species have over time experienced often novel visual and thermal stimuli from intense fires, volcanoes, ignited gas plumes, and other unknown sources of heat and light. The innate ocular protective mechanisms that birds have evolved over 150 million years to protect vision have proven to be effective at avoiding and protecting against potentially harmful stimuli. It is likely that these adaptations will protect also protect avian species from ocular harm potentially related to concentrated solar flux.

In response:
The assertion that birds occasionally encounter bright light, even equivalent to a second sun, does not support the conclusion that prolonged observation by birds would not result in retinal damage. Moreover, the evidence here demonstrates that the solar energy intensity above the reflector array can be much greater than “two suns”.
The testimony does not reflect a thorough search of light-caused mortality in birds. There is a wealth of documentation to show that artificial light causes birds to veer off their normal migratory pathway. They may circle around light sources for extended periods, collide with lighted structures, and become disoriented such that they collide with nearby structures or the ground (Cochran and Graber 1958; Verheijen 1981, 1985; Rich and Longcore 2006). Migrating birds at sea are particularly susceptible to deleterious effects of artificial lighting (Telfer et al. 1987, Le Corre et al. 2002, Russell 2005, Montevecchi 2006).

For birds that spend their lives around water, for example, a sea bird such as a Laysan albatross (*Phoebastria immutabilis*), which spends more than 90% of its time at sea, a water surface is hardly “alternative” or “novel”. Moreover, most birds (animals and plants in general) have species-specific adaptations to their environments. Many albatross species, for example, reduce overall metabolic rate that limits all organ functions including processing features of the eye (they are still able to fly due to an adaptation of the wing tendons (arranged as a large sheet) that locks the wing when fully extended) and have glare-limiting plumage around their eyes, all of which limit adverse effects of sunlight (to name but a few of their niche-specific adaptations). Emperor penguins (*Aptenodytes forsteri*) spend up to 75% of their adult lives under water, which also minimizes lifetime exposure to an otherwise harsh optical environment (i.e., ice and snow).

The testimony does not explain the conditions under which the observations and studies were made. Whether the studies cited were conducted at night matters, since the facility would only operate during the day. Other critical aspects include: the distance at which the light source could first be perceived, the direction(s) of the lights relative to the birds' direction of travel, whether the tests were done under controlled circumstances, whether the data were collected in the vicinity of existing anthropogenic light sources, whether the birds observed have exceptional protective behaviors and structures enabling them to avoid such lights, and whether the birds observed were migrating, or local such that they learned about and adapted to the light sources in their environment.

General references, such as to "some birds" that "gaze at the sun", without reference to whether this is characteristic of all individuals of some (or all) species, likely to encounter the facility, are of little value to assessing the potential impact of the facility. The testimony should provide references and clearly elaborate on the parameters under which these findings were tested and proved, including the period of time observed (i.e., how long is a "gaze"), how it was measured (especially since harmful effects of sun-gazing may only be detected after long periods of time), and how follow-up studies were conducted (difficult at best except for captive specimens). Further, it is speculation that the birds actually look at the sun as opposed, for example, to using other cues linked to the sun's position, without an explanation how it was determined that these purported species actually gaze at the sun. The references in the footnotes do not clearly substantiate the testimony.

Similarly, support is not provided for the testimony about the effects of volcanoes, fires, gas plumes, etc., on avian vision. I am unaware of any studies that address such effects. Moreover, extreme events such as the 1980 eruption of Mount Saint Helens, Southern California wildfires, etc. result in the mass death of local fauna (and flora); no birds were found along the slopes of Mount Saint Helens in the wake of its eruption. No behaviors, physiology, nor specialized adaptations were sufficient to protect against its ferocity.

Question 11: In Section 7.0 Summary of Risk, Dr. Schwab testifies:
Given the well-developed protective visual systems birds have and the speed of flight through any flux field.

I believe the chance of significant visual or heat injury to avian species is insignificant.

The unique characteristics of the avian nictitans, saccadic oscillations and retinal adaptations discussed above would likely avoid blindness or other ocular harm from reflected sunlight or heat.

More generally, avian species would likely use their well-documented speed and airborne agility, and the rapid recognition of danger facilitated by high flicker fusion rates to learn to avoid injury potentially associated with solar reflections or heat in a heliostat field.

In response:
The testimony does not provide any empirical data to support the hypothesis that such "visual systems" would protect any, much less every species of bird from conditions imposed by this large-scale project.

As stated previously, the testimony does not accurately reflect flight speeds (as well as the size and conformation of the flux and reflected light fields, much less the number and distribution of heliostats that are project-specific) of migratory birds. As I have stated previously, flycatchers although quite agile fly at relatively slow speeds. Species such as gnatcatchers (family Polioptilidae), kinglets (family Regulidae), and shrikes (family Laniidae) – to name but a few additional groups – are slow, weak flyers.

It is also unsupported to assert that whatever pre-adaptive protections that birds might have would be protective with respect to "any flux field".
The testimony does not describe any measure of "significance" or "insignificance", whether to an individual of any one species, or any special group of highly sensitive, fast-flying species (which, as I have indicated, would be a small group of exceptional species).

The testimony does not provide reference to or supporting documentation for any of these "protective visual systems" with respect to their ability to repel or withstand elevated temperatures (above the range normally experienced), especially of temperatures experienced at high levels of solar energy flux (i.e., above 5 kW/m^2) or more specifically what neurological and physical effects a bird would experience with a body temperature elevated well above its normal range; testimony does not address anywhere the effects of extreme heat on the eye and its associated structures. The mechanism for addressing this and virtually every other assertion in the testimony is to assume that every bird will utilize fast flight, quick reflexes, and a suite of meager protective anatomical structures to avoid these hazards. Nowhere is any evidence presented to demonstrate, much less prove that they are specifically protective to the suite of hazards that might be encountered in the airspace around the proposed facility. But no empirical data is provided to support these speculations and no reference is made to any publication of merit.

Overall, this testimony makes no reference to testing or to scientific studies to support its conclusions in context with the extreme conditions that would occur during power plant operation. In keeping with that approach, to support the author's final assertion regarding site accommodation, there is no empirical data, nor literature reference, and no assessment of what injury would be suffered during that learning period. The statement is made with no reference as to whether this statement would be pertinent to migrants or only to resident species, especially since the former would be far more numerous. It also omits notably the conditions and effects that might result in extended periods of exposure to solar flux; for example, the occurrence of prey and in particular, insect blooms and migration episodes. Swifts and swallows (aerial insectivores) would be <u>highly likely to perish</u> or suffer injury at the site when such prey is present. There is evidence a) that they are indeed killed in areas of elevated solar flux (McCrary 1986) and b) that insects that are prey for such birds are drawn to the areas of elevated solar flux. This contrary evidence is never mentioned: The McCrary et al study (1986) demonstrates moreover the potential for impact from several sources associated with the facility: solar reflections, extreme heat, and mirror image disorientation at a facility of extremely smaller size.

Q: What changes has the applicant recommended to COC **BIO-15**, and what is staff's response: [Carol Watson]
A: The applicant has stricken the entire Eagle Conservation Plan, highly recommended by staff and the USFWS. This position of the applicant is completely new to staff, and is underpinned by the applicant's opinion that there is a zero percent chance of golden eagle take over the proposed 30 year permitted life of the project. Staff contends that potential for take of golden

eagle exists, and there is no means of ensuring with absolute certainty that no golden eagle will ever collide with project features or be injured or killed by exposure to elevated solar flux. Golden eagle have been documented at the site, and as Staff's witness William Haas has testified, Applicant's surveys insufficiently estimate bird resources at the site that are potentially impacted the proposed facility. Consequently, staff disagrees with Applicant's characterization of golden eagle potential to occur at the HHSEGS site as "Low, and latent" (page 55). Elsewhere, the applicant has mischaracterized eagle use in the vicinity of the project, "The nearest potentially occupied golden eagle nest is approximately seven miles west of the proposed facility" (page 5), but applicants' own research has determined that an occupied golden eagle nest is "being tended…4.7 miles west from the Hidden Hills…site…"(CH2MHILL, 2012)(Emphasis added).

Q: Does staff have any new information that supports the implementation of **BIO-15**? [Carol Watson]
A: Yes, staff has discovered two more scientific studies conducted at the Solar One site (McCrary et al 1984)(Wagner et al 1982). Chief to come from Wagner et al (1982) is data regarding insect incinerations, which is the first empirical evidence of insect incinerations that staff is aware of. Events of insect incineration were rare, yet when they occurred, killed "large numbers of insects" including an estimated 800 insects during three 15-second intervals. The McCrary et al (1984) report similarly contains informative data, noting that insect incinerations affected dragonflies, wasps, bees, and butterflies. Staff notes that many of these species are migrational. Aerial foraging species such as swifts and swallows were noted to be most affected by flux at Solar One. It is possible that the heat and light generated by the project could attract insects, in turn attracting aerial foragers, or other species. Staff considers the available data as highly suggestive, and accordingly recommended **BIO-15** to monitor, minimize, collect further data, and require conservation efforts based on monitoring results.

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BIOLOGICAL RESOURCES – AVIAN IMPACTS / SOLAR FLUX

by: Geoff Lesh PE, Rick Tyler, Alvin Greenberg Ph.D., William E. Hass MS

Q: What is the purpose of this testimony?
A: To respond to the Applicant's Opening Testimony filed January 23, 2013.

Q: What is the nature of the disagreement between Staff and Applicant regarding avian hazards from solar flux?
A: The essence of the disagreement is how such hazard is assessed in an area of great uncertainty, with precious little empirical evidence. Only a few power towers of the kind proposed here exist in the world, and they are orders of magnitude smaller than the HHSEGS project. Ivanpah, currently under construction, will be the first scaled-up power tower project when it goes on line later this year. Only a few small facilities exist or have existed, and there are few published empirical studies of any importance on avian mortality, dating from a 1980s study of the Solar One facility near Barstow. Those studies established the potential for avian death and injury from such projects.

The issue of the potential adverse effects of avian exposure to concentrated solar radiation at a solar tower power plant is complex and quite frankly poorly documented. Despite attempts to measure, quantify, survey, or estimate potential impacts of solar tower technology on birds flying into, through, or around in the vast open space that lies between the mirrors and the tower, the science is evolving and the empirical evidence and anecdotal observations are not nearly as accurate and precise as staff would like. Although staff appreciates the applicant's attempts to obtain useful valid data, the existing data-base is extremely small and fraught with scientific and observational uncertainty. There exists a need for more empirical real-world evidence, not the anecdotal "reports" offered. Furthermore, relying only upon the sparse observational studies and surveys of questionable scientific and methodological validity would not be appropriate in this case. Simply put, the empirical evidence to date lacks both a scientific basis and comparative value because of the major differences between the few solar power tower plants and their setting in existence today which were observed and the much larger and technologically different solar towers proposed.

Q: So the avian hazard is subject to a high degree of uncertainty?
A: Yes. And there is likely some significant agreement between Staff and Applicant that should not be lost. First, it appears both parties believe that power towers create solar flux levels that are capable of, and will, kill and injure birds. (See, e.g., Applicant's testimony, Biological Resources, p. 27 [avian mortalities were detected at Daggett facility with evidence of feather singeing]; proposed Finding of Fact 15, 2.5 kW/m^2 level of potential harm under most conservative estimates]. There is no doubt about this and no real disagreement.

Second, both parties realize and acknowledge that there is a fair amount of uncertainty about what level of solar flux will harm birds. This has something to do with what typical levels of solar flux will result from these projects under differing conditions, but even more with the variation

among the multitudes of birds, large and small, fast and slow, light and dark colored, that may be subjected to such flux, and the lack of any strong evidence of bird behavior with regard to power towers.

Lastly, Staff believes that the hazard should be acknowledged and assessed, followed with monitoring studies, and, if opportunities exist, mitigated to the extent reasonable.

Q: What is the magnitude of the impact?
A: Given the uncertainties, Staff has termed the impact potentially significant. It is possible that these projects will kill a lot of birds across a broad range of species, depending on how many and how often and by what path birds fly through the flux fields above the facility. But we do not know for sure. The hazard could be worse, or much less, than that posed by a wind farm project, by comparison. We cannot really know until there is experience with such projects, and careful monitoring of mortality and injuries. Any assessment of impact, whether by Staff or Applicant, is by necessity an “imprecise estimate”, given the uncertainties.

Q: Simply stated, how did Staff analyze the hazard?
A: First, Staff took (and confirmed) the solar flux levels the project will produce, provided by Applicant. Second, it calculated how this radiant energy would heat and dissipate on a bird in flight, considering a variety of factors. Third, based on this heating that results from the solar flux, it estimated the effect on the bird, and particularly the keratin structures of feathers, to determine at what threshold damage to a bird would become possible or likely.

Staff believes that its predictive risk assessment results are more useful to estimate potential adverse impacts on avian species than the sparse observational data which are so fraught with scientific uncertainty that a decision on the magnitude of the potential impacts cannot be made based solely on the available surveys and studies to date. A risk assessment can be both predictive and preventative, that is, can be used to predict (estimate) adverse impacts or to prevent adverse impacts from occurring. It appears that the applicant’s testimony agrees that staff’s risk assessment was conducted using the appropriate criteria (avian exposure and radiant heat flux assumptions) and methodology (approach) but differs with staff on the precise values to use for those criteria (e.g., factors describing the airflow over wings, the optical absorptivity and emissivity of feathers, ambient temperature, etc.). However, although staff and applicant disagree with those input values, the net result is that the level of risk predicted differs by only one order of magnitude and both approaches demonstrate that adverse impacts are likely to occur. While staff believes the potential risk is significant, the applicant believes the potential for adverse impacts is insignificant. Staff explains below why its choice of assumptions is valid. The important point to make is that both assessments (the applicant’s and staff’s) demonstrate that a solar power tower plant will most likely have some level of adverse effects on birds.

Q: Why has Applicant's testimony failed to convince Staff that the impact is insignificant?
A: Applicant's focus has been very different. It has put forward purportedly "real world" evidence that is in essence short-term surveys of bird death counts at small power tower facilities in Israel and Spain. Applicant buttressed this with an attempt to produce empirical results from an experiment in Israel with dead birds exposed to flux from a power tower, a study that Staff has questions about that will be addressed in future testimony following a workshop to be held February 11, 2013, with applicant’s witness Mr. Gary Santolo who conducted the experiment in question. In sum, Staff believes that this "real world" evidence raises more

questions than it answers, and does not readily support a conclusion that the hazard to birds is insignificant.

Q: What question is staff attempting to answer with their flux-exposed bird modeling?
A: Staff is attempting to determine a safe level of concentrated solar flux for a temperature=160° C that would apply for most birds expected at the site exhibiting reasonably expected behaviors such that significant feather damage would not occur to most birds and would be limited in magnitude and area for those that might suffer some damage. Staff used the keratin, or feathers, as a measure of changes to birds exposed to the heat flux and a temperature of 160° C at which keratin begins to degrade. Staff did not estimate physiological effects such as overheating, dehydration, exposure on bird morbidity or mortality, but these would also be likely mechanisms that could adversely affect exposed avian species.

Q: Where do the temperature modeling approaches for this risk assessment agree?
A: Agreement exists on the general approach of how to build such a risk assessment model, to determine steady state temperature, and by balancing incoming and outgoing heat transfers from a feather to determine a steady state temperature. There is also no dispute that at temperatures above 160° C, property changes and decomposition of keratin (the material of feathers) begins to occur.

Q: Where do the modeling approaches disagree?
A: Clearly, staff and applicant are attempting to answer different questions with their respective analyses. This difference leads to different input parameters to the risk assessment model with respect to which heat transfer mechanisms are operating in a modeled instance and what relevant material property values should be used in the model.

Staff is attempting to determine a safe exposure threshold for reflected flux intensity that would cover *most* expected birds at the site exhibiting reasonably expected behaviors such that it would preclude permanent functional damage to the birds' feathers. The applicant's analysis seems to be attempting to answer the question of what is the highest flux exposure that *some* (i.e.: *any)* bird could endure while still having *some (any) part* of its feathers remaining *undamaged* (i.e. without damaging *every* area of that bird's feathers)? These are fundamentally different questions.

The difference in the question being addressed by the respective analyses leads to a difference in the *exposure scenario* held to be representative. The exposure scenario chosen affects the parameter values that are input to a given modeling calculation. A chosen exposure scenario will control what values are input into various factors used in the temperature model. Factor values could be affected, with some judgment and assumptions, by a range of the bird's attributes including its flight speed, wing size, color and optical properties (including darkness or brightness), amount of dust on the feathers (Bennett), wing flapping frequency, gliding tendency, feather texture (scale of micro-structure), age and condition of feather at the time of exposure, flight altitude, and flight attitude (e.g., whether they are banking, climbing or diving).

Q: How does applicant arrive at a critical flux level that is up to 10-times that of staff's value?
A: By simultaneously compounding several assumptions (risk assessment inputs) that staff finds are inappropriate for use in this type of assessment, as listed in **Table 1.** Applicant claims that Staff's estimate is off by "at least" a factor of 10 (Applicant's testimony on FSA, "Response to Appendix BIO-1 and BIO-2, Staff's flux Model, Table BR-3 p. 44). Staff is not suggesting that

none of the applicant's chosen input values can ever occur; it is instead suggesting that they cannot be relied upon to be present, not individually, and especially not collectively for every bird type, gender, age, color, and health condition that enters the solar field.

Q: Has staff considered the effect of individually changing input parameters for the model to the values suggested by the applicant?
A: Yes. **Table 1** below shows how much the modeled critical flux level to reach 160° C changes from staff's modeled result. Both the new critical flux level and the percentage change are shown in the table. Although the applicant has referred to each of staff's choices as dramatically and unrealistically biased, individually, their contributions would be considered within the expected range of uncertainty, where many assumptions must be made about a widely varying population of subjects (birds). There are widely varying and as-yet untested field conditions and behaviors, and relevant field data is limited.

Q: At what level of flux does staff's calculation indicate feather temperatures might reach 160° C?
A: Staff's calculation indicates that a flux level below 4.9 kW/m^2 would not cause feather temperature to exceed 160° C. Staff chose 4.0 kW/m^2 as a safe threshold to allow for attribute variations within the bird populations and to allow for the uncertainty related to the current absence of reliable, extensive field data on bird sensitivities to flux exposure.

Table 1 summarizes the differences between the applicant's and staff's inputs to flux modeling. In Table 1, the column headed "Modeling Property" lists important input factors to the flux model about which staff and applicant have had differences of what value should most properly be used. The columns headed "Value used by Staff" and "Value used by Applicant" list the respective values used for that factor (from the first column).The columns headed "Staff's Q*160" and "Applicant's Q*160" list the respective critical flux values needed to reach a feather surface temperature of 160° C using the listed value. For Staff's Q*160, the value 4.9 kW/m^2 represents staff calculated value found by setting all factors to the value as listed in column 2, "Value used by Staff". The column headed "Applicant's Q*160" indicates how Q*160 varies when only the factor on that line is changed from staff's value to applicant's value (e.g.: in row 1, changing the optical flux absorptivity from 0.95 to 0.65, would change the resulting Q*160 from 4.9 to 7.1 kW/m^2, and so on down the rows of the table). The final column of Table 1, "Staff's Comments" reflects staff's rationale for its choice of level for that factor.

Note that none of the factor level changes by itself can move the Q*160 level to above 14.2 kW/m^2. The largest effect (due to View Factor) comes from requiring that the incidence angle of flux hitting the lower wing surface be at 70° angle from straight-on, yielding a View Factor (VF) of 0.34. That situation cannot be relied upon. On the other hand, there is, at all times, some portion of the bird perpendicular to the incident flux. What particular surface area will vary as the bird changes position, changes direction, passes the tower, etc.

The next largest effect, changing Q*160 from 4.9 to 10.1 kW/m^2, relies upon assuming that any exposed surface of concern on the bird is in fully turbulent air flow. Staff finds no strong rationale for making that assumption, and in fact does find strong rationale for assuming that laminar flow is to be expected. Changes to the remaining factors are smaller yet (none changing 4.9 to beyond 8.9 kW/m^2). Only by setting multiple factors to values that staff finds inappropriate, can Q*160 values greater than 15 kW/m^2 be obtained.

Table 1: Comparison of Input Assumptions and Resulting Critical Flux Level between Applicant's and Staff's Temperature Modeling

Modeling Factor	Value used by Staff	Value used by Applicant	Staff's Q*160 (kW/m^2) (Q*160 = Flux level to reach T=160°C)	Applicant's Q*160 (kW/m^2)	Staff's Comments
Optical Flux Absorptive (α) of plumage	0.95	0.65	4.9	7.1	$\alpha \cong \varepsilon$ for "black" bodies and "grey" bodies, and generally for surfaces without visual color. Brightly colored surfaces would have lower optical absorptivity in a particular visual wavelength.
Optical Emissivity (ε) of plumage	0.95	0.95	4.9	4.9	
Optical Transmissivity (τ) of plumage	0	>0	4.9	> 4.9	Staff analysis assumes that feathers on the bottom side of wing may be backed up by other overlapping feathers or by skin of the bird
View Factor of surface exposure; Cosine of angle to normal	1.0	0.342	4.9	14.2	Some part of any 3-D object, including the wings, are at VF = 1.0, always. This is important because transients (time needed to reach steady state temperature) are short.
Laminar Vs Turbulent Flow on bottom wing surface at Re = 68,000	Laminar Laminar if Re < 500,000	Turbulent No criterion given. (Pipe flow used?)			Note: both calculations are for entire surface in that condition.
Convection heat transfer coefficient	28.5	71.8	4.9 (3.1)	10.1 (5.8)	Staff is not looking at worst or best "spots" but average. Bottom surface of wing is practically always entirely laminar. (numbers in parentheses would apply to localized conditions near trailing edge of bottom of wing)
Convection from top of wing in addition to bottom?	No. Bottom surface only	Yes. Top and Bottom surface	4.9	7.35	Staff assumes flesh, bones, and overlapping feathers would impair heat transfer from bottom surface to top surface of wing.
Re-radiation from top surface of wing in addition to bottom?	No. Bottom surface only	Yes. Top and Bottom surface	4.9	6.5	Staff assumes flesh, bones, and overlapping feathers would impair this heat transfer from bottom surface to top.

0° C sky temperature (for re-radiation) from top of feather?	Yes, but Is not applicable unless radiating from top surface.	Uses 0° C for conduction from top surface of wing.	4.9	4.9	Sky temperature does not enter into staff's calculations as re-radiation is assumed to be occurring from bottom surface of wing only.
Assume there is unimpeded heat transfer between the top and bottom surfaces of wing and both surfaces are at the same temperature?	No. Top surface not a factor as flux is incident on ground-facing surfaces.	Yes. BOTH re-radiation and convection occur from top surface of wing.	4.9	8.9	Re-radiation from top surface of wing is assumed because of impeded heat transfer from bottom surface to top.
Ground and Air Temperature	45 C (113 F)	40 C (104F)	4.9	5.1	Consider temperature that would be expected to re-occur periodically.

Q: How does Applicant's testimony mischaracterize staff's FSA?
A: Applicant's testimony has demonstrated several areas of misunderstanding, misinterpretation, and unfortunately mischaracterization of staff's testimony in the FSA. Staff strongly recommends that readers refer directly to staff's testimony rather than assume the applicant understands and correctly summarized or referenced concepts and conclusions from staff's testimony. For example, applicant states that staff's calculations indicate that a flux level of 4.0 kW/m^2 causes a temperature of 160° C. As explained, the staff makes clear that that flux level is 4.9kW/m^2.

Applicant also improperly implies that fire-science-related materials testing is "from fires" and uses a spectrum "almost entirely within the far-infrared spectrum." In fact, this is not accurate as several articles in the scientific literature show that fires emit infrared radiation in both the near-, mid-, and far infrared spectrum. (They are now referred to as IRA, IRB, and IRC). Indeed, there exist standardized testing protocols which provide results of measureable repeatability using flame-temperature (1500 – 1800 Kelvin) prescribed radiant heat sources. The average wavelength for such thermal sources is approximately 1.5 - 2 microns, as opposed to 0.6 microns for the solar spectrum. There is substantial overlap in their wavelength spectra. Applicant's claim that UV radiation is largely removed from heliostat-reflected solar flux would make the reflected flux spectrum even more similar to that used in materials-related fire tests by shifting the heliostat-reflected solar flux to a higher average wavelength.

Applicant also suggests that staff's thermal flux model has not and cannot be correlated to actual experimental temperature data. Staff has compared its risk assessment model's predicted surface temperatures to measured equilibrium temperatures of other materials under varying flux levels with known convection heat losses. It matches available data to within published measurement accuracy limits, thus correlating as well as reasonably as can be expected to available "real world" materials test data for the mechanisms being modeled. The response curve of staff's model matches the response of other published models, which in turn match actual measurements. Published test procedures and results are available from fire testing organizations such as the National Fire Protection Association (NFPA), The National Institute for Testing of Materials (NIST), the American Society for Testing of Materials (ASTM). Although staff has not found published test results specifically for feather temperatures

undergoing various levels of flux exposure, staff's model for feathers (keratin) places them on the same response curve as other carbohydrate-based materials.

As mentioned above, applicant appears to also misunderstand the purpose of staff's risk assessment model as evidenced by the inclusion of the following incorrect and misleading statements contained in applicant's comments on the FSA (paraphrased below):

- Staff improperly assumes that "a bird feather is always perfectly perpendicular to each and every solar reflection"
- Staff assumes that ambient temperature is 45C at "all times", even during winter
- Staff assumed radiant temperature of the sky to be 45C instead of 0C
- Staff assumes that "all birds in the solar field airspace will at all times be oriented perfectly perpendicular to any mirrored reflection"
- Staff assumes that "all birds will always be pointed upwards at an angle of 20 degrees when they fly through the air space"
- Staff used a permanently-fixed 1.0 view factor
- FSA asserts that "avian feathers would be damaged by solar flux exposures as low as 4 kW/m^2."
- Staff fails to consider pass through of flux and transmissivity of feathers
- Applicant's testimony suggests that by adding in additional heat transfers associated with wing movements, lighter colored feathers, lower ambient temperatures Q*160 values would increase beyond 50 kW/m^2.

Staff has previously considered and addressed all of these issues in their FSA testimony.

Q: Why did staff develop its own model of potential feather damage from solar flux?
A: Staff remained unconvinced by applicant's seemingly incomplete summary presentation of results from their flux exposure study conducted on dead birds which concluded that 50 kW/m^2 would also a safe exposure level for live birds. Staff has been requesting more complete information from the event since August 2012, when the applicant provided a few power point slides summarizing some parts of the dead bird exposures.

Q: How has the applicant's response to staff's flux-temperature model and threshold calculation varied during permit proceedings?
A: First applicant suggested that such modeling simply could not be done, must be wrong, and should be abandoned. Applicant then asked for a complete description of the model method, details, and computer source code. Applicant then presented their consultant's analysis of our method. Other than differences of opinion of what were appropriate exposure scenario assumptions, he presented his conclusion that staff's analysis was plainly wrong because, in his opinion, air flow across a bird's wing could not be laminar, and was in fact well into the fully turbulent range because the Reynolds number (Re) was too high at 68,000. A PowerPoint slide presented laminar and turbulent flow development inside tubing (not over a flat plate or wing), where indeed, Re=68,000 would imply turbulent flow, as in that flow-in-a-tube arrangement, laminar-to-turbulent flow transition is accepted to occur at around Re=4,000. Using the incorrectly derived assumption that the flow was turbulent across the wing and applicant's other input assumptions, critical solar flux values ranging from 35 to 50 kW/m^2 were concluded. In response to a question, applicant's consultant suggested that values up to 80 kW/m^2 were quite likely safe.

However, birds' wings do not operate inside of tubes. The more appropriate fluid mechanics heat transfer model is the so-called "flat plate" arrangement, where the laminar-to-turbulent flow transition is accepted to occur at around 500,000, implying laminar flow beneath the wing. The applicant does not accept the "flat plate" method yet, stating that its valid use would require "perfectly uniform flow with air molecules moving in the same direction." Applicant further states that the generally accepted turbulent transition value of Reynolds number = 500,000 "is applicable only to perfectly laminar airflow around a large smooth flat plate." Staff strongly disagrees with that assertion. The "flat plate-method" is generally size independent, and internally accommodates varying surface sizes. Although it is true that the laminar-to-turbulent transition can occur over a range of values dependent on the particular geometries involved, Re=500,000 for transition is the empirically accepted value. With Reynolds numbers generally below Re=100,000, birds are nowhere near the transition value. Even so, applicant's testimony continues on immediately with the statement that "the airflow around a bird in flight is substantially more complex and *consists of areas of laminar and turbulent flow.*" Staff does not dispute that. Staff would not be surprised to find turbulent flow behind highly curved surfaces of the bird such as its head, neck, and feet, but has not attempted to model those surfaces. Instead, staff focused on important exposed lower wing surfaces. Applicant continues to insist on a fully turbulent flow assumption for temperature modeling, leaving their suggested critical solar flux values unchanged, ranging from 35 to 50 kW/m^2.

References

BENNETT – JM Bennett, Bennettech, LLC "Black Widow" Thermal Absorptivity – enhanced Dry Chemical Powder – Recent Evaluations in Various Fire Protection Applications

CULTURAL RESOURCES

by: Dr. Thomas Gates

1. Does Applicant incorrectly assume that the prima facie guidelines to apply to staff HHSEGS cultural landscape investigations are Bulletin 30 *Guidelines for Evaluating and Documenting Rural Historic landscapes and* Bulletin 38 *Guidelines for Evaluating and Documenting Traditional Cultural Properties* and that staff is documenting a Traditional Cultural Property. (Sebastian Testimony Page 5, Para 2).

The Ethnographic Report and the FSA make very clear that the staff is interested in documenting ethnographic landscapes, one of four types of cultural landscapes. This approach was taken due to affiliated tribes' requests to consider cultural landscapes instead of traditional cultural properties. The staff ethnographic report makes clear that "for the purposes of this study the resource focus is with Native American places and areas otherwise referred to as ethnographic resources and how those resources contribute to a cultural or ethnographic landscape" (Staff Ethnographic Report: 16). Staff relied on NPS Preservation Brief 36 *Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes* and the subsequent publication by the same author,*Guidelines for the Treatment of Cultural Landscapes*, and other nationally recognized guidance. The applicant' expert witness erroneously assumes that NPS Bulletin 38 *Guidelines for Evaluating and Documenting Traditional Cultural Properties (TCP)* are the correct guidelines to follow. TCPs are **places**, and landscapes are contiguous **areas** that consist of **areas**, **places, sites, objects, plants, animals, landforms, waterways** etc. TCPs are historic properties of a unique type and on the same federal hierarchical and taxonomical footing as objects, buildings, structures, sites, and districts. Cultural landscapes are subsets or types of districts. Further, ethnographic landscapes are contiguous districts. That is, all of the things inside the boundaries that have been identified as contributing elements or attributes, are treated as contributors. However, staff relied on upon Bulletin 38 and related literature (Places That Count: Traditional Cultural Properties in Cultural Resources Management – King 2003) for general advice for working with tribes and other ethnic groups interested in protecting their cultural life-ways.

2. How much documentation is necessary and specifically how precisely should landscape and contributing attribute boundaries be drawn?

A. The applicant's testimony erroneously suggests that staff describes the Salt Song Landscape as a vast site or district (Sebastian Testimony Page 6 Para 4)and suggests that staff should have documented the "historic property as "some sort of thematic multiple property" covering large portions of four states (Sebastian Testimony Page 6 Para 5). This is erroneous. It is an ethnographic landscape that has the shape of a corridor. The corridor loops through portions of four states to form a circuit. Due to time constraints, budget constraints and the narrow focus, the ethnographic report only attempted to collect information of that part of the trail corridor that exists in the Pahrump Paiute Ancestral Territory area of the Pahrump Valley and surrounding mountains. Applicant's testimony asserts that the specific locations, boundaries, and scales of the Salt Song corridor throughout four states are necessary to evaluate impacts and asks for specific location, boundaries and scale. Staff provides an additional map (Rebuttal Figure 1) to further specifically show the corridor and related general viewshed in relation to the

project. However, the referenced map cannot ultimately convey with specificity, what applicant requests.

The trail is a corridor within which there is a general trajectory that runs from landmark to landmark with accompanying viewshed-to-viewshed type linkages. Power emanates from within this corridor. How little or much this power emanates is a relation between the deceased, the grieving, the singers and the landscape. The project will impact the Salt Song Trail Landscape and the impacts will be significant and unmitigable. Under these circumstances, it does not matter how precisely boundaries are drawn, particularly when the landscape in the vicinity of the project is larger than the project. The applicant's testimony makes similar erroneous assumptions concerning the Paiute Home landscape and the Ma-hav landscape (Sebastain's Testimony Pg 10, Para 1; Pg 11, Para 4; Pg 12, First incomplete Para). Staff was not documenting specific delineated sites of the Ma-hav landscape.. Instead, staff was documenting a landscape consisting of contributing attributes (See Rebuttal Figure 2), not specific sites. While specific locations are known by staff, only some of those specific locations are in the project site, and it is not necessary to provide specific locations for the purposes of articulating the larger landscape. However, the traditional plants and animals important to Pahrump Paiute and located in the project area and as documented in the staff ethnographic report are ubiquitous throughout the project area. Staff was not documenting singular ethnographic sites, or a dis-contiguous district.

3. Why is Criteria C applicable to the Salt Song Trail Landscape?

   A. Despite the applicant's testimony to the contrary (Page 7, Para 2), the Salt Song Trail Landscape is eligible to the California Register of Historic Resources (CRHR) per Criteria C. The Salt Songs are believed by traditional practitioners to be provided to them by the creator who *designed* the world, provided a means by which humans should handle the burden of life and death and provided them with assistance or "familiars" or "spirit helpers." The songs only have meaning and the power to affect, if the songs are learned, practiced and sung in the landscape where the songs, familiars and landscapes co-evolved. The songs and the land resonate with one another. Therefore, to impact the landscape is to render the songs useless and would, without a landscape to sing within, the songs would not resonate or function as they are intended to do.

4. Why is Pahrump Paiute Homeland introduced in staff documents?

   A. The Pahrump Paiute Homeland is introduced in the staff documents to provide a conceptual link between the Salt Song Trail Landscape (an all Southern Paiute affiliated landscape) with the Ma-hav landscape. This was intended to help document readers understand, and it was also included at the insistence of the Pahrump Paiute tribe who felt that it would help define, in a holistic fashion, who they are and what their history and territory are to a larger audience that otherwise would not be exposed to such information. The applicant's testimony critiques this landscape as not being precisely delineated, questions if Chief Tecopa's journey is a significant historical event, and contends that such a landscape would be comparable to the absurd example of considering the Untied States a landscape. The outer limits of the Homeland are not necessary to document because they are well away from the project, in some places imprecise and in some places contested. It is obvious to staff that the circumstances and

decisions that heavily weighed upon Chief Tecopa as he made his journey around his homeland are diametrically opposed to the events by which the boundaries of the United States were derived (including the treaty negotiations and reservation establishment policies that attempted extinguishment of aboriginal and ancestral homeland claims). Chief Tecopa was potentially losing a homeland; the United States, State Government agents and U.S. citizens were gaining a homeland.

5. Ethnographic Report (pp61, 65) and Final Staff Assessment (4.3 - 96-97) Eratta: The staff ethnographic report and FSA have mistaken language about John Yount, the first non-Indian to settle at Hidden Hills Spring. The Report and Assessment indicate that John had two wives.

A. This is not the case; he only had one wife, Susie, whose family was from the Hidden Hills Spring area. The Pahrump Paiute Tribe recently provided the following information:

"Susie Belle Yount was John Yount's wife. John Yount did not have two wives. Susie Belle Yount was born in 1870. She was born in Nevada. She never went to school. She did not read or write. She spoke Southern Paiute. Her father was of mixed blood and her mother was full blooded Pahrump Paiute. Susie and her family lived there before the Younts. A Traditional Powwow or Cry Ceremony, as it is called now, is never done for a white person, only Native Americans."

FACILITY DESIGN

by: Shahab Khoshmashrab

Q. What is the purpose of this testimony?
A. To respond to the Applicant's testimony filed on January 29, 2013.

Q. Do you agree with the Applicant's proposed changes to the Facility Design conditions of certification as outlined in the Applicant's testimony?
A. I only agree to the following changes shown in underline/~~strikeout~~. I do not agree with the remaining changes because they would limit, hinder, and complicate the CPM and Energy Commission's oversight of project construction.

GEN-1 The project owner shall design, construct, and inspect the project in accordance with the 2010 California Building Standards Code (CBSC), also known as Title 24, California Code of Regulations, which encompasses the California Building Code (CBC), California Building Standards Administrative Code, California Electrical Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Fire Code, California Code for Building Conservation, California Reference Standards Code, and all other applicable engineering LORS in effect at the time initial design plans are submitted to the CBO for review and approval (the CBSC in effect is the edition that has been adopted by the California Building Standards Commission and published at least 180 days previously). The project owner shall ensure that all the provisions of the above applicable codes are enforced during the construction, addition, alteration, moving, or demolition~~, repair, or maintenance~~ of the completed facility. All onsite transmission facilities (lines, switchyards, switching stations and

substations) are covered in the conditions of certification in the **Transmission System Engineering** section of this document.

In the event that the initial engineering designs are submitted to the CBO when the successor to the 2010 CBSC is in effect, the 2010 CBSC provisions shall be replaced with the applicable successor provisions. Where, in any specific case, different sections of the code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

The project owner shall ensure that all contracts with contractors, subcontractors, and suppliers clearly specify that all work performed and materials supplied comply with the codes listed above.

Verification: Within 30 days following receipt of the certificate of occupancy, the project owner shall submit to the CPM a statement of verification, signed by the responsible design engineer, attesting that all designs, construction, installation, and inspection requirements of the applicable LORS and the Energy Commission's decision have been met in the area of facility design. The project owner shall provide the CPM a copy of the certificate of occupancy within 30 days of receipt from the CBO.

Once the certificate of occupancy has been issued, the project owner shall inform the CPM at least 30 days prior to any construction, addition, alteration, moving, ~~or~~ demolition, ~~repair, or maintenance~~ to be performed on any portion(s) of the completed facility that requires CBO approval for compliance with the above codes. The CPM will then determine if the CBO needs to approve the work.

We do not agree to the changes proposed in **GEN-2, -3, -7,** and **-8**.

GEN-4 Prior to the start of rough grading, the project owner shall assign a California-registered architect, or a structural or civil engineer, as the resident engineer (RE) in charge of the project. All onsite transmission facilities (lines, switchyards, switching stations, and substations) are addressed in the conditions of certification in the **Transmission System Engineering** section of this document.

The RE may delegate responsibility for portions of the project to other registered engineers. Registered mechanical and electrical engineers may be delegated responsibility for mechanical and electrical portions of the project, respectively. A project may be divided into parts, provided that each part is clearly defined as a distinct unit. Separate assignments of general responsibility may be made for each designated part.

The RE shall:

1. Monitor progress of construction work requiring CBO design review and inspection to ensure compliance with LORS;

2. Ensure that construction of all facilities subject to CBO design review and inspection conforms in every material respect to applicable LORS, these conditions of certification, approved plans, and specifications;

3. Prepare documents to initiate changes in approved drawings and specifications when either directed by the project owner or as required by the conditions of the project;

4. Be responsible for providing project inspectors and testing agencies with complete and up-to-date sets of stamped drawings, plans, specifications, and any other required documents;

5. Be responsible for the timely submittal of construction progress reports to the CBO from the project inspectors, the contractor, and other engineers who have been delegated responsibility for portions of the project; and

6. Be responsible for notifying the CBO of corrective action or the disposition of items noted on laboratory reports or other tests when they do not conform to approved plans and specifications.

The resident engineer (or his delegate) must be located at the project site, or be available at the project site within a reasonable period of time, during any hours in which construction takes place.

The RE shall have the authority to halt construction and to require changes or remedial work if the work does not meet requirements.

If the RE or the delegated engineers are reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer.

Verification: At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, the resume and registration number of the RE and any other delegated engineers assigned to the project. The project owner shall notify the CPM of the CBO's approvals of the RE and other delegated engineer(s) within five days of the approval.

If the RE or the delegated engineer(s) is subsequently reassigned or replaced, the project owner has five days to submit the resume and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

GEN-5 Prior to the start of rough grading, the project owner shall assign at least one of each of the following California registered engineers to the project: a civil engineer; a soils, geotechnical, or civil engineer experienced and knowledgeable in the practice of soils engineering; and an engineering geologist. Prior to the start of construction, the project owner shall assign at least one of each of the following California registered engineers to the project: a design engineer who is either a structural engineer or a

civil engineer fully competent and proficient in the design of power plant structures and equipment supports; a mechanical engineer; and an electrical engineer. (California Business and Professions Code section 6704 et seq., and sections 6730, 6731 and 6736 require state registration to practice as a civil engineer or structural engineer in California). All onsite transmission facilities (lines, switchyards, switching stations, and substations) are handled in the conditions of certification in the **Transmission System Engineering** section of this document.

The tasks performed by the civil, mechanical, electrical, or design engineers may be divided between two or more engineers, as long as each engineer is responsible for a particular segment of the project (for example, proposed earthwork, civil structures, power plant structures, equipment support). No segment of the project shall have more than one responsible engineer. The onsite transmission line may be the responsibility of a separate California registered electrical engineer.

The project owner shall submit, to the CBO for review and approval, the names, qualifications, and registration numbers of all responsible engineers assigned to the project.

If any one of the designated responsible engineers is subsequently reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned responsible engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer.

A. The civil engineer shall:

    1. Review the foundation investigations, geotechnical, or soils reports prepared by the soils engineer, the geotechnical engineer, or by a civil engineer experienced and knowledgeable in the practice of soils engineering;

    2. Design (or be responsible for the design of), stamp, and sign all plans, calculations, and specifications for proposed site work, civil works, and related facilities requiring design review and inspection by the CBO. At a minimum, these include: grading, site preparation, excavation, compaction, construction of secondary containment, foundations, erosion and sedimentation control structures, drainage facilities, underground utilities, culverts, site access roads and sanitary sewer systems; and

    3. Provide consultation to the RE during the construction phase of the project and recommend changes in the design of the civil works facilities and changes to the construction procedures.

B. The soils engineer, geotechnical engineer, or civil engineer experienced and knowledgeable in the practice of soils engineering, shall:

    1. Review all the engineering geology reports;

    2. Prepare the foundation investigations, geotechnical, or soils reports containing field exploration reports, laboratory tests, and engineering analysis detailing

the nature and extent of the soils that could be susceptible to liquefaction, rapid settlement or collapse when saturated under load;

3. Be present, as required, during site grading and earthwork to provide consultation and monitor compliance with requirements set forth in the 2010 CBC (depending on the site conditions, this may be the responsibility of either the soils engineer, the engineering geologist, or both); and

4. Recommend field changes to the civil engineer and RE.

This engineer shall be authorized to halt earthwork and to require changes if site conditions are unsafe or do not conform to the predicted conditions used as the basis for design of earthwork or foundations.

C. The engineering geologist shall:

1. Review all the engineering geology reports and prepare a final soils grading report; and

2. Be present, as required, during site grading and earthwork to provide consultation and monitor compliance with the requirements set forth in the 2010 CBC (depending on the site conditions, this may be the responsibility of either the soils engineer, the engineering geologist, or both).

D. The design engineer shall:

1. Be directly responsible for the design of the proposed structures and equipment supports;

2. Provide consultation to the RE during design and construction of the project;

3. Monitor construction progress to ensure compliance with engineering LORS;

4. Evaluate and recommend necessary changes in design; and

5. Prepare and sign all major building plans, specifications, and calculations.

E. The mechanical engineer shall be responsible for, and sign and stamp a statement with, each mechanical submittal to the CBO, stating that the proposed final design plans, specifications, and calculations conform to all of the mechanical engineering design requirements set forth in the Energy Commission's decision.

F. The electrical engineer shall:

1. Be responsible for the electrical design of the project; and

2. Sign and stamp electrical design drawings, plans, specifications, and calculations.

Verification: At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of rough grading, the project owner shall submit to the

CBO for review and approval, resumes and registration numbers of the responsible civil engineer, soils (geotechnical) engineer and engineering geologist assigned to the project.

At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of construction, the project owner shall submit to the CBO for review and approval, resumes and registration numbers of the responsible design engineer, mechanical engineer, and electrical engineer assigned to the project.

The project owner shall notify the CPM of the CBO's approvals of the responsible engineers within five days of the approval.

If the designated responsible engineer is subsequently reassigned or replaced, the project owner has five days in which to submit the resume and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

GEN-6 Prior to the start of an activity requiring special inspection, including prefabricated assemblies, the project owner shall assign to the project, qualified and certified special inspector(s) who shall be responsible for the special inspections required by the 2010 CBC. All onsite transmission facilities (lines, switchyards, switching stations, and substations) are handled in conditions of certification in the **Transmission System Engineering** section of this document.

A certified weld inspector, certified by the American Welding Society (AWS), and/or American Society of Mechanical Engineers (ASME) as applicable, shall inspect welding performed on-site requiring special inspection (including structural, piping, tanks and pressure vessels).

The special inspector shall:

1. Be a qualified person who shall demonstrate competence, to the satisfaction of the CBO, for inspection of the particular type of construction requiring special or continuous inspection;

2. Inspect the work assigned for conformance with the approved design drawings and specifications;

3. Furnish inspection reports to the CBO and RE. All discrepancies shall be brought to the immediate attention of the RE for correction, then, if uncorrected, to the CBO and the CPM for corrective action; and

4. Submit a final signed report to the RE, CBO, and CPM, stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications, and other provisions of the applicable edition of the CBC.

Verification: At least 15 days (or project owner- and CBO-approved alternative time frame) prior to the start of an activity requiring special inspection, the project

owner shall submit to the CBO for review and approval, with a copy to the CPM, the name(s) and qualifications of the certified weld inspector(s), or other certified special inspector(s) assigned to the project to perform one or more of the duties set forth above. The project owner shall also submit to the CPM a copy of the CBO's approval of the qualifications of all special inspectors in the next monthly compliance report.

If the special inspector is subsequently reassigned or replaced, the project owner has five days in which to submit the name and qualifications of the newly assigned special inspector to the CBO for approval. The project owner shall notify the CPM of the CBO's approval of the newly assigned inspector within five days of the approval.

We do not agree to the changes proposed in **CIVIL-1, -2, -3,** and **-4**.

We do not agree to the changes proposed in **STRUC-1, -2, -3,** and **-4**.

We do not agree to the changes proposed in **MECH-1, -2,** and **-3**.

ELEC-1 Prior to the start of any increment of electrical construction for all electrical equipment and systems 110 Volts or higher (see a representative list, below) the project owner shall submit, for CBO design review and approval, the proposed final design, specifications, and calculations. Upon approval, the above listed plans, together with design changes and design change notices, shall remain on the site or at another accessible location for the operating life of the project. The project owner shall request that the CBO inspect the installation to ensure compliance with the requirements of applicable LORS. All <u>onsite</u> transmission facilities (lines, switchyards, switching stations, and substations) are handled in conditions of certification in the **Transmission System Engineering** section of this document.

A. Final plant design plans shall include:

1. one-line diagram for the 13.8 kV, 4.16 kV and 480 V systems;
2. system grounding drawings;
3. lightning protection system; and
4. hazard area classification plan.

B. Final plant calculations must establish:

1. short-circuit ratings of plant equipment;
2. ampacity of feeder cables;
3. voltage drop in feeder cables;
4. system grounding requirements;
5. coordination study calculations for fuses, circuit breakers and protective relay settings for the 13.8 kV, 4.16 kV and 480 V systems;

~~system grounding requirements;~~

6. Lighting energy calculations; and

7. 110 volt system design calculations and submittals showing feeder sizing, transformer and panel load confirmation, fixture schedules and layout plans.

C. The following activities shall be reported to the CPM in the monthly compliance report:

1. Receipt or delay of major electrical equipment;

2. Testing or energization of major electrical equipment; and

3. A signed statement by the registered electrical engineer certifying that the proposed final design plans and specifications conform to requirements set forth in the Energy Commission decision.

Verification: At least 30 days (or project owner- and CBO-approved alternative time frame) prior to the start of each increment of electrical construction, the project owner shall submit to the CBO for design review and approval the above listed documents. The project owner shall include in this submittal a copy of the signed and stamped statement from the responsible electrical engineer attesting compliance with the applicable LORS, and shall send the CPM a copy of the transmittal letter in the next monthly compliance report.

HAZARDOUS MATERIALS MANAGEMENT

by: Geoff Lesh, PE, and Rick Tyler

Q: Regarding hazardous materials management, what updates to staff's testimony in the FSA address the Applicant's testimony of February 4, 2013?

A: Bright Source has proposed changes to staff's proposed conditions of certification in the **Hazardous Materials** Final Staff Assessment section. The change to conditions that staff disagrees with can be summarized as moving parts of the actual requirements of the condition to the verification. Staff opposes these types of changes as they would compromise the enforceability of the condition. The proposed changes to **HAZ-2** are clarifications that staff does not oppose and shows them below. Bright Source has proposed changes to staff's proposed conditions of certification **HAZ--3**, and **-5**. Staff disagrees with the proposed changes to **HAZ-3** and **-5** for the reasons stated above.

HAZ-2 The project owner shall concurrently provide a Hazardous Materials Business Plan to the Southern Inyo Fire Protection District (SIFPD) and Inyo County Environmental Health Services Department (ICEHSD) for review and comment, and the CPM for review and approval. After receiving comments from SIFPD, ICEHSD, and the CPM, the project owner shall ~~reflect all~~ address comments received recommendations in the final documents. If no comments are received from the county or SIFPD within 30 days of submittal, the project owner may proceed with preparation of final documents upon receiving comments from the CPM. Copies of the final Hazardous Materials Business

Plan shall then be provided to the ICEHSD and the Southern Inyo Fire Protection District for information, and to the CPM for approval.

Verification: At least 60 days prior to receiving any hazardous material on the site for commissioning or operations, the project owner shall provide a copy of a final Hazardous Materials Business Plan to the CPM for approval.

NOISE AND VIBRATION

by: Shahab Khoshmashrab

Q. What is the purpose of this testimony?
A. To respond to Applicant's testimony filed on January 29, 2013 and Cindy MacDonald's testimony filed on February 4, 2013.

Staff's Responses to the Applicant's Testimony:

Q. Do you agree with the Applicant's assertion that Condition of Certification **NOISE-8** is not necessary (Applicant's Noise Testimony, p. 4)?
A. Staff believes that because there could be the potential for pile driving to result in noise complaints, this condition of certification must remain. However, staff believes that in order to reduce the potential noise impact of this activity while making it a more practical requirement, this condition should be rewritten as follows to replace existing **NOISE-8**.

NOISE-8 The project owner shall notify the residents of Charleston View and M1 of pile driving prior to start of this activity. Pile driving shall be performed in a manner to reduce, as much as practicable, the potential for any legitimate noise complaints from the surrounding communities.
Verification: At least 5 days prior to first pile driving, the project owner shall notify the residents of Charleston View and M1 of the duration of this activity. In this notification, the project owner shall state that it will perform this activity in a manner to reduce the potential for any legitimate noise complaints, as much as practicable. The project owner shall submit a copy of this notification to the CPM prior to the start of pile driving.

~~**NOISE-8** The project owner shall perform pile driving using a quieter process than the traditional pile driving techniques to ensure that noise from this operation does not cause annoyance at monitoring locations CR1 and M1.~~
Verification: ~~At least 15 days prior to first pile driving, the project owner shall submit to the CPM a description of the pile driving technique to be employed, including calculations showing its projected noise impacts at monitoring locations CR1 and M1.~~

Q. Do you agree with the Applicant's proposed changes to the Noise and Vibration conditions of certification?
A. We only agree to the following changes shown in underline/strikeout. In regards to the changes that we do not agree with, we did not include them in the conditions below.

NOISE-1 Prior to the start of ground disturbance, the project owner shall notify all residents within one mile of the project site boundaries, by mail or by other effective means, of the commencement of project construction. At the same time, the project owner shall establish a telephone number for use by the public to report any undesirable noise conditions associated with the construction and operation of the project. If the telephone is not staffed 24 hours a day, the project owner shall include an automatic answering feature, with date and time stamp recording, to answer calls when the phone is unattended. This telephone number shall be posted at the project site during construction where it is visible to passersby. This or a similarly effective telephone number shall be maintained throughout the operational life of the project.

Verification: At least 15 days prior to ground disturbance, the project owner shall transmit to the compliance project manager (CPM) a statement, signed by the project owner's project manager, stating that the above notification has been performed, and describing the method of that notification. This communication shall also verify that the telephone number has been established and posted at the site, and shall provide that telephone number.

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NOISE-2 Throughout the construction and operation of the project, the project owner shall document all noise complaints and investigate, evaluate, and attempt to resolve all legitimate project-related noise complaints.

The project owner or authorized agent shall:

- use the Noise Complaint Resolution Form (below), or a functionally equivalent procedure acceptable to the CPM, to document all complaints and respond to each noise complaint by;
- attempting to contact the person(s) making the noise complaint within 24 hours;
- conducting an investigation to determine the source of noise in the complaint;
- taking all feasible measures to reduce the source of the noise if the noise is project related; and
- submitting a report documenting the complaint and actions taken. The report shall include: a complaint summary, including the final results of noise reduction efforts and, if obtainable, a signed statement by the complainant, stating that the noise problem has been resolved to the complainant's satisfaction.

~~**Verification:**~~**Verification:** Within five days of receiving a noise complaint, the project owner shall file a Noise Complaint Resolution Form, shown below, with the CPM, which documents the resolution of the complaint. If mitigation is required to resolve the complaint, and the complaint is not resolved within a three business-day period, the project owner shall submit an updated Noise Complaint Resolution Form when the mitigation is implemented ~~performed and complete~~.

NOISE-4 The project design and implementation shall include appropriate noise mitigation measures adequate to ensure that the operation of the project will not cause the noise levels due to normal steady-state plant operation alone to exceed an hourly average of 51 dBA L_{eq} measured at or near monitoring location CR1 and an hourly

average of 49 dBA L_{eq} measured at or near monitoring location M1. During transients, start-up and shut-down operations the noise level shall not exceed the allowable steady state noise limits by more than 3 dBA. The above noise limits exclude emergency operations.

No new pure-tone components (as defined in Noise Table A1) shall be caused by the project. No single piece of equipment shall be allowed to stand out as a source of noise that draws legitimate complaints[2].

When the project first achieves a sustained output of 90 % or greater of rated capacity, the project owner shall conduct a 25-hour community noise survey at monitoring locations CR1 and M1, or at a closer location acceptable to the CPM. This survey shall also include measurement of one-third octave band sound pressure levels to ensure that no new pure-tone noise components have been caused by the project.

The measurement of power plant noise for the purposes of demonstrating compliance with this condition of certification may alternatively be made at a location, acceptable to the CPM, closer to the plant (e.g., 400 feet from the plant boundary) and this measured level then mathematically extrapolated to determine the plant noise contribution at the affected residence. The character of the plant noise shall be evaluated at the affected receptor locations to determine the presence of pure tones or other dominant sources of plant noise.

If the results from the noise survey indicate that the power plant noise at the affected receptor sites exceed the above values, mitigation measures shall be implemented to reduce noise to a level of compliance with these limits.

If the results from the noise survey indicate that pure tones are present, mitigation measures shall be implemented to reduce ~~eliminate~~ the pure tones to a level that complies with Noise Table A1.

Verification: The survey shall take place within 30 days of the project first achieving a sustained output of 90 % or greater of rated capacity. Within 15 days after completing the survey, the project owner shall submit a summary report of the survey to the CPM. Included in the survey report will be a description of any additional mitigation measures necessary to achieve compliance with the above listed noise limits, and a schedule, subject to CPM approval, for implementing these measures. When these measures are in place, the project owner shall repeat the noise survey.

Within 15 days of completion of the new survey, the project owner shall submit to the CPM a summary report of the new noise survey, performed as described above and showing compliance with this condition.

[2] A legitimate complaint refers to a complaint about noise that is caused by the HHSEGS project as opposed to another source (as verified by the CPM). A legitimate complaint constitutes a violation by the project of any noise condition of certification (as confirmed by the CPM), which is documented by an individual or entity affected by such noise.

Regarding **NOISE-5** and **-6**, we do not agree to the changes to these Conditions.

Regarding **NOISE-7**, we agree to the following changes, shown underlined below.

NOISE-7 If a traditional, high-pressure steam blow process is used the project owner shall equip steam blow piping with a temporary silencer that quiets the noise of steam blows to no greater than 89 dBA measured at a distance of 50 feet. The steam blows shall be conducted between 7:00~~8:00~~ a.m. and 7:00~~5:00~~ p.m. unless arranged with the CPM such that offsite impacts would not cause annoyance to receptors. If a low-pressure, continuous steam blow process is used, the project owner shall submit to the CPM a description of the process, with expected noise levels and planned hours of steam blow operation.

Staff's Responses to Cindy MacDonald's Opening Testimony:

Q. What is your response to Section 1 (starting on p.21-4) regarding the accuracy of the noise survey data?

A. The applicant conducted a 9-day survey, taking noise measurements at St.Therese's Mission (M-1) and a selected residence at the Charleston View Residential Park (M-2). The extent of this sample exceeded the standard 25-hr. long-term survey required by CEQA. This survey was comprehensive and the applicant and staff used it as a basis for design and analysis.

Q. What is your response to Section 2 starting on p. 21-6 of Ms. MacDonald's testimony?

A. The applicant used calibrated instruments and performed the data gathering in accordance with industry-accepted standards. They would necessarily differ from the five-minute readings presented in Ms. MacDonald's testimony because the method and extent of the samples were different than the applicant's.

The propriety of choosing the location of M-1was made by the applicant and determined at the time the measurement instruments were set. The location was based on providing a representative sample, the security of the instruments, and permission from the homeowner to leave the instruments for the duration of the test. Standard mathematical derivation was used by the applicant and staff to apply survey results to the CR-1 site, which is physically closer to project property line.

Q. What is your response to Section 3 starting on p. 21-8 of Ms. MacDonald's testimony regarding the concrete batch operations and construction?

A. **NOISE-6** requires that nighttime construction be approved only by the CPM. This means that before such an activity, the project owner must inform staff of the length of time and the hours of night this activity will be performed and the noise levels to be expected at the nearest receptors. The project owner will also be required to notify all the residents within one mile of the project boundaries about the commencement of this activity. To ensure the project owner's adherence, staff has included specific language to **NOISE-6** that requires these steps to be taken by the project owner.

Because concrete pouring would be performed in a large area, its noise levels at the residential receptors would vary considerably depending on the location of this activity at any given time. In order to determine the precise noise levels at any receptor, a noise modeling would have to be performed for each location; there would be many. **NOISE-6** will ensure that the project owner

submits a statement to the CPM, specifying the time of night and the number of nights for which concrete pouring will occur, the approximate distance of this activity to the nearest receptors, and the expected sound levels at these receptors. Upon receiving this document/letter from the project owner, staff will evaluate the proposed mitigation measures and determine if they are sufficient. If not sufficient, staff will work with the project owner to revise those measures accordingly prior to the start of this activity. This has been the staff's standard practice and has worked well in protecting communities surrounding power plants.

With regards to the differences in the predicted noise levels between Figure 4 and Figure 5 of Ms. MacDonald's opening Testimony (p. 21-9), the values in Figure 4 are for distances of M1 and CR1 to the construction activities, 1.7 miles and 3,500 feet respectively, while the values in Figure 5 represent the noise levels predicted at 50 feet and 1 mile.

Q. What is your response to Section 4 starting on p. 21-10 of Ms. MacDonald's Testimony?
A. Both, the PSA and FSA encompass this analysis. The project's operational impacts have been calculated using industry-accepted methods and modeling software that account for all of the noise levels from operational equipment as listed in the AFC. Thus, the operational noise levels do not need to be recalculated. **NOISE-4** ensures that the project's operational noise levels meet the limits therein in order to limit the impacts to less than significant. The operational noise modeling used in this project is similar to those used in many other CEC-licensed power plant projects. Previously, most of the modeled noise levels have proven to meet the noise limits set forth for each respective project and staff believes that HHSEGS will do so as well. In the event it does not, **NOISE-4** would require the project owner to bring the project into compliance.

Q. What is your response to Section 5 starting on p. 21-12 of Ms. MacDonald's testimony?
A. The plant would only operate during the daylight hours, when the sun is shining, and thus would not have an operational impact at night.

Q. What is your response to Section 6 starting on p. 21-13 of Ms. MacDonald's testimony?
A. Construction traffic would be subject to the requirements in **NOISE-6**, such as restricted hours of 7 a.m. to 7 p.m. and requiring haul trucks to be equipped with adequate mufflers, operate in accordance with posted speed limits, and limiting engine exhaust brake use to emergencies.

Q. What is your response to Section 7 starting on p. 21-13 of Ms. MacDonald's testimony?
A. The applicant has accepted the lower noise limits as outlined in **NOISE-4** of the FSA, as opposed to the higher limits in the PSA. Thus, the Applicant agrees that adequate feasible mitigation measures are available to achieve these lower limits. Staff believes that adequate feasible mitigation measures are available to reduce the project noise by up to 3 dBA in order to comply with the limits in **NOISE-4**, but states that any reduction beyond that would likely be extremely difficult to achieve, considering the quiet character of the noise environment and the lack of intervening structures or topographical/natural barriers between the project site and the noise-sensitive receptors. The FSA does not claim that the project would need to be any quieter than required by **NOISE-4**; beyond the 3 dBA reduction that results in the limits in **NOISE-4**. If the project complies with those limits, then the impacts are considered less than significant. If the project does not comply with those limits, **NOISE-4** requires that the project owner implements additional mitigation measures to bring the project into compliance.

SOILS AND SURFACE WATER

by: Marylou Taylor

1. What issues has applicant raised with regard to the Soils and Surface Water section of the FSA?

   A: The applicant's testimony included revisions to the FSA with respect to State jurisdictional waters, proposed changes to COC **SOILS-1**, and proposed changes to COC **SOILS-6**.

2. Do you disagree with any of these issues raised?

   A: I only disagree with one change the applicant is proposing. having to do with **SOILS-6,** which requires both a detailed hydraulic analysis using FLO-2D and a Perimeter Drainage Management Plan. The applicant agrees that a Perimeter Drainage Management Plan would be beneficial, but states that the detailed hydraulic analysis is unwarranted. Staff believes the hydraulic analysis is necessary.

3. What reasons did they give that the hydraulic analysis is unwarranted?

   A: The applicant does not believe that the tortoise fencing would cause a significant increase in flooding potential along Tecopa Road. The applicant believes that the tortoise fence would not create a true flow obstruction due to the large open area to wire fence ratio (water would easily flow through the wire fence); that if the fence becomes clogged with debris, then flows would simply be routed around to an unobstructed area of the fence; that even with extensive clogging, the low strength of the fence material and relative shallow post depths would most likely create a failure of the fence long before a backwater depth of one foot is created; and, that the likelihood of these conditions occurring can be minimized by the design and good-housekeeping requirements in **SOILS-5** (Storm Water Management Monitoring and Response Plan) and **SOILS-6** (Perimeter Drainage Management Plan). Additionally, the applicant believes that FLO-2D calculations already provided in the AFC showed no impact.

4. Why do you disagree with Applicant's contention that such modeling is unnecessary?

   A: As shown on FEMA flood hazard maps and verified by the applicant's FLO-2D calculations provided in the AFC, portions of Tecopa Road currently flood in the vicinity of the project site. Intervener comments on the PSA prompted staff to further analyze the potential for exacerbated flooding at Tecopa Road adjacent to the proposed project site. Staff now believes the project has the potential to exacerbate existing flooding for the following reasons:
   - As seen in **Soils & Surface Water Figure 11** of the FSA, the tortoise fencing at the Ivanpah site dammed flows in numerous areas and eventually failed in a number of other areas because it trapped vegetation and debris. This experience clearly indicates the tortoise fence could block and slow the flow of water to the HHSEGS site. Additionally, the landscape screening required per Condition of Certification VIS-2 (Landscape

Improvements, Permanent Fencing and Screening) could also potentially impede flows resulting in localized flooding to Tecopa Road.

- Staff agrees that flows would be "routed around to an unobstructed area", but staff is considering conservative scenarios for the impact analysis. The length of fence adjacent to Tecopa Road would stretch approximately 1.95 miles. Soils & Surface Water Figure 10 shows that much of that length is placed in an area that currently experiences flood depths of about one foot from a 100-year, 24-hour storm.
- COC BIO-9 (Desert Tortoise Clearance Survey and Exclusion Fencing) requires that the tortoise fence be securely attached to the perimeter chain-link fence, which would increase its strength. Whether or not failure of the perimeter chain-link fence would occur prior to a backwater depth of 1 foot has not been analyzed.
- Although staff agrees that **SOILS-5** and **-6** would surely reduce impacts, accurate flow calculations and depth estimates are needed to determine if the design would reduce impacts enough to less than significant and meet staff's proposed requirements (shall not increase flood depth by more than one foot at any point on Tecopa Road).
- The FLO-2D modeling submitted in the AFC did not account for any perimeter elements (proposed landscaping, perimeter chain link fence and overlapping tortoise fencing) or the potential for these elements to obstruct flows adjacent to Tecopa Road. Because these elements were not considered flow obstructions, the model did not include them as physical characteristics of the proposed project. The additional analysis completed by staff in the FSA suggest there could be localized flooding that impacts Tecopa Road.

SOILS-6 was written to require the applicant to develop and implement a Perimeter Drainage Management Plan to reduce flooding and erosion damage to the section of Tecopa Road adjacent to the project site. and to show that incremental changes in flood depth on Tecopa Road would not exacerbate existing, baseline flooding.

- Analysis of flows related to specific storm events (2-, 5-, 10-, 25-, and 100-year) are needed to also show incremental impacts of the project. Although the performance criteria of "flood depth calculated for the 100-year, 24-hour storm, the analysis would show residents of Charleston View whether significant flooding to Tecopa Road would occur during smaller storms.
- Although the performance criteria of "flood depth… shall not increase more than one foot" applies to Tecopa Road, the analysis would show residents of Charleston View that incremental flooding to Tecopa Road would not result in significant incremental flooding to residential properties in Charleston View.

5. Would such a requirement be unnecessarily burdensome?

   A: No. The project's perimeter elements have the potential to exacerbate existing flooding on Tecopa Road. The applicant must show that project's design and maintenance procedures would prevent significant incremental flooding. FLO-2D is specifically identified because of its ability to simulate problems associated with flow obstructions. Additionally, staff assumes that the applicant's use of FLO-2D for the analysis submitted with the AFC would make FLO-2D more convenient for further analysis.

TRAFFIC AND TRANSPORATION

by: John Hope

TRANS-1

*BrightSource states Condition **TRANS-1** should be deleted because it is burdensome and has not been imposed on other similarly situated renewable energy projects.*

Staff disagrees with the deletion of Condition of Certification **TRANS-1**. As identified in the FSA, the intent of and need for Condition of Certification **TRANS-1**, as written, is to ensure all vehicles serving the proposed Hidden Hills project comply with applicable transportation laws (e.g., licensed drivers, vehicle weights). In addition, since 2008, eleven solar thermal projects have been approved and this condition was imposed on six of these projects including Palen, Genesis, Blythe, Calico, Palmdale, and Rice.

TRANS-2

*BrightSource states Condition **TRANS-2** should be revised to specify the project owner shall provide necessary right-of-way for acceleration and deceleration lanes.*

Staff disagrees with the requested revisions. Specifically, the revisions would remove the action of providing acceleration and deceleration lanes and in its place require submittal of a traffic study that identifies necessary improvements along Old Spanish Trail/Tecopa Road. Staff believes this would defer needed actions to reduce potentially significant impacts indentified in the FSA and defer mitigation.

TRANS-3

*BrightSource states Condition **TRANS-3** is more stringent than standard condition and states there is no justification for such.*

It should be noted that requested revisions to Condition of Certification **TRANS-3** in the PSA (removal of “or better” language) was completed as part of the FSA. Staff disagrees with requested revisions to Condition of Certification **TRANS-3** as needed actions to reduce potentially significant impacts indentified in the FSA should be part of the condition itself and not part of the verification process to ensure actions are implemented to prevent or substantially reduce the potential for an impact to occur. Specifically, the FSA identifies a substantial amount of construction workforce traffic would use Old Spanish Trail/Tecopa Road west of the project site on certain days. In addition, the FSA identifies the limited existing daily traffic along Old Spanish Trail/Tecopa Road. Condition of Certification **TRANS-3**, as written, is intended and needed to ensure all roadway damage to Old Spanish Trail/Tecopa Road, caused by heavy trucks or construction worker vehicles, would be repaired by the applicant.

TRANS-4

*BrightSource states Condition **TRANS-4** should be revised to limit the process to “legitimate” complaints.*

Staff disagrees with the requested revisions. Staff also questions how “legitimate” would be defined by the applicant. Specifically, Condition of Certification **TRANS-4** is written in such a way to prevent heavy trucks from using Old Spanish Trail/Tecopa Road west of the project site because Old Spanish Trail/Tecopa Road is not designed to handle heavy trucks. In addition, needed actions to reduce potentially significant impacts indentified in the FSA should be part of the condition itself and not part of the verification process to ensure actions are implemented to prevent or substantially reduce the potential for an impact to occur.

TRANS-5
*BrightSource states Condition **TRANS-5** should be revised to remove provisions that are not practical.*
Staff disagrees with the requested revisions. The intent of Condition of Certification **TRANS-5**, as written, is to require the applicant to work with local agencies (e.g., Inyo County) to substantially reduce or eliminate potential impacts created by increased construction traffic. In addition, needed actions to reduce potentially significant impacts indentified in the FSA should be part of the condition itself and not part of the verification process to ensure actions are implemented to prevent or substantially reduce the potential for an impact to occur.

TRANS-6
*BrightSource states Condition **TRANS-6** should be deleted because it is burdensome and unnecessary.*
Staff disagrees with the deletion of Condition of Certification **TRANS-6**. As identified in the FSA, the intent of and need for Condition of Certification **TRANS-6**, as written, is to ensure all vehicles serving the proposed Hidden Hills project comply with applicable laws associated with transportation of hazardous materials. In addition, since 2008, eleven solar thermal projects have been approved and this condition was imposed on five of these projects including Palen, Genesis, Blythe, Calico, and Palmdale.

TRANS-7
*BrightSource states Condition **TRANS-7** should be revised to allow for construction cranes up to 820 feet in height as a result of previous approvals from the FAA.*
Staff disagrees with the requested revisions. Condition of Certification **TRANS-7** is written in such a way to ensure the proposed project conforms to current FAA regulations (e.g., FAA Advisory Circular 70/7460-1K, FAA Safety Alert for Operators 09007) and not to any previous FAA determinations.

TRANS-8
*BrightSource states Condition **TRANS-8** should be revised to allow additional flexibility in developing and implementing the Heliostat Operations Positioning and Monitoring Plan.*
Staff disagrees with the revision of Condition of Certification **TRANS-8**. As identified in the FSA, the intent of and need for Condition of Certification **TRANS-8**, as written, is to ensure reflectivity would never be directed toward ground level viewers located outside the project site. Since 2010, eleven solar thermal projects have been approved and this condition was imposed on five of these projects including Palen, Blythe, Calico, Palmdale, and Rice. In addition, needed actions to reduce potentially significant impacts indentified in the FSA should be part of the condition itself and not part of the verification process to ensure actions are implemented to prevent or substantially reduce the potential for an impact to occur.

VISUAL RESOURCES

by: Melissa Mourkas

View Blockage
Q: Applicant's testimony on Visual Resources focuses much attention on view blockage from BLM Class I and II lands (Visual Resource Inventory, or VRI, ranking), filing two figures (figures

3 and 4) to illustrate that much of such land within a larger region will not have views of the site. What is your response to this contention?
A: Such a claim is unconvincing for several reasons. First, as discussed in the FSA, VRI lands with I or II ranking are lands that are sensitive to visual impacts because they have been inventoried to have high visual resource values. The FSA describes that there is a large amount of federal land with these high visual sensitivity values within proximity to the project site. Applicant's figures 3 and 4 include a very broad swath of land up to 40 miles from the project. The figures show that VRI I and II lands distant from the project do not have views of the project. But it matters little that you cannot see the project site from Tecopa or Death Valley. The important fact is that a very large area, including areas with large tracts of VRI I and II visually sensitive lands, do have direct views of the project site. And from many of these views the visual change will be dramatic, and the project elements will be dominant.

Q: So does it matter that 50% or 60% of the VRI sensitive lands depicted in the figures will not have a view of the project site?
A: Not at all. The testimony is conceptually flawed. The notion of view blockage from a certain percent of "visually sensitive" areas as a fundamental determinant of impact does not work. For instance, if one constructed a 750 foot power tower in Curry Village in Yosemite Valley, it would be a correct statement that, because of view blockage, it could not be seen from 99.99 percent of the surrounding visually sensitive parklands. That hardly means that the impact from the power tower in Yosemite Valley would be less than significant.
In addition, this notion of calculating a "percentage of blockage" of some set of visually sensitive lands can be manipulated by changing the scale and scope of the map one uses. If one wants to shrink the percentage, one merely makes the map include a larger geographic area. Here, had applicant's testimony focused instead on views within a 10 mile radius of the project site, a much higher proportion of sensitive lands occur within that radius. This is a false criterion that is subject to manipulation.

It is actually ironic that applicant would employ such an argument in this instance, because (unlike Yosemite Valley) views of the project site are largely unobstructed for a huge segment of the surrounding area because of the topography. View blockage is actually what it does not have. In fact, FSA Figure 26 shows that the project is clearly visible from portions of the Spring Mountains National Recreation Area, specifically the Bonanza Peak Trail, which is nearly 30 miles as the crow flies from the center of the project site.

Furthermore, the applicant's testimony has confused the use of the FSA Figures 1-4 as viewshed analysis, when in fact, the Figures and the associated discussion on FSA pages 4.12-1 through 4.12-5 were part of the description of the regional setting of the project. The FSA Figures 1-4 show the highly scenic character of the overall landscape of the regional setting and provide metrics for assessing the visual quality in general and for each KOP later in the analysis.

Screening Vegetation
Q: Applicant thinks views from residents in Charleston View (KOP 4) site will be mitigated to insignificant levels by offering screening vegetation at the residences. The applicant also concludes that impacts to views of visitors to the St.Therese Mission (KOP 3) will be less than significant as the modifications to the view at KOP 3 already taking place by construction of the Mission will cause the project to introduce only a moderate level of visual change. What is your response?

A: I disagree. Applicant's testimony suggests that if a resident puts a tree outside the north window, views of the project are blocked, and the problem solved. The problem is that people are not static and they move about in the world. That tree outside the Charleston View resident's window does not necessarily screen views from the driveway, the side yard, the street leading from the residence, a trip to the garbage bins, the drive to Tecopa and back, and so forth.

Mission visitors may have views of the project partially blocked while at the mission, but they will be very aware of it as they approach and leave. It is hard to imagine that the brightly glowing solar receivers atop the power tower structures will not be seen from the St. Therese Mission grounds in many areas of the complex, even with intervening structures or tree canopies. Consider that trees that are native to or thrive in the Mojave Desert tend to have an open and airy habit, not a dense foliage canopy that would effectively block some views. Additionally, the site plan renderings as seen in the Magnificat St. Therese Mission Project Brief show a large open area in the center of the complex, where views to the project will be largely unobstructed. Returning to the hypothetical power tower in Yosemite Valley: screening of views of the tower from existing vegetation might obscure views of the tower from 60 to 70 percent of the valley floor. But as people move within the park, the tower would be apparent, and the screening of some views would hardly make the impact less than significant.

Even so, I support the residential screening mitigation, which staff incorporated into Condition of Certification **VIS-7**, as it can help, but it is unrealistic to assume that such mitigation mitigates an impact of this magnitude to one that is insignificant. The towers are so large and dominant that they will be seen from many views proximate to the site, regardless of screening, and people do move around.

Number of Viewers

Q: Applicant's testimony states that the number of viewers is small based on Old Spanish Trail Highway/Tecopa Road counts, and states that it makes impacts less than significant. What is your response?

A: The focus on Old Spanish Trail Highway/Tecopa Road pertains to the most direct views, but is a complete oversimplification. The project can be viewed from Tecopa Road, of course, and will be. But there are many other people who will view it. First, you have the residents of Charleston View, who live in close proximity. They and their visitors will see it every day. However, because the project is so tall, because the project sprawls for more than 5 square miles, because it will have glowing boilers 750 feet above the ground, because it will have night lights and aviation warning lights, the towers will be visible from many areas in and around the City of Pahrump, and the entire site will be visible for the many thousands of drivers and passengers who daily drive Highway 160 in Nevada. The glowing boilers will be particularly visible during the day; the aviation lighting and ambient lighting will be very visible at night, particularly to those traversing Highway 160, who will have largely unobstructed distant views of the project below them.

Views from Wilderness Areas

Q: Applicant's testimony states that the fact that the project can be viewed from surrounding wilderness areas is of no moment, because the Wilderness Act and other laws do not protect wilderness from views from outside it. What is your response?

A: The statement totally avoids the real issue, which is not one of legal restriction, but one of impact. The Energy Commission's decision in the Rice AFC proceeding held that views from

wilderness areas that surrounded the project site were significant impacts because of their impact on that surrounding wilderness. That decision turned on the *impact* to surrounding wilderness, and had nothing to do with the entirely different issue of legal restriction. This is especially true when one considers the BLM's own definition of what Wilderness Areas, by their very nature, offer to visitors: "places of solitude where people may experience freedom from our fast-paced industrialized society". The project would have significant visual impacts to those experiences in the nearby Wilderness Areas.

Scenic Views

Q: The CEQA Guidelines Appendix G includes significance criteria for scenic impacts, and suggests that one such criterion for significant impacts is whether a project would damage a "scenic vista." Applicant's testimony states that there are no "scenic vistas" in the area because the local government has not designated the Old Spanish Trail Highway/Tecopa Road as a scenic highway. What is your response?

A: There are scenic vistas in every direction from the project site and surrounding areas. As the FSA states, and as confirmed by BLM's visual inventory analysis, this is an area with very high visual resource values. A claim that there cannot be a scenic vista without a government action declaring a particular view "scenic" is untenable. I know of nothing in CEQA or the law that would support such a curious distinction, or such an extraordinary contention.

Impact from Night Lighting

Q: Applicant's testimony states that night lighting will not be a significant impact because it can be mitigated with directional lighting, hooding, and other mitigation. What is your response?

A: I would like to believe this but I do not. Certainly there must be mitigation to reduce the night light from the project. But the project site, and the area surrounding Charleston View, is a very dark place with little ambient light and few direct light sources. There are no streetlights, and, at night, there is little traffic. There are no electronic or illuminated billboards. Houses are very modestly lit. The light from the project will make a very big change in this, particularly during construction, but also during operation. The site will be very visible. If Ivanpah is any guidance, there will be a significant amount of direct light from the site during construction. A photograph caption published in BrightSource Energy's *Update from Ivanpah, December 2012*, describes the beautiful sunrise over the project site, in which the project is lit up like a Christmas tree in a vast, dark desert landscape. Mirror washing, security lighting, and other light requirements will make the project site quite visible over a very broad area.

Aesthetics

Q: Applicant's testimony suggests that the project would provide an aesthetic enhancement to the area, as suggested by artistic photographic depictions of the Ivanpah project. What is your response?

A: Aesthetic judgments of this nature are individual and subjective. Photographers make artistic photos of all sorts of things, including the twisting curving symmetry of piping in industrial projects, the weird symmetry or asymmetry of clothesline laundry hanging in Brazilian *favelas,* or the blackened faces of coal miners. That is the nature of creative art. However, I think most people would find the assertion in applicant's testimony audacious: that placing a very large industrial facility in a classic western desert landscape somehow improves the view. Not a single intervener has characterized the addition of the project as an enhancement. Even those who have the potential to profit from additional tourism have taken a position against the project because it would negatively impacts the views.

Q: Do you agree with any of Applicants proposed changes to the conditions of Certification?
A: Yes. The applicant has suggested several changes with which I agree based on my experience with the compliance review process during construction and operation. Those are as follows:

> **VIS-1**: Within the body of the condition, the applicant has introduced the following underlined language: "Colors shall be chosen from palettes of color available from the manufacturers of the project's equipment that are similar to or consistent with the colors on the BLM's Standard Environmental Colors. The colors selected [shall] be pre-tested in the field to the extent feasible". All other language in the condition should remain as proposed, including the requirement to paint or tint the concrete power tower structures.
>
> **VIS-2**: Condition of Certification **VIS-2** was developed to include perimeter screening of the project based upon Inyo County LORS requiring screening of industrial uses (General Plan LU Policy 4.9: Landscaping and VIS 1.4: Equipment Screening). Condition of Certification **VIS-2** includes the requirement for perimeter plantings on the south, east and west boundaries and slatted fencing in all areas to achieve these goals. In further consultation with Biological Resources staff, it may be helpful to the project to limit the screening plantings to the southern boundary and to keep the height of the plantings low to discourage perching by ravens and raptors. Therefore, I agree with the applicant that the plantings may be limited to the southern perimeter of the site, providing screening to the residents of Charleston View and to those passing through on Old Spanish Trail Highway, but not for the reasons they put forward in their testimony. The need for privacy slats in the fencing is again a response to LORS. It may behoove the applicant to consider the role that slatting will provide in reduction of wind-born dust. Staff asserts that slatting is an integral tool in the screening of the project equipment and structures from the road and the community and at the very least, should be required for the entire boundary along Old Spanish Trail Highway.
>
> **VIS-7**: Condition of Certification **VIS-7** was built upon the applicant's suggested mitigation to provide tree plantings for residences in Charleston View in an effort to screen views of the project. I think that offering the planting of trees for the "life of the project" is not too burdensome as there are likely to be few new owners in the community of Charleston View. However, for the purposes of managing compliance, I think it reasonable to limit the period of time the project owner is responsible for offering this benefit can be limited to 2 years as suggested by the applicant's testimony.

The applicant has also suggested a change to part b.) of the condition with which I agree. The project owner may employ a local landscape contractor to implement the tree planting program rather than an arborist.

There are no other suggested changes to the Visual Resources Conditions of Certification with which I agree.

Q: Does this complete your rebuttal testimony?
A: Yes.

WATER SUPPLY

by: Mike Conway, John Fio, Gus Yates, CHG, and Paul Marshall, CHG

Q*:* What is the purpose of your testimony?

A: The purpose is to respond to the most significant elements of applicant's testimony filed January 28, 2013, and to address the most important elements of the disputes regarding ground water resources.

The applicant relies on incorrect quantitative analysis and gut instinct to predict the impact of the proposed project's pumping. Their conclusion is that impacts to local receptors (vegetation, well owners) will be zero. The applicant says the impact of project pumping, or drawdown in water levels would decrease to zero at a radius of 1,500 feet from each of the two production wells and these effects would not go beyond the project boundary. These estimates of impact are based on a two-week pumping test conducted on the site. The applicant has also agreed that it would be prudent to monitor changes in ground water levels associated with the project.
Staff's concerns are multi-fold, and it does not believe that the pumping test provides any reliable basis for the conclusions of non-impact voiced by applicant. As stated in the FSA, staff's concerns include local resident well impacts, impacts to mesquite areas (including the BLM ACEC) east of the project, cumulative basin impacts, and potential impacts to the Amargosa River.

With regard to protecting the mesquite areas on BLM land, staff designed a monitoring program that would initiate vegetation monitoring when the project's impact (draw down) exceeds 0.5 foot at the nearest mesquite stand. This "trigger" exceeds the applicant's drawdown prediction by at least two orders of magnitude (100 times). For example, based on their own calculations, the applicant would have to pump 100 times more water than planned each year to come close to hitting staff's currently proposed trigger of 1.0 foot at the site boundary or 0.5 foot of ground water decline at the nearest mesquite plants after 30 years of pumping. The source of the drawdown would be confirmed by additional monitoring wells between the project and the "trigger" point at the property boundary.

Staff believes that 1.0 foot of project-induced decline at the site boundary or 0.5 foot of project-induced water level decline at the nearest mesquite is a reliable and reasonable threshold – it is measurable, and would trigger the examination of vegetation to determine whether there are effects on the mesquite before irreversible damage is done. Therefore, staff does not agree to applicant's proposed change of the threshold from 0.5 feet to 2 feet in condition of certification **WATER SUPPLY-4**. Staff's calculations suggest that the project could result in drawdown that exceeds the 0.5 foot trigger by an increased order of magnitude (10 times, or five feet of decline) as early the end of project construction. Given that this was calculated using the average of the aquifer characteristics determined by the applicant, this scenario is plausible and the trigger is reasonable.

Q: How is it that the applicant and staff are so different in their conclusions?

A: The applicant has presented a highly questionable, if not completely incorrect, estimate of ground water level drawdown at distance. Again, the applicant appears to rely on instinct and incomplete analysis rather than accepted practice. Inyo County, BLM, and the Amargosa Conservancy have all reviewed the applicant's calculations and came to the conclusion that applicant's conclusions are unwarranted.

Based on staff's conclusions, and that of others (Inyo County, BLM, and the Amargosa Conservancy) analysis of staff's conclusions, it is reasonable to establish a monitoring program for offsite water level impacts. Staff has received positive feedback from all of the mentioned entities regarding trigger mechanisms and the proposed certifications.

Q: From an overall perspective, what is important about the applicant's new testimony?
A: First, as described below, the applicant has now filed analysis never introduced in data responses or workshops, or otherwise presented to staff and the parties. Staff has had little time to examine and respond to the applicant's latest theories on groundwater impacts, but staff believes most of them have little bearing on either the staff's conclusions or the applicant's suggested changes to the Conditions of Certification.

Second, there are some areas of agreement between staff and applicant, and these should not be overlooked. Staff for instance agrees that ground water quality monitoring should be done less frequently. These details are discussed below, near the conclusion of this testimony.

Third, having reviewed applicant's latest analysis, staff has important disagreements about the approach(es) used, which has led applicant to ascribe a high degree of certainty to its conclusions that staff believes are simply unwarranted.

Finally, although staff can agree to some changes in the Conditions of Certification, some of applicant's proposals would greatly undermine the effectiveness of mitigation, for reasons that are not justified. We urge these changes be rejected.

1. <u>Items of Disagreement</u>

Q: Why does the applicant continue to state that ground water recharge will limit the propagation of impacts?

A: The applicant continues to state that "recharge" will limit the propagation of drawdown. However the applicant has yet to identify any new sources of recharge to the system that would limit propagation of a cone of depression.

Rain falling in the Spring Mountains is known to provide new water to the Pahrump basin. However this rainfall will continue with or without the project and it is already contributing to the groundwater gradient we see in the basin today. If this project were to begin pumping, it would not result in new water that would flow into the system – the pumping would not cause new "recharge." The type of recharge that would be new with pumping would be termed "head-dependent" recharge, and would just be reallocating or

redirecting water already in the basin. For example, if project pumping lowered water levels in an area where alfalfa could no longer consume groundwater there would appear to be a new source of water in the basin. However, there would be no new water in the basin that was not there before, it has just been redirected because of project pumping. This type of recharge is irrelevant to analysis of project impacts.

a. **Q**: Did staff use unrealistic parameters for their analysis that predicted too much drawdown at distance?

A: Staff's drawdown analysis utilized only transmissivity (T) and storativity (S) values provided by the applicant.

They represent the range in reported and applicant-measured T and S values. As stated in the FSA, the drawdown analysis results capture the possible range in pumping impacts that are estimated by the reported/measured T and S values, thereby respecting the observed uncertainty in actual aquifer conditions represented by the range in actual reported/measured parameter values. Staff's drawdown analysis also assumed fully confined conditions and ignored the effects of a potential flow barrier from the State Line Fault System.

The assumption to discount the importance of the State Line Fault System is conservative: faults are usually partial or even significant barriers to underground flow. However, the permeability of the fault is not known, and discounting the existence of the fault provides the minimum and maximum estimated impacts to groundwater levels beneath Stump Springs and areas that support Groundwater-Dependent-Vegetation. Staff results support the need to monitor groundwater conditions and detect possible water level declines from project pumping that impact existing neighboring wells and groundwater dependent vegetation. The applicant's Water Supply testimony indicates that monitoring groundwater conditions for potential impacts is acceptable. So, with regard to the monitoring, there is agreement.

b. **Q**: Applicant's testimony is that the aquifer is "leaky", that is, it draws water from either above or below the aquifer. Does this matter with regard to the project impact? If the aquifer was leaky, would the extent of the project's pumping impact be lessened?

A. No. All of the project's water (4,900 acre-feet if project operates 30 years) would come from the basin. A leaky system could provide all of the water pumped by the project supply wells, but perhaps from two, three, or more aquifer units. The presence of a leaky aquifer system simply means that the pumped aquifer does not supply all of the water produced by the well. Overlying and/or underlying aquifer units contribute to supply the total volume.

The presence of a leaky aquifer system means that drawdown impacts are redirected to overlying and/or underlying aquifer units. In this case, for example, drawdown in overlying aquifers could potentially impact vegetation, and drawdown in underlying aquifers could potentially diminish basin outflow via the regional carbonate aquifer, which is presumed to

supply the Amargosa River. The applicant's testimony completely neglects these ancillary impacts, which could be highly significant.

c. Q: Can the "Stateline Fault System" isolate groundwater on the southwest side (including the project location) from groundwater on the northeast side, thereby protecting the mesquite growth areas along the east property boundary and on BLM land?

A: It is unlikely that the fault system completely isolates the two sides of the fault. The evidence indicates that one or more fault strands between the mesquite patches and the project's supply wells impede groundwater flow but do not completely block it. This presumably low-permeability fault system diminishes the amount of drawdown that would result from pumping on the other side of the fault, but some drawdown could, and likely would, still be transmitted across the fault.

Evidence that the fault is partially permeable includes:

- If the fault were impervious, groundwater levels would be essentially flat on either side. On the upgradient side (northeastern), the water table would intersect the ground surface and create a line of springs along the fault trace. All groundwater would cross the fault as surface flow from spring discharge.
- The presence of relatively shallow water tables and phreatophytic vegetation on the upgradient (northeastern) side of fault traces indicates that permeability across the fault is low, causing the water table to be shallow. For an example, see FSA **Water Supply Figure 5**.
- The regional groundwater gradient (shown by staff and Nye county data) is consistently shown as continuous from northeast to southwest across the basin. If the fault were impermeable, continuous contouring would not be possible, and groundwater on the northeast side of the barrier would be forced to flow in a more northerly direction to a different discharge point. This is strong evidence of fault permeability.
- While some desert basins in southeastern California have such impermeable faults (e.g. Twentynine Palms basin), the fault strand or strands between the project site and mesquite patches do not appear to be that impermeable.
- The applicant states that "the Valley Fill aquifer to the west of the fault that would be used by the project is primarily recharged in the eastern portion of the basin from runoff from the Spring Mountains." (p. 13, item 4, 1st paragraph) obviously, if the fault were a barrier, this recharge that applicant attests would never reach the project site on the other side of the fault.

d. Q: Staff has proposed a trend analysis of monitored water levels and well level decline “trigger,” as a method to define the threshold when the project owner would have to initiate monitoring of mesquite health east of the fault. Applicant states that staff’s suggested trend analysis of monitored water levels is ambiguous because of confounding influences. What is your response?

A: We disagree strongly. The applicant illustrates how recharge events associated with infrequent wet years disrupt the trends in some hydrographs, and can complicate trend analysis. Staff agrees observed water levels need to be corrected for recharge

events, seasonal water-level fluctuations caused by nearby irrigation pumpers, long-term declines associated with overdraft, and local drawdown from any future wells in the area in order to isolate project-related declines. However, staff believes this can be done for the following reasons:

- Many available long-term hydrographs—including all of the ones on the southwest side of the Pahrump-Stewart Valley Fault Zone—are smooth, with little to no seasonal pumping effects or responses to recharge events. This supports very precise linear regression estimates of long-term trends; as a result, well monitoring in this area is a reliable and predictable method.
- The hydrographs that show large responses to recharge events are located near washes where percolation from mountain front runoff is concentrated. This aspect of well location can be considered when evaluating trends.
- Long-term trends can be projected for 2-3 years through recharge events, then shifted to the post-recharge water level to continue the trend analysis without an unreasonable loss of accuracy.
- Seasonal fluctuations related to irrigation pumping (such as at Beyond Sherry's well) can be eliminated by linear regression, filtering using the method described in USGS Scientific Investigations Report 2006-5024, or other method.
- Effects of new wells can be estimated by drawdown analysis using aquifer parameters calibrated to on-site monitoring data.
- Declining trends due to regional overdraft can be estimated using linear regression over multiple years.
- Confounding water-level effects could also potentially be subtracted using a "double-mass" approach in which annual changes in a well potentially affected by the project are plotted against annual changes in a control well.

The above steps would produce a set of "corrected" water levels that could reflect the remaining project pumping effects. To be attributed to the project, drawdown would also need to decrease continuously with distance from the pumping well (the distance-drawdown test), start after the onset of project pumping, and would need to increase with time. These will provide clear markers of project pumping drawdown.

e. **Q**: Applicant states in its testimony that “trigger monitoring” is impractical, as no data analysis method is likely to detect a 0.5-foot impact? What is your response?

A: Again, we disagree. Wells on the southwest side of the Pahrump-Stewart Valley Fault Zone (i.e. at or near the project site) have long-term trends that are steady enough to detect a drawdown of 0.5 foot using linear regression. As discussed above, the most complete record of water levels currently available show that water levels in all onsite wells have a steady trend with >95% confidence. One-half of a foot is well within this range of confidence.

The new monitoring wells installed on the project site are expected to have similarly smooth long-term downward trends. This contrasts to the water levels for most (but not all) wells located *northeast* of the fault zone. The water levels in these wells might not support a detection limit of 0.5 foot, depending on how successfully the confounding water-level influences can be filtered out. But the northeast-of-fault wells are not critical for this monitoring of drawdown.

f. **Q**: Applicant states that the barrier effect of the fault decreases drawdown by a factor of 10 on the opposite side of the fault from HHSEGS. What is your response?

A: As stated above, the fault's permeability is unknown, and staff cannot accept this optimistic assumption because it is risks the existence of the valuable mesquite habitat on BLM land located just east of the fault. Additionally this is inconsequential to the **WATER SUPPLY-4** as staff proposed it. Any time prior to, or when the 0.5 foot trigger is hit, the applicant has the opportunity to prove through field data, that the fault serves to buffer the impact to the mesquite on the other side. The argument by applicant that the fault is impermeable is based on applicant's new water chemical analysis, which staff believes does not warrant the conclusions applicant has drawn. Staff disagrees with applicant's interpretation of ground water chemistry and isotope data and applicant's conclusion that the proposed project's water source is isolated from the source supplying Stump Springs and mesquite habitat in the area. After a quick review of the new data provided by the applicant, staff is not convinced that the new water quality data provides any additional support for the applicant's contention that the new data proves discrete and separate sources of water to Stump Springs and the HHSEGS site. For instance, the water collected at Stump Springs was a surface water sample, while the others are ground water samples. It should be no surprise that these two samples have unique isotopic signatures; evaporation of the surface water pool could easily explain the difference. This in no way speaks to the source of water to each area.

The applicant also presented Stiff diagrams in their rebuttal, stating that the the cation and anion constituents in the water samples differ between Stump Springs and the site. Not only does staff disagree that the Stiff diagrams indicate different types of water, this is also inconsequential. Staff is concerned with protecting mesquite near the border of the project. These samples do not speak to the quality of the water beneath the mesquite in this location. To date we have no samples from this area.

As previously stated, the fault likely will diminish drawdown, but the extent of this reduction is unknown. Long-term water-level trends are influenced primarily by a well's proximity to pumping and not its proximity to the fault. The wells on the east side of the fault are closer to regional and local pumping stresses than wells on the west side. Accordingly, the average annual decline is greater on the east side of the fault, where the pumping rate is relatively greater, than the west side where the pumping rate is relatively lower. Thus, a second plausible explanation exists for the smaller observed historical drawdown on the west side of the fault.

g. **Q:** The applicant suggests that a more lenient threshold (2.0 feet) for drawdown would protect mesquite near the site boundary, and that its proposed "Tier 2" mitigation would provide timely benefits to vegetation? What is your response?

A: Staff disagrees. First, because a 2.0 foot threshold would be insensitive to critical impact on the mesquite habitat, and unnecessarily so for the reasons discussed previously (i.e., reliability of SE well monitoring). Second, because the Tier 2 measures are not sufficiently quick to provide protection, providing only delayed results that may also be speculative. For instance, Tier 2 reduced pumping in northern Pahrump Valley: it

would take years or decades for pumping reductions in northern Pahrump Valley to benefit water table elevations at the BLM mesquite habitat. Also, it is speculative as to what other sources of water "might then be available." Finally, a groundwater feasibility study is unnecessary if recharge was already implemented in Tier 1, and a feasibility study would not achieve timely mitigation in any case.

h. **Q**: Applicant's testimony proposes measuring mesquite stand expansion/retreat as a better approach to monitoring the health of the mesquite patches, rather than the quantitative measures proposed in **BIO-23** or soil coring to study root depths. What is your response?
A: Staff disagrees with this approach. See staff's biology rebuttal testimony.. By the time die-back is detected, it will be too late to mitigate with a decrease in pumping. The water-level recovery would take as long to reach the mesquite as the original water-level decline, so drawdown would continue to get worse for some period of time (years?) before it would improve. Soil coring is offered by staff as a supplement to the quantitative measures of plant stress. This could provide the applicant valuable evidence of the rooting depth of the mesquite which could be used along with other evidence to show whether the project pumping is a potential.

2. Areas of Agreement

a. **Q**: Can staff agree to quarterly rather than monthly monitoring of groundwater quality, as proposed by the applicant?
A: Yes, any impacts should be indirect and gradual. Quarterly sampling should be sufficiently representative and protective.

3. Items Needing Clarification

a. **Q:** Applicant contends that its pump tests prove that the aquifer beneath the HHSEGS site is a "leaky" confined aquifer, and that this would preclude any impact to local wells or habitat. What is your response?
A: As stated in the FSA, "staff agrees with the applicant that the water level response in some of the wells could possibly indicate local leaky aquifer conditions." However, the applicant ignores the limitations in their analysis and the resulting uncertainty in their conclusions. For example, the applicant's model of the aquifer system requires that there be three discrete units that supply water to the well, two aquifers with an aquitard in between them. The applicant's conclusions about total drawdown looked at only one of these three units, resulting in a conclusion about drawdown that is necessarily incomplete and totally unreliable. Furthermore, the applicant fails to quantify the groundwater level and storage changes that would occur in the other two units. Staff's conclusion about the applicant's analyses is shared by Inyo County, BLM, and the Amargosa Conservancy.

b. **Q**: How does staff need to modify Condition of Certification **WATER SUPPLY-1**?

A: **WATER SUPPLY-1** requires the applicant to offset all of their use in the Pahrump Valley basin. An example of an effective offset would be an irrigation efficiency improvement project that could save about 148 acre-feet per year. If this could be shown to be a viable improvement project with lasting impact, it would have the potential to offset all of operation and construction pumping (assuming 2 years, 5 months construction and 30 years operation).

The project may be offset continuously by an average annual amount over the construction and operation periods. The weighted average of 2.5 years at 288 AFY and 30 years at 140 AFY is 151 AFY. It is not necessary to arrange separate offset amounts for the construction and operation periods. The storage impacts are long-term, and the difference in pumping rates for the two periods will be buffered by groundwater storage capacity. Applicant's proposal to eliminate mitigation for construction use, the years when water use is highest, makes no sense at all, and should not be considered.

Staff proposes additional changes to **WATER SUPPLY-1** that clarify the type of measure that qualifies as an offset. The measure must eliminate recent historical consumptive use of groundwater in the basin. In other words, it must involve "wet" water, not just "paper" water. Examples of acceptable offsets long term retirement of land that has been irrigated during the past 5 years, changing crops to ones that consume less water, and changing to irrigation methods that reduce evaporation losses from sprinkler spray or bare soil.

An example of an ineffective an unacceptable offset would be the purchase of water rights that have not been used in the last few years. The Pahrump Valley basin has many more water rights than it has users of water, but it is still in overdraft. To be effective, a water rights offset would have a recent use history equal to project pumping and would also be one reasonably expected to continue into the future. Water rights that have been unused in the last few years would not meet the intent of retiring a current water use in the basin. Also unacceptable are offsets that decrease gross pumping but not net consumptive use. For example, high-efficiency residential plumbing fixtures decrease gross water use but decrease groundwater recharge from septic systems by an equal amount. There would be no net change in overall consumptive use of groundwater.

4. New Material Presented By Applicant in Their Rebuttal

The applicant has added new material, discussed here, as well as provided new analysis and theories. Staff has some fundamental disagreements with portions of the new analyses which are they are discussed in more detail earlier in this testimony and below.

a. **Q**: The applicant presented new geochemical data of groundwater constituents from both sides of the fault, and contends that the isotope data demonstrates that the fault is an impervious barrier to groundwater movement, and that the water supply to each side is unique. What is your response?

A. Staff disagrees with applicant's interpretation of ground water chemistry and isotope data and applicant's conclusion that the proposed project's water source is isolated from the source supplying Stump Springs and mesquite habitat in the area. After a quick review of the new data provided by the applicant, staff is not convinced that the new water quality data provides any additional support for the applicant's contention that the new data proves discrete and separate sources of water to Stump Springs and the HHSEGS site. For instance, the water collected at Stump Springs was a surface water sample, while the others are ground water samples. It should be no surprise that these two samples have unique isotopic signatures; evaporation of the surface water pool could easily explain the difference. This in no way speaks to the source of water to each area.

The applicant also presented Stiff diagrams in their rebuttal, stating that the the cation and anion constituents in the water samples differ between Stump Springs and the site. Not only does staff disagree that the Stiff diagrams indicate different types of water, this is also inconsequential. Staff is concerned with protecting mesquite near the border of the project. These samples do not speak to the quality of the water beneath the mesquite in this location. To date we have no samples from this area.

In summary, the new ground water data is interesting, but does not give staff pause in suggesting the Conditions as they are, without modification.

b. **Q**: Applicant's testimony states that its water-level trend analysis (pgs. 20-22 and Figure 9) indicate that 0.5 foot of drawdown would be statistically impossible to detect? What is your response?

A: No, staff disagrees. As discussed above, the most complete record of water levels currently available show that water levels in all onsite wells have a steady trend with >95% confidence. One-half of a foot is well within this range of confidence.

5. <u>Summary of Staff's Changes</u>

a. Clarification of WATER SUPPLY-1.

Staff could not accept the applicant's suggested revisions. The condition remains generally unchanged. Staff also refined the language of the condition to state more clearly that the offset must constitute a real water savings for the basin. Paper water rights are unacceptable.

b. Staff accepts most of applicant's revisions to WATER SUPPLY-4

Staff accepted the applicant reorganization of the condition. Please read entire revised condition contained in the next section of this document.

Most significant changes include:

1. Staff's proposed trigger has not changed and would still require the initiation of monitoring when 0.5 foot of decline is measured at the site boundary.
2. Staff agreed to change all monthly ground water quality sampling events to quarterly.

c. Staff accepts applicant's revisions to WATER SUPPLY-6

Staff agreed to remove language from this subsidence condition that would require the project to "cease" pumping.

d. Staff does not accept applicant's revisions to WATER SUPPLY-7

Staff made no changes to this proposed condition. It is staff's belief that the Energy Commission cannot issue a permit for a Non-Transient, Non-Community water system in-lieu of the County of Inyo. This authority is granted through the Federal Safe Drinking Water Act.

6. <u>Detailed Modifications to Conditions of Certification</u>

WATER USE OFFSET PLAN

WATER SUPPLY-1: The project owner shall submit a Water Supply Plan that will identify how the project would mitigate project overdraft impacts to Pahrump Valley Groundwater Basin (PVGB). These activities shall result in replacement of 288 acre feet per year of groundwater consumptive use during the construction period and 140 acre-feet per year during the project operation period. Alternatively, consumptive use may be decreased by the weighted average of 151 acre-feet per year throughout both periods. Replacement shall occur or be in implementation; by the time the project begins to pump groundwater for construction. Offsets must be a reduction in consumptive use of groundwater, not groundwater pumping. The activities proposed for mitigation may include, but are not limited to, retirement of water rights currently in use (actively pumping with a sufficient recent use history), forbearance of water use, and water conservation. The proposed method would be outlined in the Water Supply Plan to be submitted to the CPM for review and approval.

The Water Supply Plan shall include the following at a minimum:

1. Identification of the activity and water source that would replace 288 acre feet per year for construction and 140 acre-feet per year for groundwater pumped from the PVGB during project operation, or an average of 151 acre-feet per year throughout both periods;
2. Demonstration that the offset is a reduction in consumptive use, not just in gross groundwater pumping.
3. Demonstration of the project owner's legal entitlement to the water or ability to conduct the activity;
4. Include a discussion of any needed governmental approval of the identified activities, including a discussion of the discussion of the conditions of approval;
5. Discuss whether any governmental approval of the identified activities would be needed, and, if so, whether that approval would require compliance with CEQA or NEPA;
6. Demonstration of how water pumped from the PVGB would be replaced for each of the activities;
7. An estimated schedule for completion of the activities;
8. Performance measures that would be used to evaluate the amount of water replaced by the activities;
9. Monitoring and Reporting Plan outlining the steps necessary and proposed frequency of reporting to show the activities are achieving the intended benefits and replacing PVGB extractions.

The project owner shall implement the activities reviewed and approved in the Water Supply Plan in accordance with the agreed upon schedule in the Water Supply Plan. If agreement on identification or implementation of mitigation activities cannot be achieved the project owner shall not begin construction or operation until assurance that the agreed upon activities can be identified and implemented.

Verification: The project owner shall submit a Water Supply Plan to the CPM for review 120 days prior to start of construction. Pumping will not begin until the Water Supply Plan has been approved by the CPM and implemented by the project owner.

WATER LEVEL MONITORING FOR NEIGHBORING WELLS, MITIGATION AND REPORTING

WATER SUPPLY–4: The project owner shall submit a Groundwater Monitoring, Mitigation, and Reporting Plan (GMMRP) to the CPM for review and approval in advance of construction activities and prior to the operation of onsite groundwater supply wells. The GMMRP shall provide detailed methodology for monitoring background, on site, and off□site groundwater levels and water quality. It shall show how the monitoring program will be effective in evaluating project pumping impacts on domestic well owners. The monitoring period shall include pre□construction, construction, and project operation periods. The plan shall establish pre□construction and project related groundwater level trends and water quality that can be quantitatively compared against predicted trends near the project pumping wells and near potentially impacted resources. The GMMRP shall include all of the following:

Monitoring Well Locations

The project owner will install up to thirteen (13) wells, subject to the ability to gain access and the right to use certain off□site well locations. Unless otherwise noted, all newly constructed monitoring wells shall be installed to a depth that matches the depth of the project pumping wells. The monitoring well locations should be as follows:

- Three wells directly up□gradient (gradient hereafter refers to inferred groundwater potentiometric surface included as part of staff analysis) from the Power Block 1 production well, in a linear array, within the property boundary. Two wells shall be installed within one –half mile of the Power Block 1 production well. The third well site shall be as close to the property lines as possible (the “Power Block 1 Monitoring Well Array”).

- Two wells directly up□gradient from the Power Block 1 production well (well site not yet identified), between 1.0 and 1.5 miles from the project property boundary at the western edge of the mesquite thicket on BLM land. One well shall monitor water levels at the water table, and the second well shall be installed to a depth that matches the depth of the project pumping wells. ("BLM Mesquite Thicket Monitoring Well 1-Shallow" and "BLM Mesquite Thicket Monitoring Well 1-Deep").

- Three wells directly up□gradient from Power Block 2, in a linear array, within the property boundary. Two wells shall be installed within one□half mile of the Power Block 2

production well (well site not yet identified) with the third well being as close to the property lines as possible (the “Power Block 2 Monitoring Well Array”).

- Two wells directly up□gradient from Power Block 2, between 1.0 and 1.5 miles from the project property boundary, at depths corresponding to the water table and the depth of the project pumping wells. (the “BLM Mesquite Thicket Monitoring Well 2-Shallow" and ” BLM Mesquite Thicket Monitoring Well 2-Deep").

- One well at the southern end of the site within the project boundaries (the “Southern Monitoring Well”).

- One well at the northern end of the site within the project boundaries (the “Northern Monitoring Well”).

- One well offsite in California between 2.0 and 3.0 miles from the southwest corner of the site, located between a bearing of southwest (225°) and west (270°) (the “Offsite California Monitoring Well”).

On - Site and Off - Site Monitoring Well Locations

The eight monitoring wells located within the project Site shall be known as the “On□Site Monitoring Wells.” The three monitoring wells located outside the project site (BLM Mesquite Thicket Monitoring Well 1, the BLM Mesquite Thicket Monitoring Well 2 and the Offsite California Monitoring Well) shall be known as the “Off□Site Monitoring Wells.”

The On□Site Monitoring Wells shall be installed and operational at least 3 months prior to the start of pumping at the project supply wells for project construction.

The ability to gain access to and the right to use the Off□Site Monitoring Wells is subject to the project owner’s ability to obtain the right to use these sites for groundwater monitoring purposes. If the right to use one or more of the Off□Site Monitoring Wells is denied or delayed, the Project Owner shall continue to use commercially reasonable efforts to obtain the right to use these sites and propose for CPM review and approval alternative location(s) for Off□Site Monitoring Wells should right to use be denied. During the time when the Project Owner is pursuing the right to use sites for the Off□Site Monitoring Wells, the Project Owner shall nevertheless be allowed to proceed with the GMMRP and construction of the Project.

Background wells shall be the existing wells beyond the extent of project pumping either on□site or off□site that the project owner is able to access and monitor before commencement of project construction and during subsequent project construction and operation. As authorized access allows, measure groundwater levels from the Off□Site Monitoring and On□Site Monitoring Wells within the network and Background Wells to provide initial groundwater levels for contouring and pre□project trend analysis. Assess the apparent trend and delineate project induced drawdown using the Drawdown Distance Method described below.

Distance Drawdown Methodology

Drawdown will be evaluated using the “Distance Drawdown Plot Method” applied to filtered water levels, which are measured water levels from monitoring and background wells adjusted to remove identifiable effects of:

- Regional long-term water level trends
- Seasonal water-level fluctuations related to nearby irrigation pumping
- Groundwater recharge events during wet years
- Drawdown from any new non-project production wells installed near the monitoring network.

These confounding influences on water levels may be removed by linear regression, filtering of periodic stresses (such as by using the method described in USGS Scientific Investigations Report 2006-5024), or other appropriate statistical method consistent with hydrogeologic principles and approved by the CPM. While the filtering process is expected to remove many sources of water level variation in the aquifer, it will not account for extraneous factors for which we do not have reliable data. Therefore, the drawdown that remains after the filtering process cannot be definitively assigned to project related pumping unless it’s timing and spatial pattern follow the established hydraulic laws that govern the shape of a cone of depression in an aquifer. Specifically, drawdown from project pumping should decrease with distance from the pumping wells and increase with time at any location. Furthermore, when drawdown is plotted on a semi-logarithmic distance-drawdown plot, the points should approximate a line and the transmissivity calculated from the slope of the line should be similar to the transmissivity values defined by initial pumping tests.

If project-related drawdown identified by the above filtering procedure exceeds specified thresholds mitigation will be implemented, as described in Section B (below). If the drawdowns measured in either the Power Block 1 Monitoring Well Array or the Power Block 2 Monitoring Well Array in the aquifer cannot be attributed to the project using the foregoing methodology, they may be associated with other causes and if the causes can be identified the applicant will not be required to institute the mitigation measures.

A. Prior to Project Construction

The project owner shall:

1. Conduct a well reconnaissance review to investigate and document the condition of existing water supply wells located within 3 miles of the project site, provided that access is granted by the well owners. The reconnaissance shall include mailing notices to all property owners within 3 miles of the project site requesting information about wells and informing the owners of the eligibility requirements for mitigation of any future drawdown impacts caused by the project, as described in Section C, below. The review shall identify the owner of each well, and shall include the location, depth, screened interval, pump depth, static water level, pumping water level, and capacity of each well to the extent such information is reasonably available or can be measured.

2. As access allows, measure groundwater levels from the off site and on site wells within the network and background wells to provide initial groundwater levels for contouring and pre-project trend analysis.

3. Construct updated water level maps within the Pahrump Valley basin, within 5 miles of the site from the groundwater data collected prior to construction. Update trend plots and statistical analyses, as data are available.

4. Commence water quality monitoring to establish pre□construction groundwater quality conditions in the monitored wells. All on-site and off-site monitoring wells shall be sampled at least quarterly for the following constituents: TDS, chloride, nitrates, major cations and anions, oxygen□18 and deuterium isotopes

5. Minor construction activities that do not require pumping from the main project supply wells may proceed before the on-site monitoring wells have been installed. However, all of the on-site monitoring wells shall be installed and operational within 3 months of the start of construction pumping from the project supply wells.

6. Within 3 months of the start of pumping from the project supply wells, all baseline groundwater quality monitoring data shall be reported to the CPM. The report shall include the following:

> a. An assessment of pre□project groundwater quality with groundwater samples analyzed for TDS, chloride, nitrates, major cations and anions, oxygen□18 and deuterium isotopes. The data shall be tabulated, summarized, and submitted to the CPM. The data summary shall include the range (minimum and maximum values), average, and median for each constituent analyzed. The report to the CPM shall assess the utility of these constituents for future monitoring. Any recommendations to add or remove constituents shall be supported with the data and other relevant factual evidence.
>
> b. The CPM shall finalize the required list of constituents to be analyzed based the review of two years of water quality monitoring results. The CPM may modify the frequency of sampling required depending on the trends demonstrated by the monitoring results.

B. Groundwater Monitoring and Protection of Groundwater Dependent Vegetation During Construction and Operation

The project owner shall:

1. Collect water levels from wells within the monitoring network on a twice daily basis (based on site and well access) throughout the project construction and operation periods. Delineate project induced drawdown using the data filtering and distance-drawdown plotting procedures (see "Distance Drawdown Methodology" above).

2. If water levels in either of the Power Block 1 or Power Block 2 Onsite Monitoring Wells indicate drawdown one-half (0.5) foot or greater at the northeastern property boundary, the project owner shall examine the result of groundwater dependent vegetation monitoring as required in **BIO-23** and submit a report to the Commission summarizing the results of the monitoring and the potential impacts to mesquite. This does not preclude the project owner from starting to monitor when pumping begins.

3. If water levels in either of the Power Block 1 or Power Block 2 Onsite Monitoring Wells identify drawdown one (1.0) foot or greater at the northeastern property boundary, or water levels in either of the deep mesquite thicket monitoring wells indicate one-half (0.5) foot or greater drawdown due to project pumping during construction or operation, the project owner shall initiate groundwater mitigation to reduce project related drawdown to less than one (1.0) foot at the northeastern property line and less than 0.5 foot in the deep mesquite thicket monitoring wells and maintain it below those levels for the life of the project. Mitigation measures may include, but are not limited to:

- relocating the pumping wells to the western portion of the site to increase the separation of the wells from the site's northeastern boundary and allow water levels to recover in areas northeast of the site;

- groundwater recharge to replace all or a portion of the project pumping and restore groundwater levels along the northeastern site boundary;

- Purchase and retire additional actual groundwater consumptive use at a nearby location in the basin.

- Seek project water from other sources that may then be available.

- Decrease project pumping.

4. During project construction, the project owner shall quarterly monitor the quality of groundwater and changes in groundwater quality in the monitoring network and submit data semiannually to the CPM. The summary report shall document water quality monitoring methods, the water quality data, water quality plots, and a comparison between pre□ and post□construction water quality trends as itemized below. The report shall also include a summary of actual water use conditions. The report shall be provided to CPM 60 days following completion of each semi□annual monitoring period.

a. Groundwater samples from all wells in the monitoring well network shall be analyzed and reported semiannually for the following constituent list: TDS, chloride, nitrates, major cations and anions, oxygen□18 and deuterium isotopes.

b. The compliance data shall be analyzed for both trends and for contrast with the pre-project data. For analysis purposes, pre□project water quality shall be defined by samples collected prior to project construction as specified above, and compliance data shall be defined by samples collected after the construction start date.

5. During the first year of project operation, the project owner shall monitor the quality of groundwater and changes in groundwater quality in the monitoring network and submit data semiannually to the CPM. Sampling will be on a quarterly basis.

6. After the first year of project operation, the project owner shall quarterly monitor the quality of groundwater and changes in groundwater quality in the monitoring network and submit data

semiannually to the CPM. The summary report shall document water quality monitoring methods, the water quality data, water quality plots, and a comparison between pre□ and post□construction water quality trends as itemized below. The report shall also include a summary of actual water use conditions.

a) Groundwater samples from all wells in the monitoring well network shall be analyzed and reported semiannually for the constituent list approved by the CPM.

b) The compliance data shall be analyzed for both trends and for contrast with the pre□project data. For analysis purposes, pre□project water quality shall be defined by samples collected prior to project construction as specified above, and compliance data shall be defined by samples collected after the construction start date.

7. Groundwater quality data shall be used to ensure the project owner complies with the requirements of **WATER SUPPLY□7**. If the water quality data show that project pumping is causing a decline in water quality that could lead to exceedance of the allowable Water Quality Objectives for beneficial uses of the PVGB the project owner shall prepare an engineering report consistent with the RWQCB requirements for protection of beneficial uses (See also SOILS□9, Septic System).

C. Protection for Neighboring Wells

If the monitoring well system put in place pursuant to this Condition demonstrates that water levels in neighboring wells have been lowered as a result of project□related drawdown 10 feet or more (under static□non□pumping conditions), the project owner shall provide CPM with evidence that the project owner has offered to compensate private well owners for the increased energy cost associated with pumping groundwater as a direct result of a drop in water levels associated with the project groundwater use. In the absence of specific electrical use data supplied by the well owner, the project owner shall use **WATER SUPPLY-5** to calculate increased energy costs. Payment or reimbursement for the increased costs shall be provided at the option of the affected well owner on an annual or one-time lump sum basis.

If Project pumping has lowered water levels in existing neighboring wells and substantially impacts well yield so that it can no longer meet its intended purpose, causes the well to go dry, or causes casing collapse, an assessment of remedial options will be conducted by project owner, followed by payment or reimbursement of an amount equal to the cost of cleaning or rehabilitating the well to restore its capacity, lowering the pump (as in item (e) below), deepening the well, or replacing the well (as cooperatively determined as the appropriate resolution) shall be provided to accommodate these effects. Payment or reimbursement shall be at an amount equal to the customary local cost of deepening the existing well or constructing a new well of comparable design and yield (only deeper). If water levels decline due to multiple causes, payment or reimbursement shall be in proportion to the project's share of the total water-level decline. The demand for water, which determines the required well yield, shall be determined on a per well basis using well owner interviews and field verification of property conditions and water requirements compiled as part of the pre□project well reconnaissance. Well yield shall be considered substantially impacted if it is incapable of meeting 110% of the well owner's maximum daily demand, dry□season demand, or annual demand – assuming the pre□project well yield documented by the initial well reconnaissance met or exceeded these yield levels. To be eligible for the well protection guarantee program, the well owner must inform

the project owner during the pre-project reconnaissance survey (see Section A.1) of the location of the well, provide such well construction data as may be known, and authorize the project owner to inspect the well, document relevant factors such as the well depth, depth to static water level, pumping rate, and pumping water level, and allow the project owner access to the well to verify the conditions of any claims.

Pump lowering – In the event that groundwater is lowered as a result of project pumping to an extent where pumps are exposed but well screens remain submerged under static nonpumping conditions, the pumps shall be lowered to maintain production in the well. The Project shall pay or reimburse the impacted well owner for the costs associated with lowering pumps.

Deepening of wells – If the groundwater is lowered enough as a result of project pumping that well screens and/or pump intakes are exposed under static□non□pumping conditions, and pump lowering is not an option, such affected wells shall be deepened or new wells constructed. The project owner shall reimburse the impacted well owner for all reasonable costs associated with deepening existing wells or constructing new wells shall be borne by the project owner.

After the first five□year operational and monitoring period the CPM shall evaluate the data and determine if the monitoring program for water level measurements and groundwater quality should be revised or eliminated. Revision or elimination of any monitoring program elements shall be based on the consistency of the data collected. The determination of whether the monitoring program should be revised or eliminated shall be made by the CPM.

Verification:

1. The project owner shall submit a Groundwater Monitoring, Mitigation, and Reporting Plan (GMMRP) to the CPM for review and approval prior to the start of construction activities and at least 4 months prior to the operation of onsite groundwater supply wells for construction. The GMMRP shall provide detailed methodology for monitoring background, on site, and off□site groundwater levels and water quality. The monitoring period shall include pre□construction, construction, and project operation periods.

2. Pre-Project Groundwater Baseline report. Prior to operation of onsite groundwater supply wells, the project owner shall submit a report to the CPM containing all of the information gathered during the pre-project monitoring period, as specified in Section A (well reconnaissance, groundwater levels and groundwater quality).

3. Semiannual Monitoring Data reports. During project construction and operation, the project owner shall submit semiannual data reports to the CPM containing water level and water quality data as described in sections B.3 and B.5.a.

4. Semiannual Data Analysis reports. During project construction and operation, the project owner shall submit a semiannual operations and data analysis report to the CPM. The semiannual report for the each half of each calendar year may be incorporated into the report, which is due by August 15 and February 15 of each year. Data and analysis in the annual report shall include:

a) Project operational parameters, including daily production at the water supply wells and monthly on-site wastewater generation and disposal.
b) Annual groundwater use in the southern Pahrump Valley, estimated based on available data.
c) Hydrographs of groundwater levels at monitoring wells, showing raw and "filtered" water levels separately.
d) Documentation and justification of water-level filtering procedures.
e) Contour maps of raw and filtered groundwater levels and estimated drawdown caused by the project (based on filtered water levels).
f) Statistical trend analysis of water level data and compare to predicted water level declines due to project pumping.
g) Statistical analysis of groundwater quality data, including trend analysis and comparison of current and pre-project water quality.
h) Documentation of any mitigation measures implemented to protect groundwater dependent vegetation (see Section B.2).
i) Documentation of any mitigation measures implemented as a result of impacts on neighboring wells (see Section C).
j) Documentation of any complaints received by the project owners and the resolution of those complaints, including compensation to impacted well owners.
k) Copies of any hydrological or groundwater reports prepared by the project owner or project consultants.

GROUND SUBSIDENCE MONITORING AND ACTION PLAN

WATER SUPPLY–6 One monument monitoring station per production well or a minimum of three stations shall be constructed to measure potential inelastic subsidence that may alter surface characteristics of the PVGB and affect structures near the proposed production wells. The project owner shall:

A. Prepare and submit a Subsidence Monitoring Plan (SMP), including all calculations and assumptions. The plan shall include the following elements:

    1. Construction diagrams of the proposed monument monitoring stations including size and description, planned depth, measuring points, and protection measures;

    2. Map depicting locations (minimum of three) of the planned monument monitoring stations;

    3. Monitoring program that includes monitoring frequency, thresholds of significance, reporting format.

B. Prepare annual reports commencing three (3) months following commencement of groundwater production during construction and operations.

    1. The reports shall include presentation and interpretation of the data collected including comparison to the thresholds developed in Item C.

C. Prepare a Mitigation Action Plan that details the following:

    1. Thresholds of significance for implementation of proposed action plan based on monitoring station data;

a. Subsidence shall not be allowed to damage existing structures either on or off the site or alter the appearance or use of the structure;

b. Any subsidence that may occur shall not be allowed to alter natural drainage patterns or permit the formation of playas or lakes;

~~c. If any subsidence violates (a) or (b) the project owner shall investigate the need to immediately modify or cease pumping for project operations until the cause is interpreted and subsidence caused by project pumping abates and the structures and/or drainage patterns are stabilized and corrected.~~

2. The project owner shall prepare an Action Plan that details proposed actions by the applicant in the event thresholds are achieved during the monitoring program

The project owner shall submit the Ground Subsidence Monitoring and Action Plan that is prepared by an Engineering Geologist registered in the State of California thirty (30) days prior to the start of extraction of groundwater for construction or operation.

Verification: The project owner shall do all of the following:

1. At least thirty (30) days prior to project construction, the project owner shall submit to the CPM a comprehensive report presenting all the data and information required in Item A above.

2. During project construction and operations, the project owner shall submit to the CPM quarterly reports presenting all the data and information required in item B above.

3. The project owner shall submit to the CPM all calculations and assumptions made in development of the report data and interpretations.

After the first five (5) years of the monitoring period, the project owner shall submit a 5-year monitoring report to the CPM that submits all monitoring data collected and provides a summary of the findings. The CPM shall determine if the Ground Subsidence Monitoring and Action Plan frequencies should be revised.

References Cited

Belcher, W.R., ed., 2004, Death Valley regional ground-water flow system, Nevada and California—Hydrogeologic framework and transient ground-water flow model: U.S. Geological Survey Scientific Investigations Report 2004-5205, 408 p.

Guest, B., N. Niemi, and B. Wernicke. November/December 2007. Stateline fault system: a new component of the Miocene-Quaternary eastern California shear zone. Geological Society of America Bulletin 119:1337-1347.

San Juan, C.A., W.R. Belcher, R.J. Laczniak, and H.M. Putnam. 2004. Hydrologic components for model development. Chapter C in W.R. Belcher, ed. Death Valley regional ground-water flow system, Nevada and California—Hydrogeologic framework and transient ground-water flow model. Scientific Investigations Report 2004-5205. U.S. Geological Survey, Washington, D.C.

WORKER SAFETY / FIRE PROTECTION

by: Geoff Lesh, PE, and Rick Tyler

Q: Regarding fire protection, rescue, and emergency medical services, what updates to staff's testimony in the FSA address the Applicant's testimony of February 4, 2013?

A: Bright Source has proposed changes to conditions of certification **WORKER SAFETY-1, -2, -5**, and **-6**. The applicant proposes to delete the Eyesight Protection and Retinal Damage Plan from **WORKER SAFETY-**1 for construction, and to move the Plan to the Verification in **WORKER SAFETY-2**. Staff does not agree with these changes but does agree to add the word "Operations" ahead of Fire Protection Plan in the **WORKER SAFETY-2** Verification. Staff also agrees with the applicant's proposed changes to **WORKER SAFETY-5**. Staff does not agree to the proposed changes to **WORKER SAFETY-6**, but proposes some alternative language for **WORKER SAFETY-6** and **-7** below.

The applicant and Southern Inyo Fire Protection District have failed to reach agreement regarding fire protection, rescue, and emergency medical services. Staff has encountered an ongoing problem with the inability of applicants to reach agreements for emergency services with local fire departments for proposed projects. Staff is concerned with the fact that agreements are typically not reached in sufficient time to be documented in the Commission's Decisions or be implemented before site mobilization. The lack of such agreement can result in significant impacts on local fire department in the form of draw down of services relied upon by the local community.

Staff recommends that Condition of Certification **WORKER SAFETY-1** be amended to ensure that permanent fire suppression systems are not constructed or installed prior to review and comment by the local Southern Inyo Fire Protection District(SIFPD). Staff has therefore modified Condition of Certification **WORKER SAFETY-1** to require submittal of the design documentation for the facility fire suppression systems to SIFPD for review and comment and to the CPM review and approval prior to start of construction. The design documents would include water flow requirements for all occupancies, fire pump flow requirements, fire water supply and distribution requirements, including flow capabilities of the under-ground fire water loop.

To provide an option to address this problem staff is proposing alternative conditions of certification **WORKER SAFETY-A6** and **WORKER SAFETY-A7**. Staff would recommend that conditions below replace the two conditions (**WORKER SAFETY-6** and **-7**) in staff's testimony and in the Decision. **WORKER SAFETY-A6** would require the project owner to develop and maintain fire and emergency medical response onsite such that drawdown does not occur at the local fire district and impacts do not occur on the surrounding communities. **WORKER SAFETY-A7** addresses the ability of the emergency transportation of injured workers to a hospital from the facility. These conditions would mitigate to the extent feasible the potential for impact on local fire services until the fire department has received tax revenue to fund fire

protection improvements that would preclude such impact. Staff proposes the following alternative conditions.

WORKER SAFETY-1 The project owner shall submit to the Compliance Project Manager (CPM) a copy of the Project Construction Safety and Health Program containing the following:

a Construction Personal Protective Equipment Program;

a Construction Exposure Monitoring Program;

a Construction Injury and Illness Prevention Program;

a Construction Heat Stress Protection Plan that implements and expands on existing Cal OSHA regulations as found in 8 CCR 3395;

a Construction Emergency Action Plan; and

a Co nstruction Fire Prevention Plan that includes the above-ground fuel depot.

an Eyesight Protection from Retinal Damage Plan that is designed to insure that workers in the solar field receive and wear the appropriate protective sunglasses. This Eyesight Protection from Retinal Damage Plan would:

(1) identify and acquire the appropriate eye protection (EP) equipment based on the IEC 62471 standards in sufficient numbers to provide safety glasses for the workers engaged in solar field work, and tower work where the potential exists for heliostat solar reflective exposure or SRSG exposure during operations,

(2) establish the requirements and procedures for the donning and doffing of the EP by workers and provide training and,

(3) monitor worker use of the PPE and compliance with the EP procedures.

- <u>Design requirements documentation for the facility fire suppression systems. The design documentation would include water flow requirements for all occupancies, fire pump flow requirements, fire water supply and distribution requirements, including flow capabilities of the under-ground fire water loop.</u>

The Construction Emergency Action Plan and the Fire Prevention Plan shall be submitted to the Southern Inyo Fire Protection District for review and comment 60 days prior to construction. The Personal Protective Equipment Program, the Exposure Monitoring Program, the Injury and Illness Prevention Program, and the Heat Stress Protection Plan shall be submitted to the CPM for review and approval of program compliance with all applicable safety orders 30 days prior to construction.

<u>At least 30 days prior to the start of construction, the project owner shall submit to the SIFPD for review and comment, and to the CPM for review and approval a copy of the design requirements documentation for the facility fire suppression systems, and to the CPM for review and approval. The submittal shall include and address any comments received from SIFPD.</u>

At least 30 days prior to the start of construction, the project owner shall submit to the CPM for review and approval a copy of the Project Construction Safety and Health Program.

WORKER SAFETY-A6 The project owner shall either:

(1) Reach an agreement with the Southern Inyo Fire Protection District (SIFPD) regarding funding of its project-related share of capital and operating costs to improve fire protection/emergency response infrastructure and provide appropriate equipment as mitigation of project-related impacts on fire protection/emergency response services within the jurisdiction no later than 30 after the CEC Final Decision; or (2) develop and maintain on-site, at all times, a fire brigade consisting of at least 5 qualified fire fighters including 1 Paramedic licensed to practice in Inyo County, and a fire pumper apparatus. This Fire brigade shall maintain an ISO (Insurance Services Office) rating of 8 or better and type III hazmat Response capability as defined by the U.S. Department of Homeland Security / Federal Emergency Management Agency and certification by the California Emergency Management Agency for Type III Haz – Mat response. A plan for the onsite brigade shall be submitted to the Southern Inyo Fire Protection District (SIFPD) with sufficient time to allow for their review and comment. The fire brigade shall exist for the entire construction period and for first year of operation.

Verification: At least 30 days prior to the start of site mobilization, the project owner shall submit to the CPM proof of conformity for approval of the fire brigade with the requirements described above and in the annual report every year thereafter. This shall include evidence of the owner's consideration of the SIFPD comments in implementation of the onsite fire brigade.

WORKER SAFETY-A7 The project owner shall enter into an agreement with an emergency transport provider to serve the facility throughout the construction period and for the first year of operation.

Verification: At least 30 days prior to the start of site mobilization, the project owner shall provide proof of an agreement with an emergency transport provider to serve the facility.

~~**WORKER SAFETY-6** The project owner shall either:~~

~~(1) Reach an agreement with the Southern Inyo Fire Protection District (SIFPD) regarding funding of its project-related share of capital and operating costs to improve fire protection/emergency response infrastructure and provide appropriate equipment as mitigation of project-related impacts on fire protection/emergency response services within the jurisdiction; or~~

~~(2) if no agreement can be reached, the project owner shall fund a study conducted by an independent contractor who shall be selected and approved by the CEC Compliance Project Manager (CPM) and fulfill all mitigation identified in the independent fire needs assessment and a risk assessment. The study will evaluate the project's proportionate funding responsibility for the above-identified mitigation measures, with particular attention to emergency response and equipment/staffing/location needs.~~

~~Should the project owner pursue option (2), above, the study shall be conducted pursuant to the Fire Needs Assessment and Risk Assessment shall evaluate the following:~~

~~(a) The project's proportionate (incremental) contribution to potential cumulative impacts on the SIFPD and the project allocated costs of enhanced fire protection/emergency response services including the fire response, hazardous materials spill/leak response, rescue, and emergency medical services necessary to mitigate such impacts;~~

~~(b) The extent that the project's contribution to local tax revenue will reduce impacts on local fire protection and emergency response services; and~~

~~(c) Recommend an amount of funding (and corresponding payment plan) that represents the project's proportional payment obligation for the above-identified mitigation measures.~~

~~Compliance Protocols shall be as follows:~~

~~(a) The study shall be conducted by an independent consultant selected by the project owner and approved by the CPM. The project owner shall provide the CPM with the names of at least three consultants, whether entities or individuals, from which to make a selection, together with statements of qualifications;~~

~~(b) The study shall be fully funded by the project owner.~~

~~(c) The project owner shall provide the protocols for conducting the independent study for review and comment by the SIFPD and review and approval by the CPM prior to the independent consultant's commencement of the study;~~

~~(d) The consultant shall not communicate directly with the project owner or SIFPD without express prior authorization from the CPM. When such approval is given, the CPM shall be copied on any correspondence between or among the project owner, SIFPD, and the consultant (including emails) and included in any conversations between or among the project owner, SIFPD and consultant; and~~

~~(e) The CPM shall verify that the study is prepared consistent with the approved protocols, ***or***~~

~~(3) If the project owner and SIFPD do not agree to the recommendations of the independent consultant's study, the Energy Commission or its designee shall, based on the results of the study and comments from the project owner and SIFPD, make the final determination regarding the funding to be provided to the SIFPD to accomplish the above-identified mitigation.~~

~~No construction shall occur until funding of mitigation occurs pursuant to either of the resolution options set forth above.~~

~~**Verification:** At least 30 days before construction, the project owner shall provide to the CPM:~~

~~(1) A copy of the individual agreement with the SIFPD or, if the owner joins a power generation industry association, a copy of the group's bylaws and a copy of the group's agreement with the SIFPD; and evidence in each January Monthly Compliance Report that the project owner is in full compliance with the terms of such bylaws and/or agreement; ***or***~~

~~(2) a copy of the completed study showing the mitigation or the precise amount the project owner shall pay for mitigation; and documentation that the amount has been paid.~~

~~Annually thereafter, the owner shall provide the CPM with verification of funding to the SIFPD if annual payments were approved or recommended under either of the above-described funding resolution options.~~

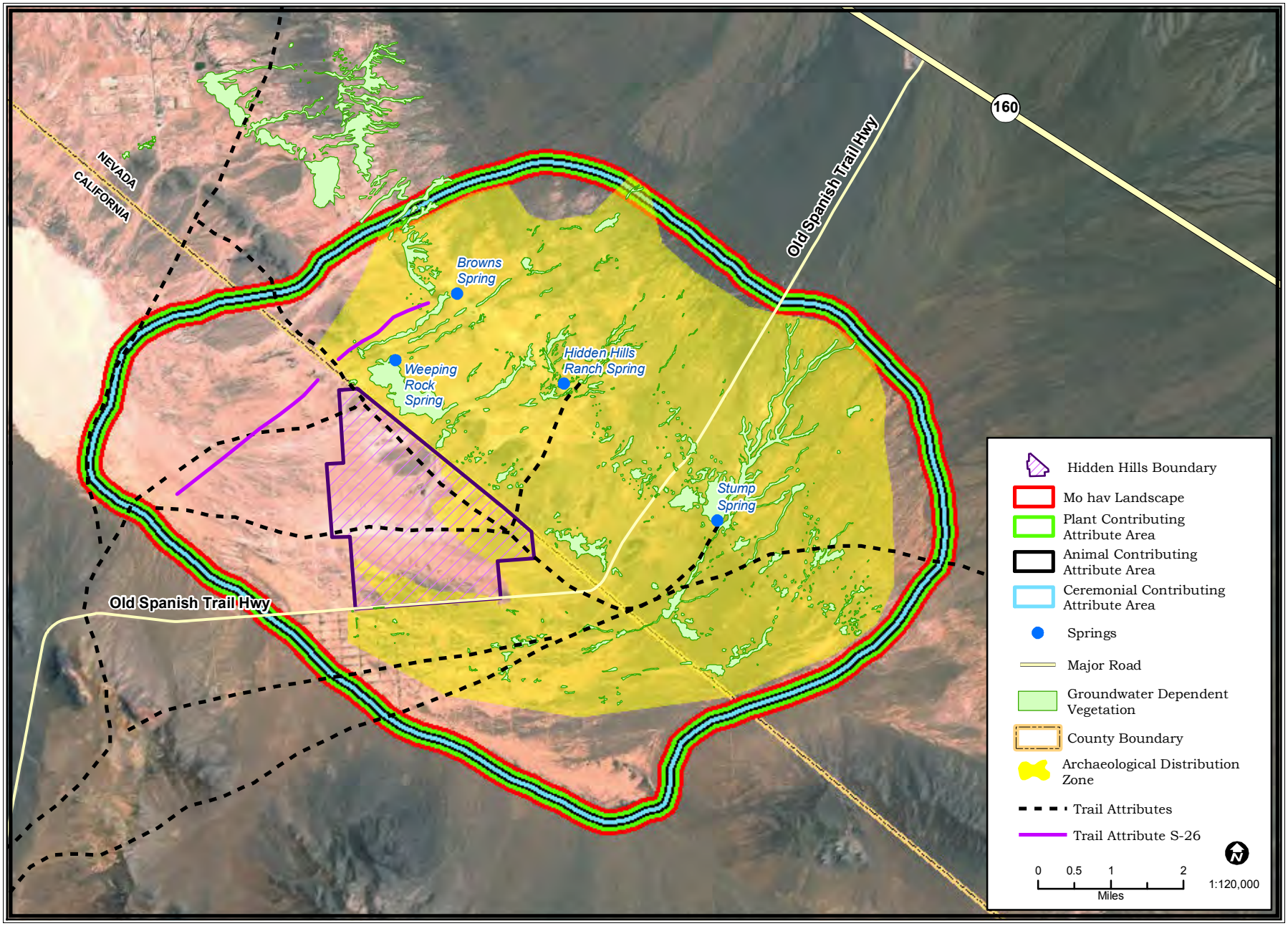
~~**WORKER SAFETY -7** The project owner shall provide a $200,000 payment to Southern Inyo Fire Protection District prior to the start of construction. This funding shall off-set any initial funding required by **WORKER SAFETY-6** above until the funds are exhausted. This offset will be based on a full accounting by the Southern Inyo Fire Protection District regarding the use of these funds.~~

~~**Verification:** At least 30 days prior to the start of construction the project owner shall provide documentation of the payment described above to the CPM. The CPM shall adjust the payments initially required by **WORKER SAFETY-6** based upon the accounting provided by the Southern Inyo Fire Protection District.~~

FIGURES

CULTURAL RESOUCES - REBUTTAL FIGURE 2

Hidden Hills Solar Electric Generating System (HHSEGS) - Mo hav Landscape Attribute Map



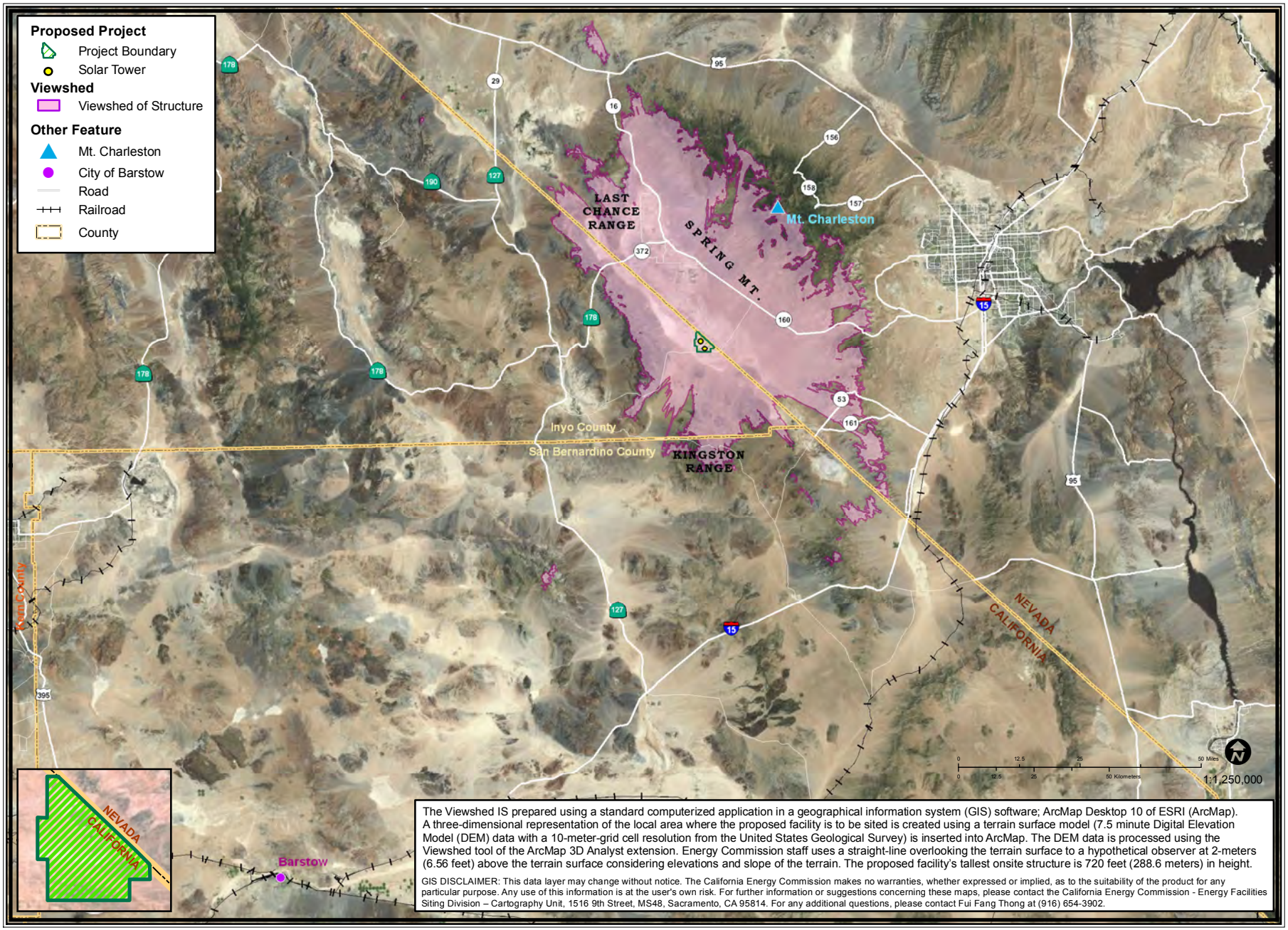
CULTURAL RESOUCES

CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: US Major Highway - USDA National Agriculture Imagery Program (NAIP) imagery and USGS Digital Ortho Quarter, Quad, CH2M HILL, Tele Atlas North America, Inc (2010).

CULTURAL RESOURCES - REBUTTAL FIGURE 1

Hidden Hills Solar Electric Generating System (HHSEGS) - Viewshed from Mt. Charleston Towards HHSEGS Project Area and City of Barstow



The Viewshed IS prepared using a standard computerized application in a geographical information system (GIS) software; ArcMap Desktop 10 of ESRI (ArcMap). A three-dimensional representation of the local area where the proposed facility is to be sited is created using a terrain surface model (7.5 minute Digital Elevation Model (DEM) data with a 10-meter-grid cell resolution from the United States Geological Survey) is inserted into ArcMap. The DEM data is processed using the Viewshed tool of the ArcMap 3D Analyst extension. Energy Commission staff uses a straight-line overlooking the terrain surface to a hypothetical observer at 2-meters (6.56 feet) above the terrain surface considering elevations and slope of the terrain. The proposed facility's tallest onsite structure is 720 feet (288.6 meters) in height.

GIS DISCLAIMER: This data layer may change without notice. The California Energy Commission makes no warranties, whether expressed or implied, as to the suitability of the product for any particular purpose. Any use of this information is at the user's own risk. For further information or suggestions concerning these maps, please contact the California Energy Commission - Energy Facilities Siting Division – Cartography Unit, 1516 9th Street, MS48, Sacramento, CA 95814. For any additional questions, please contact Fui Fang Thong at (916) 654-3902.

CULTURAL RESOURCES

CALIFORNIA ENERGY COMMISSION, SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: ESRI, USGS - 2012, OpenStreetMap January 2013, BING Aerial Imagery, and California Energy Commission

ALTERNATIVES - FIGURE 1a

Hidden Hills Solar Electric Generating System (HHSEGS) - Site Preparation and Revegetation at the Topaz Solar Farm Project Site - PV Array Block 6 before Project Construction

ALTERNATIVES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Photographs provided by First Solar, Inc. January 2013

ALTERNATIVES - FIGURE 1b

Hidden Hills Solar Electric Generating System (HHSEGS) - Site Preparation and Revegetation at the Topaz Solar Farm Project Site - PV Array Block 6 after Installation of Posts and Tilts

ALTERNATIVES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Photographs provided by First Solar, Inc. January 2013

ALTERNATIVES - FIGURE 1c

Hidden Hills Solar Electric Generating System (HHSEGS) - Site Preparation and Revegetation at the Topaz Solar Farm Project Site - PV Array Block 6 after Construction

ALTERNATIVES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Photographs provided by First Solar, Inc. January 2013

ALTERNATIVES - FIGURE 2a

Hidden Hills Solar Electric Generating System (HHSEGS) - Revegetation at the Topaz Solar Farm Project Site - PV Array Area, Revegetation Occurring in Second Growth Period

ALTERNATIVES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Photographs provided by First Solar, Inc. January 2013

ALTERNATIVES - FIGURE 2b

Hidden Hills Solar Electric Generating System (HHSEGS) - Revegetation at the Topaz Solar Farm Project Site - PV Array Area, Revegetation Occurring in First Growth Period

ALTERNATIVES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Photographs provided by First Solar, Inc. January 2013

ALTERNATIVES - FIGURE 3

Hidden Hills Solar Electric Generating System (HHSEGS) - Installation of PV Panel Support Posts at the Topaz Solar Farm Project Site - Posts supporting the PV arrays are driven piles without concrete foundations

ALTERNATIVES

CALIFORNIA ENERGY COMMISSION - SITING, TRANSMISSION AND ENVIRONMENTAL PROTECTION DIVISION

SOURCE: Photographs provided by First Solar, Inc. January 2013

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
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APPLICATION FOR CERTIFICATION FOR THE HIDDEN HILLS SOLAR ELECTRIC GENERATING SYSTEM

Docket No. 11-AFC-02

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(Revised 2/8/13)

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DECLARATION OF SERVICE

I, Cenne Jackson, declare that on February 12 2013, I served and filed copies of the attached Rebuttal Testimony, dated February 12, 2013. This document is accompanied by the most recent Proof of Service, which I copied from the web page for this project at: http://www.energy.ca.gov/sitingcases/hiddenhills/.

The document has been sent to the other persons on the Service List above in the following manner:

(*Check one*)

For service to all other parties and filing with the Docket Unit at the Energy Commission:

x I e-mailed the document to all e-mail addresses on the Service List above and personally delivered it or deposited it in the US mail with first class postage to those parties noted above as "hard copy required"; OR

____ Instead of e-mailing the document, I personally delivered it or deposited it in the US mail with first class postage to all of the persons on the Service List for whom a mailing address is given.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that I am over the age of 18 years.

Dated: 2/12/13 Originally Signed by Cenne Jackson